

**Recent Innovations in
The Informetrica Model (TIM)**

By

Michael McCracken

Nancy Cebryk

Informetrica Limited

Canadian Economics Association Annual Meeting

Hamilton, Ontario

May 2005



Table of Contents

Abstract of Paper for CEA	i
1 Introduction	1
2 Estimation of Consumer Expenditure in current dollars.....	1
3 Investment by Asset Type	4
4 Endogenous Government Spending	6
5 Labour Markets	7
5.1 Employment by Industry.....	7
5.2 Employment by age and sex by industry.....	7
5.3 Participation Rates by Age and Sex.....	7
6 Industry Output and Prices.....	8
6.1 Determination of Gross Output and GDP by Industry	8
6.2 Determination of Prices.....	9
6.2.1 Industry Unit Costs.....	9
7 Employment and GDP by Industry and Province	10
8 Other Regional Dimensions	10
8.1 Housing Sector	10
8.2 Participation Rates.....	11
8.3 Unemployment rates.....	11
9 Development and Management of Large Models.....	11
9.1 Software systems.....	11
10 Future Developments	12
10.1 Interprovincial Mobility of Population.....	12
10.2 National-provincial Interactions	12
A Appendix TIM 2005 Summary	1
A.1 Background.....	1

A.2	US Model and Forecasts.....	2
A.3	Population Calculators	2
A.4	Provincial Population Calculator	3
A.5	The Informetrica Model (TIM).....	5
A.6	Applications.....	8
B	Disaggregation of Investment.....	1
C	Employment and Unemployment by Age-Sex: 1990, 2000	1

Recent Innovations in The Informetrica Model (TIM)

Abstract of Paper for CEA

Informetrica Limited has used a large macroeconomic model of the Canadian economy continuously since 1979 (TIM). In the early 1980s, it added a provincial dimension through a regional-industrial model (RIM). With each major change in the statistical system (industrial classifications, base years, and methodological changes), the model has been re-estimated and updated.

Construction of TIM 2004 was started in 2003 with the first working version available in 2004. The new version of the model incorporates a number of data changes, including the North American Industrial Classification System (NAICS), the new CSNA 93 data with Fisher price and quantity indexes, and the population data from the 2001 Census.

Innovations have also been introduced, including:

- Estimation of many equations in current dollars
- Endogenous government spending, linked to demographic variables
- Separate treatment of supplementary labour costs by industry
- Investment by asset type
- Employment by age and sex by industry
- Participation rates by age and sex, using employment by age and sex as one of the explanatory variables
- Detailed integrated input-output model, for both the determination of GDP and final demand prices
- Employment and GDP by industry and province
- Housing starts by type by province

The model currently has more than 10,000 equations, not including other models that feed it for national and provincial population and demographic variables. As well, TIM is a simultaneous part of two other large energy and environment models and will feed into a large model of economic regions.

The emphasis in the paper will be on areas **not** usually found in other econometric models.

Recent Innovations in The Informetrica Model (TIM)

1 Introduction

Informetrica Limited has used a large macroeconomic model of the Canadian economy continuously since 1979 (TIM).¹ In the early 1980s, it added a provincial dimension through a regional-industrial model (RIM), recursive to TIM. With each major change in the statistical system (industrial classifications, base years, and methodological changes), the model has been re-estimated and updated.

Construction of TIM 2004 was started in 2003 with the first working version available in 2004. This new version of the model incorporates a number of data changes, including the North American Industrial Classification System (NAICS), the new CSNA 93 data (Canadian System of National Accounts) with Fisher price and quantity indexes, and the population data from the 2001 Census.

The model currently has more than 20,000 equations, not including other models that feed into it for national and provincial population and demographic variables. As well, TIM is a simultaneous part of two other large energy and environment models and will feed into a large model of economic regions.

This paper will describe some of the innovations in the most recent version of TIM of general interest to model-builders. An overview of TIM is provided in Appendix A. Those interested in more details should contact Informetrica Limited.

2 Estimation of Consumer Expenditure in current dollars

The introduction of Fisher quantity and price indexes into the SNA highlighted the respective information base for the expenditure information in the Accounts. Essentially, the process of developing an estimate for the components of consumer expenditure requires a current dollar estimate for expenditure on a specific category. A parallel price index for that category is developed from CPI detail or other sources of price information. The constant dollar expenditure (real) is obtained by using the identity that the price index times the quantity index times the base year value yield the current dollar value. Aggregation of detailed prices and real "quantities" requires weighting the prices with expenditure weights (Fisher indexes) and doing the same operation on the real quantities. In such a framework, simple summation of constant dollar amounts is not consistent with the Fisher index values.

This has led us to develop behavioural equations in current dollars (data as estimated). Price indexes are developed independently by the aggregation of final demand prices that, in turn, are determined by an input-output table. In a regression framework, this leaves us with the task of minimizing the errors in a specific category of current dollar expenditure, and in a separate

¹ From its founding in 1973 until 1979, Informetrica Limited used the CANDIDE model, housed at the Economic Council of Canada. TIM can be thought of as an elaboration of that earlier model.

equation minimizing the error in the corresponding price index, using an input-output proxy as the explanatory variable. The error terms in these two equations are expected to be independent.

The "normal approach" has been to use the constant dollar and price indexes as the variables to be explained and the current dollar estimate arrived at as the product of the two components. The convenience of aggregation of real expenditure was convenient, and the use of real expenditure, real income, and relative prices fit with the conventional wisdom for determining quantities demanded. Issues about error terms were ignored or treated with the use of a consistent estimator.

We decided on a different approach. Current dollar expenditure is the estimated variable. The specification uses nominal income, price indexes for the detailed category and an aggregate price index. However, the innovation didn't stop there. We decided to allow money illusion to be present in each nominal expenditure equation, rather than forcing it to be zero through specification. The starting point for the consumer expenditure equations is as follows.

The initial model for estimation is based on a standard real consumption estimation equation. The concept of this equation is that real demand is based on real income per demographic variable, relative prices between the particular consumption item price and the aggregate price. Other variables are shown in equation 1, but these are specific to what is being estimated (the basic model does not include any other variables).

$$\frac{K_i}{D_1} = e^A * \left(\frac{Y}{D * P_T} \right)^\alpha * \left(\frac{P_T}{P_i} \right)^\beta * e^{\eta_j} \text{ (other variables)} \quad (1)$$

- K_i/D_1 = Real consumption of good i per demographic concept
- Y = Nominal income (total, disposable, "spendable", etc.)
- D = Demographic variable (households or population), may or may not be different from D_1 , but generally it is a broad concept
- P_T = Aggregate consumption price index
- P_i = Price index of good i
- A = Constant

The other variables can be either in level or log form. Some examples are: stock of vehicles, age of vehicles, the unemployment rate, heating degree-days, and employment.

Note: This is a theoretical model, which is our starting point. Once the model is tested with data by estimating the equation, the equation can be fine-tuned to fit the data more closely. For example, the equation may be better specified and make more sense without any demographic concept included.

For sensible results that coincide with economic theory, α can be greater than (superior good) or less than (inferior good) zero and β must be greater than zero (as the price of the commodity increases then real demand decreases).

Nominal specification of this model is accomplished by multiplying both the right hand and left hand sides by P_i . The equation is re-arranged, which results in individual price variables and nominal income per demographic variable.

$$\frac{C_i}{D_1} = e^A * \left(\frac{Y}{D}\right)^\alpha * P_T^{(\beta - \alpha)} * P_i^{(1 - \beta)} * e^{\eta_j} \text{ (other variables)} \quad (2)$$

C_i/D_1 = Nominal consumption of good i per demographic concept

The examination of the coefficients in this equation shows that they have identical properties to the model in real terms. However, because they are not estimated separately the resulting estimation coefficients are a little bit harder to interpret. The regression coefficients would be the following:

$$\delta = 1 - \beta \quad (3)$$

$$\gamma = \beta - \alpha \quad (4)$$

We know that $\beta > 0$, which means that $\delta < 1$. Examination of equation 4, shows that γ can either be positive or negative, because $\beta > 0$ and $\alpha \neq 0$.²

When there is an absence of money illusion then all coefficients in equation 2 would be equal to the coefficients in equation 1. However, when γ is different from $(\beta - \alpha)$ then money illusion can enter the nominal equations. The result can either be negative money illusion (less real demand) or positive money illusion (more real demand) with identical relative changes in nominal income and prices. Money illusion occurs when $\gamma \neq \beta - \alpha$ or $\gamma = \beta - \alpha + \chi$.

Assuming that prices and nominal income have increased by the same relative amount, positive money illusion occurs when $\chi > 0$. Nominal consumption will increase more rapidly than the inputs and real consumption increase. Negative money illusion occurs when $\chi < 0$. Nominal consumption will either increase less rapidly or decline relative to prices and nominal income, which results in a decline in real consumption. Aggregate consumption could be neutral in money illusion, if the net effect of all the positive and negative money illusion of the consumption detail cancels out.

Money illusion is present in most consumer demand equations, and is predominately positive. Strong money illusion is evident in most of the consumer durables equations (autos, furniture, major appliances) and in electricity and natural gas.

How can we determine if this approach has worked better?

- Lower RMSE for total nominal consumer expenditure when compared to an older model.

² An elaboration of understanding and testing the nominal coefficients is discussed in Working Paper 99.cc.

- No persistent under or over-estimation of nominal expenditure.
- Income and price responses that are "sensible", and with more statistically significant coefficients compared to previous empirical work.

We are putting in place the necessary analytical frameworks to answer these questions.

3 Investment by Asset Type

Most macroeconomic models have only a few investment functions, perhaps distinguishing between government and business and possibly between construction expenditure and expenditure on machinery and equipment (M&E). Such models are little impacted by the new SNA data.

