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domestic product (RGDP)
1997-2000

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FOREWORD

The gross domestic product is one of the key indicators of the economic situation of a country or region. The GDP is the unduplicated value of the goods and services produced in the economic territory of a country or region during a given period, regardless of the place of residence of those receiving the income.

GDP is thus different from personal income, which is the income received by the residents of a given territory, regardless of the place of production. It is the sum of the values added of various economic activities, value added being defined as the value of production minus the value of intermediate inputs.

This publication, which is a sequel to the work done for the Institut de la statistique du Québec (ISQ) by André Lemelin and Pierre Mainguy, researchers at the Institut national de la recherche scientifique (INRS), describes the methodology developed to determine a regional GDP (RGDP) for the 17 administrative regions of Québec. This economic indicator greatly enhances the indicators used in current regional analysis.

This document is intended for those interested in regional statistics and the methods used to produce them.

Camille Courchesne
Director, economic and social statistics

Symbols

..	Data not available
...	Not applicable
-	Nil or zero
–	Negligible
e	Estimate
p	Preliminary
r	Revised figure
x	Confidential

Abbreviations

%	Percentage
n	Number
k	In thousands
M	In millions
$	In dollars

Estimating regional gross domestic product (RGDP), 1997-2000

André Lemelin[1] and Pierre Mainguy[2]

INTRODUCTION

This paper describes the method applied to evaluate the GDP of Québec's administrative regions for the years 1997-2000. When the project was launched, the first step was to survey what had been attempted elsewhere for the calculation of regional GDPs (RGDP), to assess the value of the methods surveyed, and to verify whether they were applicable to our regions. To tell the truth, we have found few examples of RGDPs computed for entities smaller than States or provinces, except in the European Union. Nonetheless, our survey led us to distinguish two families of methods for calculating RGDP:

- So-called "bottom-up" methods consist in collecting economic data at the individual production-unit level (establishment), and then adding them up to obtain the corresponding regional data. Various adjustments are then performed in order to make the regional data consistent with national data, so that the sum of regional products is equal to total production over the national territory.

- So-called "Top-down" methods consist in allocating an overall national figure across regions. They therefore do not require knowledge of local establishment data. The national figure is distributed using an indicator which is as close as possible to the variable to be estimated.

- Practically speaking, most methods are mixed. For, on the one hand, data almost always have gaps that must be filled using a top-down method. And, on the other hand, bottom-up methods also make use of exhaustive data sources similar to those required by bottom-up methods.

(A) Gross domestic product: the concept

First of all, what is GDP? It is the value of whatever is **produced within a given territory**, no matter where those to whom the income accrues live. So GDP is fundamentally different from personal income, which is the income received by the residents of a given territory, no matter where their productive activity was performed. The discrepancy between the GDP of a region and its personal income is closely related to commuting, that is, home-to-work trips between regions: thus, the salary of a worker who lives in region A and works in region B is part of region A's personal income, but it belongs to the GDP of region B. The same logic applies to the ownership of productive capital: if the shareholders of a business established in region A live in region B, then the profits of the business are part of region A's GDP, but dividends

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paid to shareholders are counted in region B's personal income.

There are several ways of computing GDP, but the calculation must be exempt from double-counting. For instance, to evaluate the production of paper mills, one must not count the value of wood used to make pulp, since it is already counted in the production of the forestry industry. That is why GDP is equal to the sum of the **value added** of the various economic activities; value added is defined as the value of production (for example, the value of the paper produced), minus the value of intermediate inputs (such as the value of pulpwood, electricity to power the mill, etc.).

There are many varieties of GDP, depending on whether production is valued at market prices or at basic prices, in constant or current dollars. The GDPs of Québec's administrative regions are estimated **in current dollars at basic prices**. To keep things simple, let's say that the value of production at basic prices excludes indirect taxes, net of subsidies, on *products* (the GST and QST, for instance, are indirect taxes on *products*), but it includes indirect taxes, net of subsidies, on *production* (wage bill or capital taxes, for example), because the latter affect the cost of production.