In earlier versions of TIM, we had developed detailed investment by industry for both construction and M&E, using data supplied by the Wealth and Capital Stocks Division at Statistics Canada. In the revised data, there was a substantial expansion of investment detail within the SNA, disaggregated by asset type. This defines investment in computer software, but without indicating the industry that buys it. Indeed, the industry detail seems to be fading away with less industrial disaggregation available.

One of the major problems in the past was the difficulty with the concept of industry investment or capital stock, since many industries rely on significant inputs of leased or rented equipment rather than owned capital goods. Moreover, this trend has been changing rapidly in some sectors. For example, most aircraft and trucks are leased from sectors other than the sectors that purchased them initially.

It may be possible to obtain more stable investment functions by disaggregating investment by asset type than by industry. This has the added advantage that the conversion of this expenditure into final demand within the input-output framework is likely to have a more stable bridge matrix than the industry translation used in the past.

In TIM, we have developed equations for the full detail available from the SNA for business nonresidential investment (12 asset types) and for most of the detail within government nonresidential investment (5 types). Buildings and Engineering Construction are further disaggregated by industry sector. See Appendix B for the full detail for investment.

We have not abandoned the industrial breakdown of investment entirely. Business engineering construction is disaggregated further into oil and gas, electric utilities, transportation, waterworks and sewage, communication, mining, and marine and other. Marine and other is estimated as one component.³

³ There is a separate project underway to provide estimates for electric power and oil and gas by province and territory.

Business machinery and equipment investment is divided into furniture, computers and office equipment, software, telecommunications equipment, automobiles, trucks, other transportation equipment, and industrial, agricultural and other machinery.

Government investment is disaggregated differently from that of business. The reason is that government investment in some asset types is quite small compared to the business sector and therefore some of the asset types are too small to separately estimate.

Government investment in buildings is divided into those for education, public administration and commercial and institutional health. These divisions are based on both the availability of the data and the expectation that these different components of building investment have different patterns of behaviour.

Government engineering investment is divided into transportation (mainly roads and highways), waterworks and sewage, and marine and other. The breakdown of the asset types is significantly less than that of the business sector. In this case, the reason is that investment in this sector is either non-existent or very small at the level used for business sector investment.

The same reasoning holds for the level of disaggregation in the government sector M&E investment. It is broken into computers and office equipment, software, and other. Other, in this case, includes an aggregate of the detail available in the business sector M&E investment.

Initial results are promising. Since investment by asset type is being estimated across all industries, issues of leasing do not arise. The focus on asset type allows for the relationship between computers and software investment to be explored. Separate estimates for trucks and cars can be made. The stability of the commodity composition in the IO bridge matrix is likely to be quite stable, particularly compared to the previous approach of converting industry investment.

We are experimenting with moving from investment by asset type to investment by industry, using a converter matrix that can change over time. Now, however, we do not have investment or capital stocks by industry, given the choice of the SNA to focus on asset type for investment. An implication is that we lack capital stocks to use in the inverted production functions for employment or the unit capital costs needed for the prices model.

This "lack" has led to another innovation. We have calculated two measures for each asset type – the average nameplate date of cumulated investment and its average age (current date less nameplate average). We then use these indicators of the quality of the capital stock in the labour demand equations, providing a framework for introducing technical change. We choose one or two of the major asset types appropriate for each industry. For example, in information and culture employment the telecommunications equipment average age is an important explanatory variable. In Finance, Insurance, and Real Estate average age of computers, software, and telecommunications has a positive effect, whereas the average age of machinery and buildings has a negative effect. This negative effect may be linked to reduced leasing and financing activity for older equipment and buildings.

Increased investment in a particular asset type will increase the nameplate average date and lower the average age. In turn, this should raise the productivity in the industries using that type of asset.

4 Endogenous Government Spending

In many short-term econometric models, government expenditure is treated as exogenous. In TIM, however, we want government expenditure to vary with different population scenarios, different inflation rates, and different fiscal positions for government. In terms of exhaustive government expenditure (capital and current spending on goods and services), the data are disaggregated by level of government and by function whenever possible. Estimates are provided for federal, provincial and local levels of government as well as for the Canada and Quebec Pension Plans (CPP and QPP, respectively). We also model defence, education at the provincial and local levels, and the health care and social services sub-sector.

Government expenditures on goods and services are primarily commercially-produced items or services. Due to the policy-driven nature of this spending, the main driver chosen for expenditures is the overall population level. In some sectors, factors like enrolment or employment serve as the driver for expenditures. It is expected that overall population increases will generate increased expenditures on goods and services. Elsewhere in the model, the wage bill, supplementary labour costs and capital consumption allowances are explained. This leaves the "residual expenditure", which is tied to demographic growth, government employment, and the CPI as a proxy for inflationary trends.

$$\text{Expenditure on } G \ \& \ S_t - (Wages_t + SLC_t + CCA_t) = \beta_1 + \beta_2 * \log(\text{Population}_t) + \beta_3 * \log(\text{Employment}_t) + \beta_4 * \log(\text{CPI}_t)$$

Usually, expenditures are elastic with respect to demographic change and inelastic with respect to inflation and government employment.

Government expenditures on transfers are also endogenous, with each transfer defined as the product of the benefit per recipient and the number of beneficiaries. For example, in the case of the EI system, benefits are determined as the product of:

- The average number of claims per month,
- The duration of the claims (months in that year that person is receiving benefits), and
- The average monthly benefit.

Disaggregation of type of claim is made among regular, maternity, and other including fishing. Each of these components in turn are linked to the parameters of the EI system (maximum insurable earnings, replacement rate), the unemployment numbers, average wages and salaries, and other economic variables.

The major advantage of having the government expenditures endogenous is that for every scenario, "reasonable" estimates of government expenditure are generated.. As well, the

financing costs (interest on debt) are generated reflecting current interest rates and the accumulation of debt because of deficits in previous years.

Users can, of course, override or augment any equation to reflect a specific policy change (e.g., daycare spending increase).

If the government sector is not endogenous, then the user must adjust government expenditure in every run or assume that the expenditure is fixed in nominal terms, independent of price change or demographic movements.

5 Labour Markets

5.1 Employment by Industry

The model starts out rather conventionally, with industry employment determined by industry output and indicators of the quality of the capital stock. These labour requirements equations can be thought of as productivity equations. Their strength is the level of disaggregation, and their consistency with the published Labour Force Survey estimates. Employment estimates are produced for 53 industries nationally and 42 industries provincially.

5.2 Employment by age and sex by industry

The Labour Force Survey publishes regular estimates of employment by industry disaggregated by age and sex. We decided to use this information in a rather novel way. Since we have industry employment at a high level of disaggregation and labour force by age and sex, we have the **marginal** totals of a table with one axis being a breakdown by age and sex and the other axis the industry detail for employment augmented by the unemployment level. The detailed table is available historically and can be extended into the future using a recursive approach with the previous year's table as a starting point. Tables for 1990 and 2000 are provided in Appendix C.

The process is to apply a biproportional matrix adjustment or RAS algorithm to the table each year, using the marginal calculated values for employment by industry, total unemployment, and labour force by age and sex. As a result, we have employment estimates by industry by age-sex. The total labour force by age and sex less the total employment by age-sex determines unemployment by age and sex.

This would just be an interesting output if it did not feedback into the model. However, we have been able to find a significant link by using employment by age-sex as an explanatory variable in the participation rate equations.

5.3 Participation Rates by Age and Sex

It is obvious that someone who is employed is always in the labour force. Any increase in employment would translate into an increase in the labour force if the person came from outside the labour force before being employed. If the person were unemployed, then gaining employment would reduce unemployment by one and leave labour force unchanged. The story doesn't stop there. With one less person in the unemployment queue, it is possible that another person would enter the labour force.

The labour force equations are estimated with the dependent variable in the form of the participation rate for a given age-sex group less the employment ratio for that **same** age-sex group. In essence, this means we are focusing on explaining the unemployed in the queues by age and sex.

Explanatory variables include the employment ratio for that age-sex group, the overall unemployment rate, fertility rates in the case of female participation rates, post-secondary education enrolment rates, and an indicator of the returns to labour market participation.

The overall performance of the labour supply blocks has been quite interesting in full simulations. Policies that generate additional employment invariably lead to a larger labour force as well. For every 1,000 increase in employment there is usually about a 500 increase in labour supply. In these scenarios, unemployment rates decline less rapidly, and supply adjusts to cushion any increase in demand.

6 Industry Output and Prices

The original CANDIDE Model in 1972, and subsequent versions of TIM have used an input-output model to move from final demand expenditure categories to industry outputs. As well, industry prices are translated into final demand prices using the same framework.

The innovations in the latest model include:

Data development provides more disaggregation of the "bridge" matrix, from final demand categories to commodity requirements. The two columns in the published I-O table for exports and imports have become 73 columns in the new bridge matrix. Investment has been redefined by asset type to be consistent with the SNA categories. Expansion of the categories for consumer expenditure, inventories, and government expenditure has also been incorporated.

The full detailed tables are being maintained, with their two dimensions of industry and commodity and the distinction between make and use matrices.

The tables are being solved iteratively and the coefficients can be changed either exogenously over time or endogenously by equations in the model. This will allow simulations of interest to those focusing on changing the industry use patterns of energy inputs.

6.1 Determination of Gross Output and GDP by Industry

Two steps are required to move from SNA final demand categories to industry GDP estimates. The first step is to calculate the gross output by industry, using the input-output table and the final demand categories in constant dollars. The next step defines GDP in constant dollars as a fraction of the Gross Output in constant dollars. In earlier versions of TIM, adjustment equations were estimated to link the real GDP to gross output measures. Published gross output is not available, requiring a simpler approach. We use an exogenous multiplicative factor varying by year to bridge the data from gross output to GDP. If we discover patterns emerging in the multiplicative factor then some additional modelling may be appropriate.

6.2 Determination of Prices

In an ideal world, we would have a rich database of observed commodity prices available, including services. However, we don't and there is little indication that it will appear in the future. As a second-best solution, we can define industry value-added prices, using information about labour and capital costs by industry. These prices, can, in turn be turned into gross output prices, calculated commodity prices, and prices for final demand categories using the input-output tables.

6.2.1 Industry Unit Costs

The industry value-added price can be defined as the sum of industry GDP components in current dollars (value-added), divided by GDP in constant dollars. The GDP is defined in **basic prices**, including indirect taxes paid by the producers (e.g., property taxes) and subsidies received by the producers. Hence the value-added is:

1. Wage bill
2. Supplementary labour costs
3. Mixed income (unincorporated income)
4. Surplus
 - a. Capital consumption allowances
 - b. Net interest paid
 - c. Profit before Tax
 - d. Inventory Valuation Adjustment
5. Indirect taxes paid by producer
6. Subsidies received by producer

In TIM 2004, the wage bill was estimated for 26 industries along with separate industry estimates for five associated supplementary labour costs, paid by employers: (CPP/QPP, EI contributions, Workers compensation premiums, pensions, welfare (e.g., insurance and supplementary health premiums)). This has been expanded to about 100 industries in TIM 2005, to support the new prices model.

Unit capital costs (surplus per unit of real GDP) are estimated for the same 100 industries, using interest rates, accumulated investment, unit labour costs and export or import prices. Essentially, the unit capital cost equations are the pricing rules followed by business. The sum of unit labour costs and unit capital costs defines the value-added deflator. These value-added deflators, along with import prices and indirect taxes less subsidies are weighted together with the input-output tables to estimate the final demand deflators.

The major innovation in this part of the prices model is the development of disaggregated supplementary labour cost components and the detailed price-setting equations by industry.

In later versions of the model, we expect to be able to move to more detail by industry and to develop better wage equations. Unincorporated income also needs to be treated separately in a few key industries.

7 Employment and GDP by Industry and Province

Innovation within the provincial dimension of the model centres on the level of disaggregation we estimate by industry.

The provincial allocation provides a spatial dimension to the detail estimated by the embedded input-output (I-O) system that estimates more than 300 industries. We allocate 186 of the I-O industries provincially.

The challenge here is not in the distribution but in developing a consistent database. Statistics Canada provides a data framework for more than 300 industries by province. However, due to confidentiality issues, only partial information is released to the public. The dataset provided to us is full of holes, with many data cells missing. As well, Statistics Canada's move to the North American Industrial Classification System (NAICS) meant that many series only started in 1997. The data were estimated using a biproportional matrix adjustment or RAS algorithm (similar to how we model employment by age and sex by industry). Using this technique, we undertook to estimate a complete dataset for all provinces. For 1997 forward, we developed estimates (consistent with Statistics Canada's published data) for more than 300 industries. For 186 of these, we estimated time series going back to 1984.

This was a major undertaking, but it provides us with a unique data set with a high level of industrial detail at the provincial level. Given that we have developed time series from 1984 to 2003 we are now in a position to move from a simple allocation of GDP to estimating relationships with regression analysis.

We were presented with similar challenges when we developed the provincial employment data. Employment data by detailed industry by province are available from Statistics Canada, but again, are full of confidential data cells, particularly within the manufacturing sector. For employment, we allocate a breakdown of 42 industries across provinces.

8 Other Regional Dimensions

8.1 Housing Sector

In TIM 2005, the breakdown of housing starts and stocks was extended to five types: Single houses, duplexes, row houses, apartments, and mobile homes. This disaggregation will be useful for energy demand analysis, since different types of houses have different energy requirements.

Now, the provincial detail is forced to match the national total for each type of housing. In the future, we may find that we do better by using the provincial detail and defining the national total as the sum of that detail.

8.2 Participation Rates

The same five age groups and male-female categories used at the national level are modelled at the provincial level. The total employment ratio is used in lieu of the age-sex specific employment ratio since that detail has not yet been developed for the provinces. Each age-sex rate is adjusted to be consistent with the national participation rate for that age-sex group.

8.3 Unemployment rates

Unemployment rates are now available for each province, given the labour force and employment estimates. It is expected that these rates will have a role to play in explaining interprovincial flows of people in the next version of the model.

9 Development and Management of Large Models

When econometric models become "large", say over 500 equations, then innovations in the management of such models can be as important as novel specifications of parts of the model. With the most recent versions of TIM, there has been a breakthrough in that the software is now operational for personal computers. This reflects the continuation of Moore's Law with the computing power doubling every few years.

9.1 Software systems

Informetrica's suite of software includes database management for about 40,000 time series with only a few people. At the same time, access to the database is pervasive throughout the company.

Estimation of equations, worksheet-type calculations, and the generation of tables are performed in MOSAIC. There are easy links to multiple databases as needed and the ability to export data to Excel.

The simulation software (SIMSYS) allows for the solution of large simultaneous, nonlinear models (over 10,000 variables) either sequentially or simultaneously. There is an ability to analyze the results of a simulation (with SCAN) by comparing two runs, transforming data into percentage changes, producing customized lists of series, referring to the mnemonic table, the model code, and examining the cross-references to identify where variables go to, and what variables influence them.

The same files used as inputs to the software support documentation of applications and the models used. This means that what you see as documentation is what is running as the model.

In addition, we recommend the production of Working Papers to describe each block in the model, in terms of specifications, interpretation of coefficients, etc. Approaches that have been tried but not successfully can be documented as well.

10 Future Developments

10.1 Interprovincial Mobility of Population

If different policies result in changing spatial patterns of economic growth and employment, then it would be useful if population moves from one region to other regions. Internal migration is usually quite large, relative to international flows. The modelling challenge will be to find useful equations that are sufficiently sensitive to produce different scenarios, but not so responsive that persistent regional differences don't continue. The disaggregation by age-sex will also be important, since the motivation for the movement may be different for different age-sex groups.

10.2 National-provincial Interactions

If successful in developing interprovincial migration equations, we can then turn to the question of whether certain variables would be better modelled at the provincial level, with the national value taken as the sum of the provincial detail. An example might be housing. In a given region, additional housing starts are needed if the gap between the housing stock and the number of households shrinks below some "normal" value. This could occur because of an influx of people into a region. If the people had instead gone to another region, the housing starts may not have been necessary, or even more starts may have resulted. Given the "local" nature of housing, we would approximate that more closely with a provincial housing model. National totals would simply be the sum of provincial totals.

Potential areas for regional modelling include:

- Housing sector
- Imputed rent on owner-occupied housing
- Paid rent
- Price indexes for housing and rent
- Electricity and Electricity Pricing
- Natural gas and natural gas pricing
- Some location-specific services
 - Health care
 - Primary & secondary education
 - University tuitions
- Minimum wages
- Participation rates

- University and college participation rates

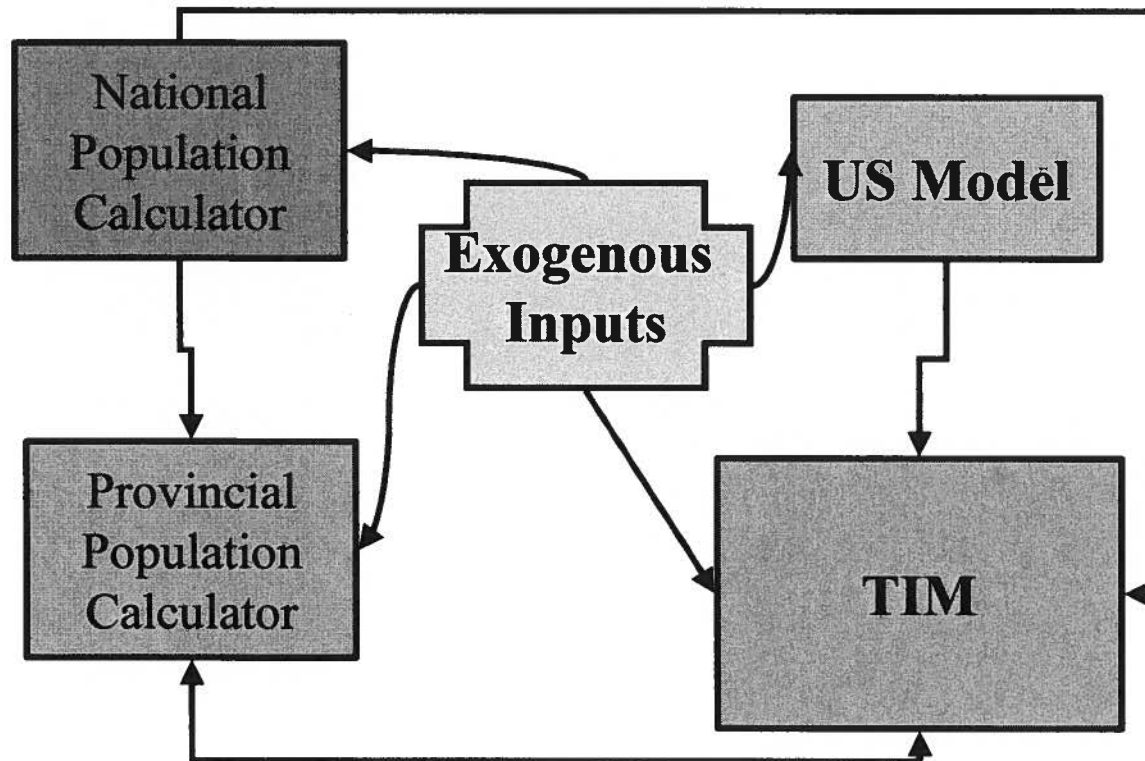
However, for this effort to be of substantial use there must be robust equations in place to alter the age-sex structure of the provincial populations over time and under different policy packages.

A Appendix TIM 2005 Summary

A.1 Background

The **Informetrica Model (TIM)** has been in existence since 1979. Before that, Informetrica used the CANDIDE model for forecasts and policy studies. With data system changes, new client needs, and the evolving structure of the economy, new versions of TIM are developed every few years. The most recent rebuilding process was completed in 2003, with subsequent improvements leading to the current version, TIM 2005.

TIM is used by Informetrica to produce forecasts of the Canadian economy through 2025. Multiple scenarios are maintained to reflect the uncertainty around key driving forces. The model is also used for **policy simulations** (e.g., new tax and expenditure programs), the **evaluation** of various proposals for economic development (e.g., major pipeline and energy projects), and to **explore** possible challenges (e.g., health expenditures and human resources).



The Informetrica modeling system includes four formal models covering:

- The US economy,

- The population of Canada measured nationally,
- The population of each province and each territory, and
- The economy of Canada measured nationally, and with each province and the territories integrated into one formal model (“TIM”).

A.2 US Model and Forecasts

In the use of the current model framework, before we produce a forecast with TIM we usually consider the US outlook, global developments, and the specifics affecting Canadian and provincial population growth.

Most of the US variables are linked to a US model. We currently use the model of Macroeconomic Advisers in St. Louis and provide long-term projections using this model, supported by monthly monitoring reports. These include a review of other country growth prospects developed through a consensus process where Informetrica is a consensus panel participant. Informetrica staff is familiar with the software system that administers the US model, and the properties of the model. The staff regularly produces long-term US projections, applies them to produce client-specific alternative scenarios (e.g., a projection consistent with the US Energy Information Administration view of US prospects), and uses this model to prepare impact statements.

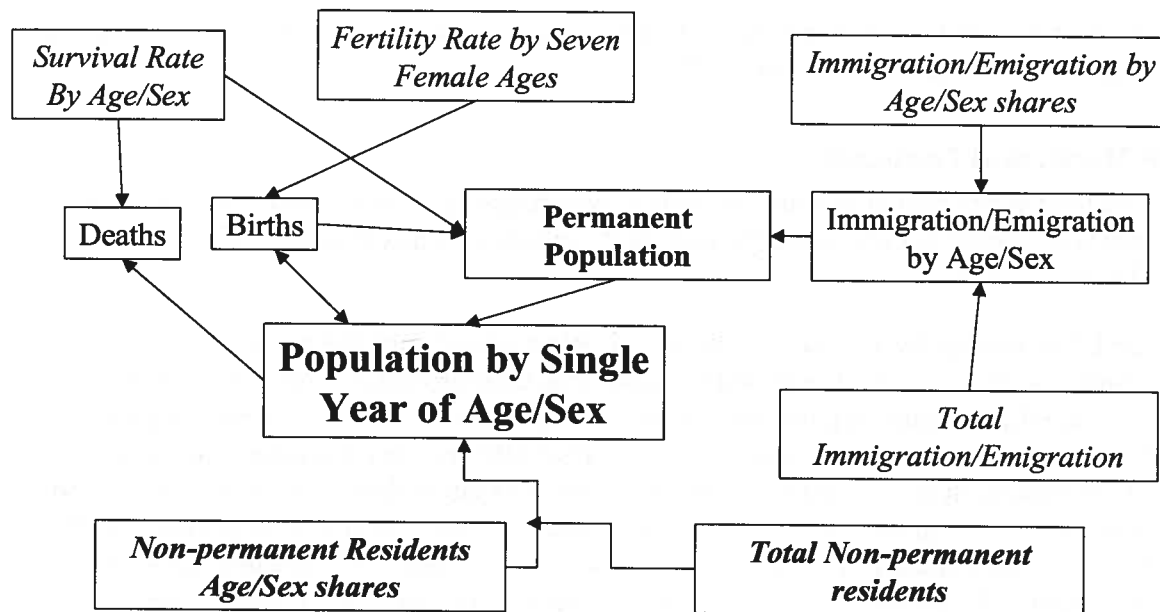
A.3 Population Calculators

We have developed our own population calculators for both the national and provincial economies, which use our assumptions about fertility, mortality, and immigration to produce detailed age-sex projections of population. Major reports detailing the assumptions, population outcomes, sensitivity to varying assumptions, and comparison to Statistics Canada projections have been prepared.

The figure below indicates the main factors determining national population. The population resident in Canada is composed of a permanent population of citizens, landed immigrants and others, and a non-permanent population. The latter is a small number (currently about 290,000). Both categories of residents are distinguished by single year of age (those aged 90 or more are a single category) and sex. Non-permanent residents are projected based on an assumed growth in the total, with this allocated to the population through assumed age and sex-specific share assumptions.

Changes to the population are dominated by factors that influence the permanent population – births, deaths, and immigration. Births are determined by fertility rates for seven female age groups and the population of women for these ages, regardless of permanent/non-permanent status. Currently, the fertility rates are set exogenously.

National Population Calculator



italics – exogenous variables

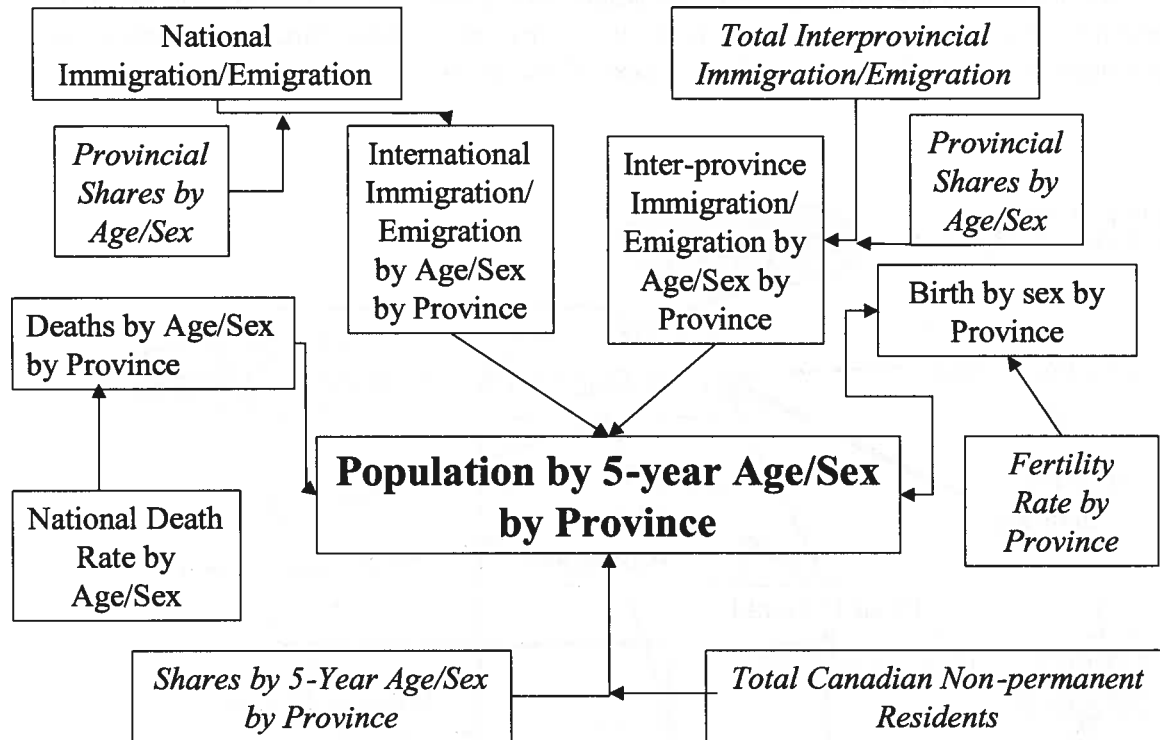
Growth in the permanent population is also determined by the probability that persons will survive (a “survival rate”) from one year to the next year of age; these are specific to each age-sex group. Survival rates are set exogenously, with this sensitive to past trends. Total deaths reported are based on the total population; survival rates for the non-permanent population are implicitly the same as for permanent residents.

Finally, immigrant landings, and emigration also determine changes in the population, where this is focused on permanent residents. In the current implementation of the population model, exogenously set totals for immigration and emigration are allocated by age and sex, with these also set exogenously.

A.4 Provincial Population Calculator

For each province (and territory) population is projected by five-year age groups (ending in a category for those 90 and older), by sex. Development of provincial population is indicated in the panel below. As in the national model, there is a distinction between permanent and non-permanent residents in each province. A formal calculation for permanent residents is not incorporated in the model, however. A province-specific single fertility rate for women aged 15-49, and the population of women of this age in the province determine births in each province.

Male and female births are distinguished. Deaths are determined for each age group, by sex, based on national death rates for that age and sex, and the appropriate population in the province.

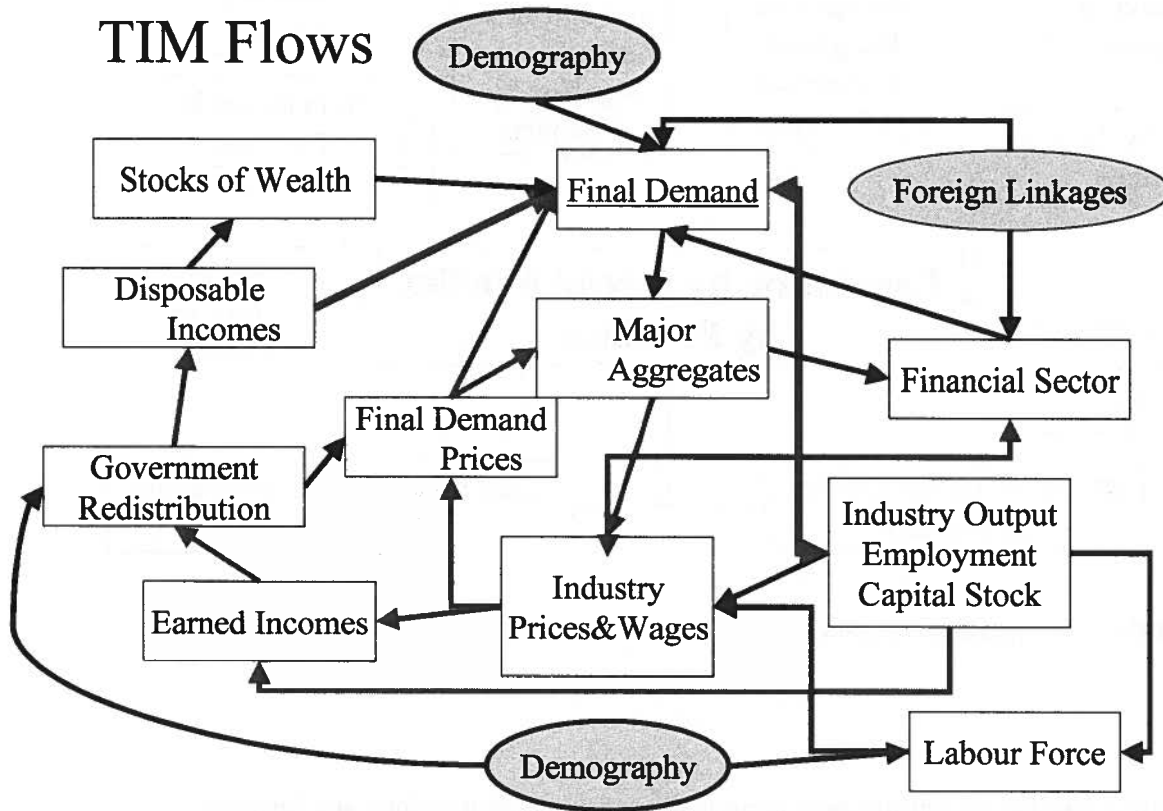


italics – exogenous variables

Two distinct sources of immigration are considered for each province and territory – international immigration and inter-provincial migration. For each component, immigration and emigration flows are distinguished, for each age and by sex. For international migration influencing each province, the national totals for immigration/emigration are shared out to each province, for each age group and by sex. For inter-provincial migration, total flows of immigration and emigration are set for each province, and are then shared out within the province by age and sex. Both total flows and their distribution are set exogenously in the current implementation of the model.

A.5 The Informetrica Model (TIM)

TIM is a large, dynamic econometric model of the Canadian national economy and provincial economies. Its size – about 20,000 equations – puts it in a class by itself among economic models. It has substantial detail on final demand expenditures by sector, industry detail for Gross Domestic Product (GDP) and employment, and wages and prices as well. Government revenues and expenditures are estimated in detail by level of government. Labour force participation rates and employment by age and sex are a unique aspect of the model.

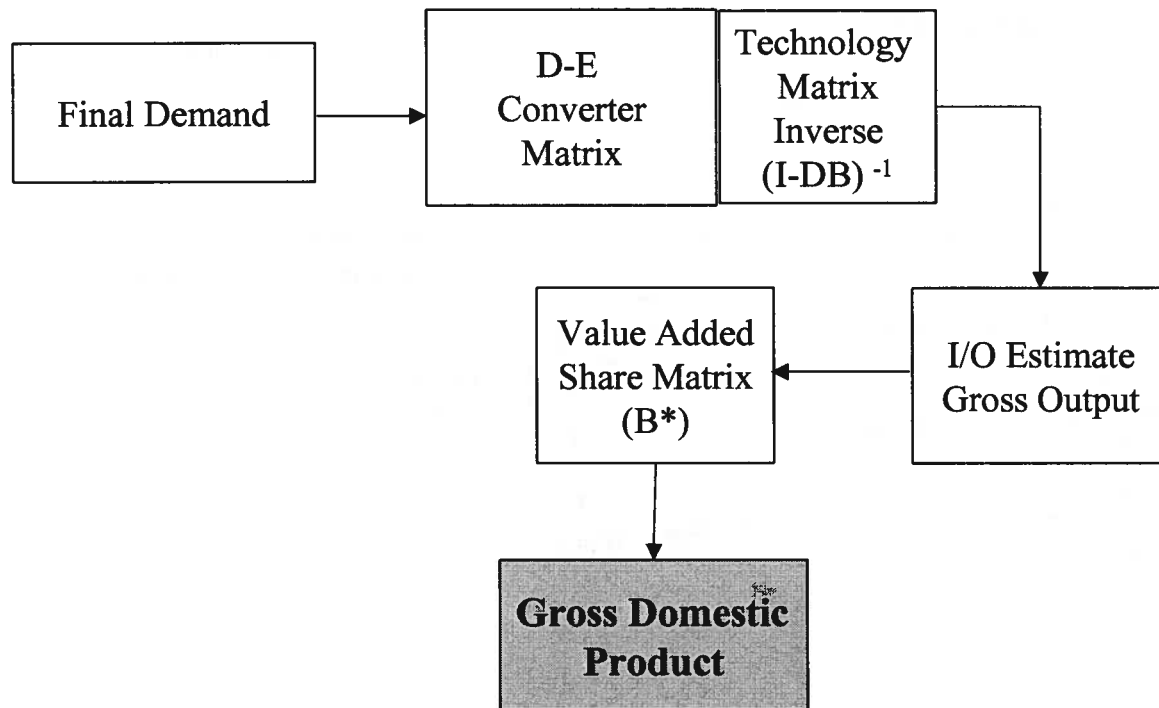


Final demand is made up of the conventional expenditure categories – consumption, residential construction and housing, business and government capital formation, government current expenditures, inventory change, and exports and imports. Each category is disaggregated into specific components and grouped in a model "block".

Our approach is to specify behavioural equations in all of these blocks in current dollars. We then take prices from the final demand prices block and deflate the nominal expenditures to obtain real expenditures. Note that Fisher price indexes have the same weights as Fisher quantity indexes. Prices are modeled independently. The real spending satisfies the identity that $C = P * K$.

Our current prices model uses an input-output model to combine industry value-added prices with import prices, energy prices, and indirect tax/subsidy rates to calculate detailed final demand prices. The exchange rate affects final demand prices through import prices directly and through some of the value-added prices that are sensitive to the exchange rate. Energy prices are determined through a rule linking the world oil price in US\$ to the landed price in Canada in Canadian dollars. Other forms of energy are priced by reference to the oil price.

Determination of Industry Output

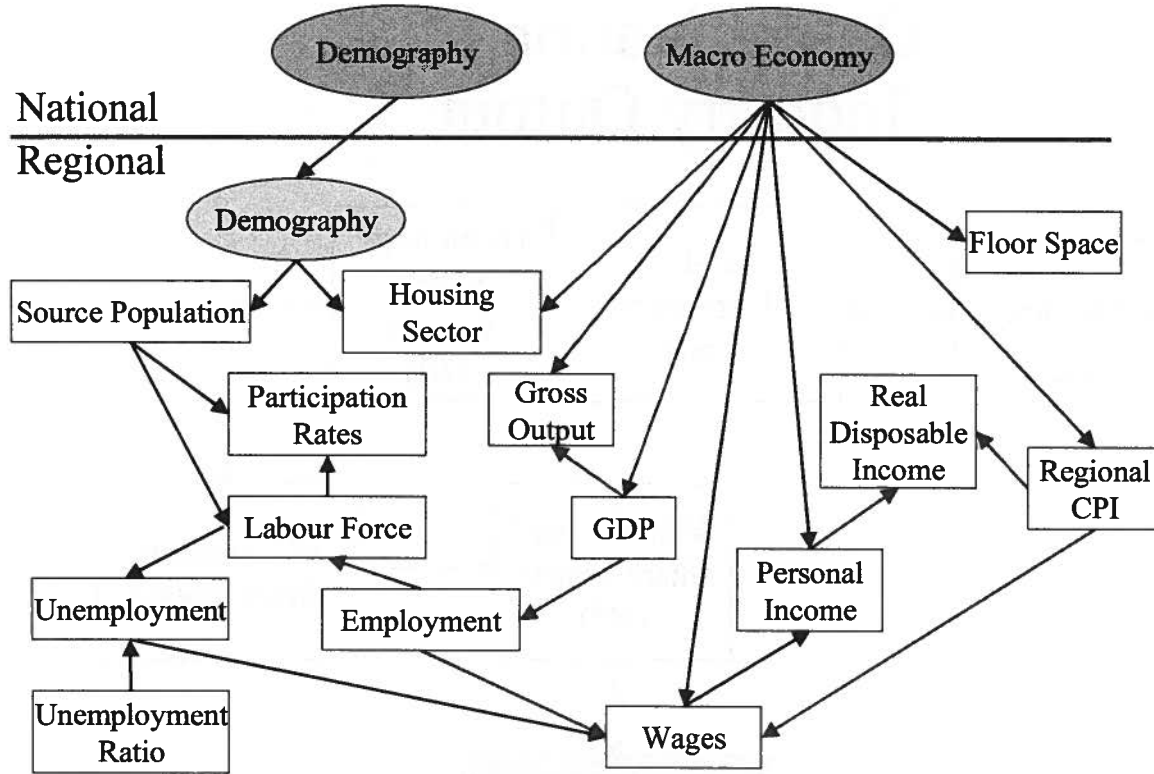


More than 300 industries are separately identified for Gross Output and Gross Domestic Product. Incorporated in the model is an input-output system (unique in its detail and developed by Informetrica) that recognizes the impact on production of final demand and inter-industry requirements. Inter-industry requirements are static, although development of variable coefficient input-output tables is underway.

Employment is currently detailed for 43 separate industries, with employment also estimated for aggregate industries by age and sex. Labour supply is derived from the population calculator estimates of source population, detailed by age and sex, and participation rates.

Investment and the capital stock is measured by asset type. The accounting for capital stock is nothing more than the sum of previous period capital stock and current year investment. Stocks are “dated” as of the end of the year. The average nameplate date is calculated here, along with the average age of the capital stock. These variables are useful in lieu of a time trend in the productivity equations.

Regional Flow Diagram



Provincial economic activity is usually an allocation of national outcomes. Service industry detail is endogenous to demographic and other province-specific information. In the case of housing and labour force participation, provincial behavior may eventually be used to determine national performance. In other areas, data quality and available detail limit the use of independent equations.

Earned incomes are combined with government transfers and taxes to estimate disposable income for persons and businesses. Government expenditures and revenues are used to define government balances by level of government. Interest rates and exchange rates are based on a variety of rules that can be set to describe central bank monetary policy.

A.6 Applications

Some users simply bring TIM data and forecasts into their environment to produce their own industry scenarios. This is made easier by the provision of spreadsheets with historical and forecast data for clients.

Informetrica Limited staff can prepare client-specific forecasts or scenarios. Client models can be developed by staff and appended to TIM.

TIM can also be integrated with other models on a PC. At present, several groups are "linking" to TIM to provide the macroeconomic module in their own large energy-environment models.

B Disaggregation of Investment

Investment by Asset Type
with supplemental industry detail

	(millions of \$)		share of total	
	1981	2003	1981	2003
01 Government investment in non-residential structures and equipment	10,490	31,276	15.67%	19.14%
02 Non-residential structures	8,374	21,196	12.51%	12.97%
03 Building	3,023	10,917	4.52%	6.68%
SED1CC Education, building, govt invest, \$C, mn	928	4,247	1.39%	2.60%
SHEBCC Health, building - commercial, govt invest, \$C, mn	14	38	0.02%	0.02%
SHECCC Health, building - institutional, govt invest, \$C, mn	850	3,347	1.27%	2.05%
ADT1CC Public admin, building, govt invest, \$C, mn	1,192	4,533	1.78%	2.77%
Residual, G buildings	40	(1,249)	0.06%	-0.76%
04 Engineering	5,351	10,279	7.99%	6.29%
GTEFCC Transportation engineering, govt invest, \$C, mn	3,227	6,170	4.82%	3.78%
GTEYCC Waterworks & sewage, govt invest, \$C, mn	1,145	2,171	1.71%	1.33%
GTEZCC Marine & other, govt invest, \$C, mn	854	1,105	1.28%	0.68%
Residual, G, Engineering	124	833	0.19%	0.51%
05 Machinery and equipment	2,116	10,080	3.16%	6.17%
06 Furniture	231	680	0.35%	0.42%
07 Agricultural machinery	13	8	0.02%	0.00%
08 Industrial machinery	207	380	0.31%	0.23%
09 Computers and other office eqpt.	316	2,240	0.47%	1.37%
10 Software	276	3,488	0.41%	2.13%
11 Automobiles	84	271	0.13%	0.17%
12 Trucks	106	257	0.16%	0.16%
13 Other transportation equipment	242	577	0.36%	0.35%
14 Telecommunications equipment	170	416	0.25%	0.25%
15 Other machinery and equipment	471	1,763	0.70%	1.08%

**Investment by Asset Type
with supplemental industry detail**

	(millions of \$)		share of total	
	1981	2003	1981	2003
16 Business investment in non-residential structures and equipment	56,464	132,118	84.33%	80.86%
17 Non-residential structures	28,094	51,155	41.96%	31.31%
18 Building	10,265	15,323	15.33%	9.38%
TLB1CC Total building, bus invest (WCS), \$C, mn	10,324	15,242	15.42%	9.33%
Residual, Bus. Bldgs	(59)	81	-0.09%	0.05%
19 Engineering	17,829	35,832	26.63%	21.93%
BNEKC Oil & gas engineering, bus invest, \$C, mn	8,654	19,693	12.92%	12.05%
BNEICC Electric utilities engineering, bus invest, \$C, mn	4,266	5,303	6.37%	3.25%
BNEXC Other engineering, total, bus invest, \$C, mn	5,034	7,836	7.52%	4.80%
BNEFCC Transportation engineering, bus invest, \$C, mn	1,049	2,165	1.57%	1.33%
BNEYC Waterworks & sewage, bus invest, \$C, mn	633	1,698	0.95%	1.04%
BNEJCC Communication engineering, bus invest, \$C, mn	807	1,819	1.21%	1.11%
BNELCC Mining engineering, bus invest, \$C, mn	1,728	1,141	2.58%	0.70%
BNEZCC Marine & other, bus invest, \$C, mn	817	1,012	1.22%	0.62%
Residual, Bus. engineering	(125)	3,000	-0.19%	1.84%
20 Machinery and equipment	28,370	80,963	42.37%	49.55%
21 Furniture	923	4,862	1.38%	2.98%
22 Agricultural machinery	2,600	2,957	3.88%	1.81%
23 Industrial machinery	10,672	22,153	15.94%	13.56%
24 Computers and other office equipment	2,243	7,395	3.35%	4.53%
25 Software	797	10,939	1.19%	6.69%
26 Automobiles	1,806	6,562	2.70%	4.02%
27 Trucks	2,003	8,562	2.99%	5.24%
28 Other transportation equipment	2,877	5,632	4.30%	3.45%
29 Telecommunications equipment	1,913	5,655	2.86%	3.46%
30 Other machinery and equipment	2,536	6,246	3.79%	3.82%
31 Investment in non-residential structures and equipment	66,954	163,394	100.00%	100.00%
Overall residual	(20)	2,663	-0.03%	1.63%



C Employment and Unemployment by Age-Sex: 1990, 2000

YEAR: 2000

	SEX/AGE											TOTAL
	F - 1519	F - 2024	F - 2554	F - 5564	F - 6500	M - 1519	M - 2024	M - 2554	M - 5564	M - 6500	TOTAL	
TOTLET	435.5	675.6	5128.1	555.3	65.9	444.5	733.6	5936.8	788.3	146.1	14909.7	
AGFLET	8.6	9.3	84.8	19.2	7.0	27.8	26.8	223.0	52.7	32.9	492.3	
RUCLET	3.0	9.8	115.3	13.1	1.7	26.7	73.8	747.6	91.5	12.9	1095.3	
MATLET	13.3	55.6	519.4	44.6	2.9	41.5	153.5	1291.7	146.4	11.4	2280.2	
TRDLET	147.7	164.5	715.5	82.2	10.3	135.6	154.2	785.1	105.9	17.1	2318.1	
TSPLET	2.6	12.2	147.7	14.2	1.2	10.9	34.9	483.4	67.4	5.5	779.8	
CICLET	10.2	18.9	143.9	7.7	0.5	13.5	18.0	159.6	7.4	2.5	382.0	
FITLET	11.5	36.9	420.6	37.4	5.8	8.2	23.3	267.8	41.5	13.9	867.0	
SPSLET	7.0	34.4	334.9	27.6	4.5	7.8	34.6	430.0	52.2	13.1	945.9	
SADLET	12.1	26.7	187.1	24.9	3.2	20.7	42.5	189.5	30.9	8.6	546.2	
SEDLET	9.1	42.0	518.0	59.6	3.0	5.2	18.7	269.2	46.5	3.6	974.8	
SHELET	19.1	80.2	1009.6	120.5	8.4	5.8	16.7	231.6	28.2	6.4	1526.4	
SARLET	22.7	22.9	79.6	8.5	2.8	25.7	18.9	88.0	10.9	3.5	283.5	
SAFLET	129.1	108.5	293.1	34.8	4.6	92.8	68.6	199.1	27.3	2.6	960.6	
SVOLET	32.0	32.0	260.4	34.5	7.9	16.0	30.0	233.8	39.2	10.1	695.8	
AFGLET	1.0	10.1	115.2	9.4	0.6	0.8	6.7	119.1	13.7	1.4	278.1	
ADPLET	0.6	4.0	106.6	9.8	0.1	0.4	3.9	87.6	10.5	0.9	224.3	
ADLLET	6.1	7.7	76.6	7.2	1.5	4.6	8.7	131.0	14.2	1.7	259.3	
UTTTL	77.4	64.0	313.9	32.3	2.1	94.3	95.6	361.1	45.1	3.8	1089.6	
LTTTL	512.8	739.7	5442.0	587.7	67.8	538.8	829.2	6297.9	833.4	149.9	15999.2	

YEAR: 2000

SEX/AGE	F - 1519	F - 2024	F - 2554	F - 5564	F - 6500	M - 1519	M - 2024	M - 2554	M - 5564	M - 6500	TOTAL
EMPLOYMENT	0.029	0.045	0.344	0.037	0.004	0.030	0.049	0.398	0.053	0.010	1.000
Agr., For, Fish	0.017	0.019	0.172	0.039	0.014	0.056	0.054	0.453	0.107	0.067	1.000
Mining, Util, Con	0.003	0.009	0.105	0.012	0.002	0.024	0.067	0.683	0.084	0.012	1.000
Manufacturing	0.006	0.024	0.228	0.020	0.001	0.018	0.067	0.566	0.064	0.005	1.000
Trade	0.064	0.071	0.309	0.035	0.004	0.058	0.067	0.339	0.046	0.007	1.000
Transport & Storage	0.003	0.016	0.189	0.018	0.002	0.014	0.045	0.620	0.086	0.007	1.000
Information & Culture	0.027	0.049	0.377	0.020	0.001	0.035	0.047	0.418	0.019	0.007	1.000
Finance & Insurance	0.013	0.043	0.485	0.043	0.007	0.009	0.027	0.309	0.048	0.016	1.000
Prof., Scientific & Tech.	0.007	0.036	0.354	0.029	0.005	0.008	0.037	0.455	0.055	0.014	1.000
Admin & Support	0.022	0.049	0.343	0.046	0.006	0.038	0.078	0.347	0.057	0.016	1.000
Education	0.009	0.043	0.531	0.061	0.003	0.005	0.019	0.276	0.048	0.004	1.000
Health	0.013	0.053	0.661	0.079	0.006	0.004	0.011	0.152	0.018	0.004	1.000
Amusement & Rec.	0.080	0.081	0.281	0.030	0.010	0.091	0.067	0.310	0.038	0.012	1.000
Accomm. & Food	0.134	0.113	0.305	0.036	0.005	0.097	0.071	0.207	0.028	0.003	1.000
Other Services	0.046	0.046	0.374	0.050	0.011	0.023	0.043	0.336	0.056	0.015	1.000
Federal Admin	0.004	0.036	0.414	0.034	0.002	0.003	0.024	0.428	0.049	0.005	1.000
Prov. Admin	0.003	0.018	0.475	0.044	0.000	0.002	0.017	0.390	0.047	0.004	1.000
Local Admin	0.024	0.030	0.295	0.028	0.006	0.018	0.034	0.505	0.055	0.007	1.000
UNEMPLOYMENT	0.071	0.059	0.288	0.030	0.002	0.087	0.088	0.331	0.041	0.003	1.000
LABOUR FORCE	0.032	0.046	0.340	0.037	0.004	0.034	0.052	0.394	0.052	0.009	1.000

YEAR: 2000

	SEX/AGE										TOTAL
	F - 1519	F - 2024	F - 2554	F - 5564	F - 6500	M - 1519	M - 2024	M - 2554	M - 5564	M - 6500	
EMPLOYMENT	0.849	0.913	0.942	0.945	0.972	0.825	0.885	0.943	0.946	0.975	0.932
Agr., For, Fish	0.017	0.013	0.016	0.033	0.103	0.052	0.032	0.035	0.063	0.219	0.031
Mining, Util, Con	0.006	0.013	0.021	0.022	0.025	0.050	0.089	0.119	0.110	0.086	0.068
Manufacturing	0.026	0.075	0.095	0.076	0.043	0.077	0.185	0.205	0.176	0.076	0.143
Trade	0.288	0.222	0.131	0.140	0.152	0.252	0.186	0.125	0.127	0.114	0.145
Transport & Storage	0.005	0.016	0.027	0.024	0.018	0.020	0.042	0.077	0.081	0.037	0.049
Information & Culture	0.020	0.026	0.026	0.013	0.007	0.025	0.022	0.025	0.009	0.017	0.024
Finance & Insurance	0.022	0.050	0.077	0.064	0.086	0.015	0.028	0.043	0.050	0.093	0.054
Prof., Scientific & Tech.	0.014	0.047	0.062	0.047	0.066	0.014	0.042	0.068	0.063	0.087	0.059
Admin & Support	0.024	0.036	0.034	0.042	0.047	0.038	0.051	0.030	0.037	0.057	0.034
Education	0.018	0.057	0.095	0.101	0.044	0.010	0.023	0.043	0.056	0.024	0.061
Health	0.037	0.108	0.186	0.205	0.124	0.011	0.020	0.037	0.034	0.043	0.095
Amusement & Rec.	0.044	0.031	0.015	0.014	0.041	0.048	0.023	0.014	0.013	0.023	0.018
Accomm. & Food	0.252	0.147	0.054	0.059	0.068	0.172	0.083	0.032	0.033	0.017	0.060
Other Services	0.062	0.043	0.048	0.059	0.117	0.030	0.036	0.037	0.047	0.067	0.043
Federal Admin	0.002	0.014	0.021	0.016	0.009	0.001	0.008	0.019	0.016	0.009	0.017
Prov. Admin	0.001	0.005	0.020	0.017	0.001	0.001	0.005	0.014	0.013	0.006	0.014
Local Admin	0.012	0.010	0.014	0.012	0.022	0.009	0.010	0.021	0.017	0.011	0.016
UNEMPLOYMENT	0.151	0.087	0.058	0.055	0.031	0.175	0.115	0.057	0.054	0.025	0.068
LABOUR FORCE	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

	YEAR: 2000										
	SEX/AGE		F - 2024	F - 2554	F - 5564	F - 6500	M - 1519	M - 2024	M - 2554	M - 5564	M - 6500
EMPLOYMENT	0.027	0.042	0.321	0.035	0.004	0.028	0.046	0.371	0.049	0.009	0.932
Agr., For, Fish	0.001	0.001	0.005	0.001	0.000	0.002	0.002	0.014	0.003	0.002	0.031
Mining, Util, Con	0.000	0.001	0.007	0.001	0.000	0.002	0.005	0.047	0.006	0.001	0.068
Manufacturing	0.001	0.003	0.032	0.003	0.000	0.003	0.010	0.081	0.009	0.001	0.143
Trade	0.009	0.010	0.045	0.005	0.001	0.008	0.010	0.049	0.007	0.001	0.145
Transport & Storage	0.000	0.001	0.009	0.001	0.000	0.001	0.002	0.030	0.004	0.000	0.049
Information & Culture	0.001	0.001	0.009	0.000	0.000	0.001	0.001	0.010	0.000	0.000	0.024
Finance & Insurance	0.001	0.002	0.026	0.002	0.000	0.001	0.001	0.017	0.003	0.001	0.054
Prof., Scientific & Tech.	0.000	0.002	0.021	0.002	0.000	0.000	0.002	0.027	0.003	0.001	0.059
Admin & Support	0.001	0.002	0.012	0.002	0.000	0.001	0.003	0.012	0.002	0.001	0.034
Education	0.001	0.003	0.032	0.004	0.000	0.000	0.001	0.017	0.003	0.000	0.061
Health	0.001	0.005	0.063	0.008	0.001	0.000	0.001	0.014	0.002	0.000	0.095
Amusement & Rec.	0.001	0.001	0.005	0.001	0.000	0.002	0.001	0.006	0.001	0.000	0.018
Accomm. & Food	0.008	0.007	0.018	0.002	0.000	0.006	0.004	0.012	0.002	0.000	0.060
Other Services	0.002	0.002	0.016	0.002	0.000	0.001	0.002	0.015	0.002	0.001	0.043
Federal Admin	0.000	0.001	0.007	0.001	0.000	0.000	0.000	0.007	0.001	0.000	0.017
Prov. Admin	0.000	0.000	0.007	0.001	0.000	0.000	0.000	0.005	0.001	0.000	0.014
Local Admin	0.000	0.000	0.005	0.000	0.000	0.000	0.001	0.008	0.001	0.000	0.016
UNEMPLOYMENT	0.005	0.004	0.020	0.002	0.000	0.006	0.006	0.023	0.003	0.000	0.068
LABOUR FORCE	0.032	0.046	0.340	0.037	0.004	0.034	0.052	0.394	0.052	0.009	1.000

Change in level (2000-1990)

	F - 1519	F - 2024	F - 2554	F - 5564	F - 6500	M - 1519	M - 2024	M - 2554	M - 5564	M - 6500	TOTAL
EMPLOYMENT	-18.9	-25.4	936.7	155.7	6.1	-47.2	-18.7	739.2	85.0	13.2	1825.7
Agr., For, Fish	-2.0	1.6	-15.0	-4.5	-1.3	-8.9	-3.0	-15.7	-14.8	-3.9	-66.8
Mining, Util, Con	-2.5	-6.8	1.1	2.7	0.8	-5.0	-36.1	-19.0	-0.5	7.6	-57.8
Manufacturing	-5.6	-7.7	71.9	1.8	1.3	-4.1	6.7	158.6	4.4	0.6	227.7
Trade	-11.1	15.8	123.3	12.5	-0.6	-30.9	6.3	101.9	22.1	2.0	241.3
Transport & Storage	-2.0	-4.2	34.8	4.5	0.0	0.0	-4.0	85.0	16.6	2.1	132.6
Information & Culture	2.5	0.7	29.5	-2.4	-0.3	5.3	0.6	19.7	-8.0	1.8	49.1
Finance & Insurance	-6.1	-31.5	31.8	9.9	0.3	-2.7	-6.2	20.3	3.7	-0.7	18.9
Prof., Scientific & Tech.	-0.7	-1.2	140.3	15.0	1.5	1.6	5.3	184.2	22.9	3.3	372.2
Admin & Support	4.9	9.6	88.1	13.3	1.2	3.7	16.9	83.2	12.6	1.9	235.4
Education	0.7	9.4	90.4	25.8	0.6	-1.6	0.1	-6.3	8.5	1.2	128.7
Health	-21.2	-30.3	202.9	48.0	-1.9	-3.2	-7.4	49.6	4.9	0.2	241.7
Amusement & Rec.	6.9	12.3	26.4	3.7	2.2	11.7	2.5	32.1	3.9	0.3	101.9
Accomm. & Food	22.1	25.8	58.2	11.9	1.8	-1.1	8.0	55.8	6.3	-1.1	187.9
Other Services	-0.4	-8.2	47.5	5.5	-0.9	-5.2	-1.4	32.6	12.5	2.2	84.1
Federal Admin	-0.8	0.9	1.5	2.2	0.1	-1.9	-0.8	-13.5	-4.9	-1.5	-18.7
Prov. Admin	-1.4	-6.5	3.5	4.6	-0.5	-1.0	-1.8	-14.5	-2.3	-0.4	-20.3
Local Admin	-1.9	-5.0	0.9	1.3	0.7	-4.5	-4.2	-14.2	-4.8	-0.4	-32.2
UNEMPLOYMENT	12.8	-13.5	-29.3	8.2	1.3	7.2	-13.6	-40.6	-1.6	1.8	-67.3
LABOUR FORCE	-6.2	-38.7	907.5	163.9	7.1	-40.0	-32.3	698.6	83.4	15.0	1758.3

Age-sex shifts

	F - 1519	F - 2024	F - 2554	F - 5564	F - 6500	M - 1519	M - 2024	M - 2554	M - 5564	M - 6500	TOTAL
EMPLOYMENT											
Agr., For, Fish	-0.6%	-0.8%	2.4%	0.7%	0.0%	-0.8%	-0.8%	0.1%	-0.1%	0.0%	0
Mining, Util, Con	-0.1%	0.5%	-0.6%	-0.3%	-0.1%	-0.9%	0.1%	2.6%	-1.4%	0.1%	0
Manufacturing	-0.2%	-0.5%	0.6%	0.3%	0.1%	-0.3%	-2.8%	1.8%	0.4%	0.7%	0
Trade	-0.3%	-0.6%	1.0%	-0.1%	0.0%	-0.4%	-0.4%	1.4%	-0.5%	0.0%	0
Transport & Storage	-1.3%	-0.1%	2.4%	0.2%	-0.1%	-2.2%	-0.5%	1.0%	0.5%	0.0%	0
Information & Culture	-0.4%	-1.0%	1.5%	0.3%	0.0%	-0.3%	-1.5%	0.4%	0.8%	0.2%	0
Finance & Insurance	0.4%	-0.5%	3.3%	-1.0%	-0.1%	1.1%	-0.5%	-0.2%	-2.7%	0.4%	0
Prof., Scientific & Tech.	-0.7%	-3.8%	2.7%	1.1%	0.0%	-0.3%	-0.8%	1.7%	0.3%	-0.1%	0
Admin & Support	-0.6%	-2.6%	1.5%	0.7%	0.0%	-0.3%	-1.4%	2.6%	0.4%	-0.3%	0
Education	-0.1%	-0.6%	2.4%	0.8%	-0.1%	-1.7%	-0.5%	0.5%	-0.2%	-0.6%	0
Health	-0.1%	0.5%	2.6%	2.1%	0.0%	-0.3%	-0.3%	-4.9%	0.3%	0.1%	0
Amusement & Rec.	-1.9%	-3.3%	3.3%	2.3%	-0.3%	-0.3%	-0.8%	1.0%	0.0%	-0.1%	0
Accomm. & Food	-0.7%	2.2%	-1.2%	0.4%	0.7%	1.4%	-2.4%	0.3%	0.0%	-0.5%	0
Other Services	-0.4%	0.6%	0.1%	0.7%	0.1%	-2.5%	-0.7%	2.2%	0.1%	-0.2%	0
Federal Admin	-0.7%	-2.0%	2.6%	0.2%	-0.3%	-1.2%	-0.8%	0.7%	1.3%	0.2%	0
Prov. Admin	-0.2%	0.5%	3.1%	1.0%	0.0%	-0.6%	-0.1%	-1.8%	-1.3%	-0.5%	0
Local Admin	-0.6%	-2.5%	5.4%	2.2%	-0.2%	-0.4%	-0.6%	-2.7%	-0.6%	-0.1%	0
UNEMPLOYMENT	-0.4%	-1.4%	3.6%	0.8%	0.3%	-1.3%	-1.1%	0.7%	-1.0%	-0.1%	0
LABOUR FORCE	1.5%	-0.8%	-0.9%	0.9%	0.1%	1.1%	-0.7%	-1.6%	0.1%	0.2%	0
	-0.4%	-0.8%	2.2%	0.7%	0.0%	-0.7%	-0.9%	0.0%	-0.1%	0.0%	0

Industry Shifts

	F - 1519	F - 2024	F - 2554	F - 5564	F - 6500	M - 1519	M - 2024	M - 2554	M - 5564	M - 6500	TOTAL
EMPLOYMENT	-2.6%	1.3%	1.8%	0.2%	-1.3%	-2.5%	1.1%	1.4%	0.8%	-1.1%	1.3%
Agr., For, Fish	-0.4%	0.3%	-0.6%	-2.3%	-3.3%	-1.2%	-0.2%	-0.7%	-2.7%	-5.3%	-0.8%
Mining, Util, Con	-0.5%	-0.8%	-0.4%	-0.2%	1.0%	-0.5%	-3.9%	-1.8%	-1.3%	4.7%	-1.3%
Manufacturing	-1.0%	-0.6%	-0.3%	-2.5%	1.6%	-0.2%	1.5%	0.3%	-1.4%	-0.4%	-0.2%
Trade	-1.8%	3.1%	0.1%	-2.5%	-2.8%	-3.6%	1.4%	0.3%	1.5%	0.2%	-0.1%
Transport & Storage	-0.4%	-0.5%	0.2%	0.1%	-0.2%	0.1%	-0.3%	0.6%	1.3%	1.1%	0.3%
Information & Culture	0.5%	0.2%	0.1%	-1.1%	-0.6%	1.1%	0.2%	0.0%	-1.2%	1.1%	0.1%
Finance & Insurance	-1.1%	-3.8%	-0.8%	-0.1%	-0.5%	-0.4%	-0.6%	-0.2%	-0.1%	-1.5%	-0.5%
Prof., Scientific & Tech.	-0.1%	0.1%	1.9%	1.7%	1.7%	0.4%	0.8%	2.4%	2.4%	1.5%	1.9%
Admin & Support	1.0%	1.4%	1.3%	1.5%	1.4%	0.9%	2.2%	1.1%	1.3%	0.8%	1.2%
Education	0.2%	1.5%	0.1%	2.2%	0.5%	-0.2%	0.1%	-0.6%	0.5%	0.6%	0.2%
Health	-4.0%	-3.4%	0.8%	3.4%	-4.6%	-0.5%	-0.8%	0.4%	0.3%	-0.3%	0.5%
Amusement & Rec.	1.4%	1.7%	0.3%	0.3%	3.1%	2.4%	0.4%	0.4%	0.4%	0.0%	0.5%
Accomm. & Food	4.6%	4.0%	0.2%	0.5%	2.2%	1.0%	1.2%	0.6%	0.5%	-1.0%	0.6%
Other Services	0.0%	-0.8%	0.1%	-1.0%	-2.8%	-0.7%	0.0%	0.1%	1.1%	0.9%	0.1%
Federal Admin	-0.2%	0.2%	-0.4%	-0.1%	0.1%	-0.3%	-0.1%	-0.5%	-0.8%	-1.2%	-0.3%
Prov. Admin	-0.3%	-0.8%	-0.3%	0.4%	-0.8%	-0.2%	-0.2%	-0.4%	-0.4%	-0.4%	-0.3%
Local Admin	-0.4%	-0.6%	-0.3%	-0.2%	0.9%	-0.7%	-0.4%	-0.5%	-0.8%	-0.4%	-0.4%
UNEMPLOYMENT	2.6%	-1.3%	-1.8%	-0.2%	1.8%	2.5%	-1.1%	-1.4%	-0.8%	1.1%	-1.3%
LABOUR FORCE	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Delta as share of total Labour Force

	F - 1519	F - 2024	F - 2554	F - 5564	F - 6500	M - 1519	M - 2024	M - 2554	M - 5564	M - 6500	TOTAL
EMPLOYMENT	-0.5%	-0.7%	2.6%	0.7%	0.0%	-0.7%	-0.7%	0.6%	0.0%	0.0%	1.3%
Agr., For, Fish	0.0%	0.0%	-0.2%	0.0%	0.0%	-0.1%	0.0%	-0.3%	-0.1%	-0.1%	-0.8%
Mining, Util, Con	0.0%	-0.1%	-0.1%	0.0%	0.0%	-0.1%	-0.3%	-0.7%	-0.1%	0.0%	-1.3%
Manufacturing	0.0%	-0.1%	0.1%	0.0%	0.0%	-0.1%	-0.1%	0.1%	-0.1%	0.0%	-0.2%
Trade	-0.2%	0.0%	0.3%	0.0%	0.0%	-0.3%	-0.1%	0.1%	0.1%	0.0%	-0.1%
Transport & Storage	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	-0.1%	0.2%	0.1%	0.0%	0.3%
Information & Culture	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.1%
Finance & Insurance	-0.1%	-0.2%	-0.1%	0.0%	0.0%	0.0%	-0.1%	-0.1%	0.0%	0.0%	-0.5%
Prof., Scientific & Tech.	0.0%	0.0%	0.7%	0.1%	0.0%	0.0%	0.0%	1.0%	0.1%	0.0%	1.9%
Admin & Support	0.0%	0.0%	0.5%	0.1%	0.0%	0.0%	0.1%	0.4%	0.1%	0.0%	1.2%
Education	0.0%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	-0.3%	0.0%	0.0%	0.2%
Health	-0.2%	-0.3%	0.6%	0.2%	0.0%	0.0%	-0.1%	0.2%	0.0%	0.0%	0.5%
Amusement & Rec.	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%	0.2%	0.0%	0.0%	0.5%
Accomm. & Food	0.1%	0.1%	0.2%	0.1%	0.0%	-0.1%	0.0%	0.2%	0.0%	0.0%	0.6%
Other Services	0.0%	-0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%
Federal Admin	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	-0.2%	0.0%	0.0%	-0.3%
Prov. Admin	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	-0.2%	0.0%	0.0%	-0.3%
Local Admin	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	-0.2%	0.0%	0.0%	-0.4%
UNEMPLOYMENT	0.0%	-0.1%	-0.4%	0.0%	0.0%	0.0%	-0.2%	-0.6%	0.0%	0.0%	-1.3%
LABOUR FORCE	-0.4%	-0.8%	2.2%	0.7%	0.0%	-0.7%	-0.9%	0.0%	-0.1%	0.0%	0.0%