(B) Some methods and examples of regional GDPs

In **Canada**, the Conference Board produces annual estimates of the GDPs of census metropolitan areas

(CMAs).[3] The method applied is to distribute value added at basic prices by industry proportionately to each CMA's share in the industry's employment, according to Statistics Canada's *Labour Force Survey* (LFS). That method is too simple to be perfectly accurate. First, it assumes equal labour productivity (GDP per worker) across regions. Second, the monthly labour force survey generates data on a place-of-residence basis, rather than on a place-of-work basis, whereas GDP is defined, as mentioned earlier, in terms of where production took place. In addition, LFS data are unreliable for small regions (or, for that matter, for small industries), because of high error margins for small sub-populations.

In the **United-States**, the Bureau of Economic Analysis (BEA) does not estimate GDP at a lesser scale than the State level. We have nonetheless reviewed their method for computing *Gross State Products* (GSP); like Statistics Canada's method for provincial GDPs, it is a mixed, bottom-up/top-down method which makes use of fiscal and administrative data.

Within the **European Union**, the rules for distributing so-called "structural" funds (in support of poorer regions) requires knowing regional GDPs. Calculations follow common principles laid down by Eurostat, the EU statistical agency. So there is an example of an approach which might throw light on our problem. But it must be kept in mind that the regions of Europe are of a much greater demographic and economic weight than most of Québec's 17 administrative regions. We have paid

particular attention to the techniques of the French *Institut national de statistique et d'études économiques* (INSEE), and of the UK Office for National Statistics (ONS).

In the **United Kingdom, the ONS** applies a method which is quite similar to that of the US BEA for estimating GSPs, and to that of Statistics Canada for provincial GDPs. It appears however that the top-down side is more important in the ONS method. The main shortcoming of that method is that wages and salaries are allocated on a place-of-residence basis, rather than on a place-of-work basis, as the concept of gross domestic product implies. On the other hand, the data requirements of the ONS method are moderate, especially when compared to INSEE's.

In **France, INSEE** applies a method which rests on a complex system of entreprise data; that system calls upon the expertise of "regional accountants", whose local presence and knowledge of the environment make it possible to better validate the information. The INSEE method is mixed, but predominantly bottom-up. It would seem to be more accurate than the ONS's, but also more demanding. That is probably why it is fully applied only for certain benchmark years, on the basis of which other years are estimated by inter- or extrapolation.

(C) The method applied to Québec

1. BROAD OUTLINE

The method developed for estimating the GDP of Québec's 17 administrative regions (AR) is described in

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3. Those estimates are published in the spring issue of the Conference Board's quarterly *Note de conjoncture métropolitaine/Metropolitan Outlook*.

the next few pages; it is a **mixed method, following the income-based approach**, closely akin to that of the ONS in the UK. Regional GDP at basic prices is computed by industry or group of industries, following the income-based approach, defined in the OECD System of National Accounts as the sum of components of value added (OCDE, 2001).

Roughly speaking, the method applied to the Québec regions consists in allocating total labour income and net income of unincorporated business (NIUB – also called "mixed income") by industry among regions using allocators constructed from Revenu Québec fiscal statistics on wages and salaries and NIUBs. Other components of value added (corporation profits, interest, capital consumption allowances, inventory valuation adjustment, and net indirect taxes on production) are then distributed for each industry in proportion to the sum of total labour income and NIUB.

In addition, five industries are treated in a special way: Fishing, hunting and trapping; Construction; Petroleum and coal products manufacturing; Lessors of real estate property; Owner-occupied dwellings. We shall come back to those later.

The process of applying the method is represented in **Figure 9**, at the end of the article. It can be summarized as follows:

1. The starting point is the Québec total, to be allocated between the regions: value added (VA) at basic prices, by industry and by component, in current dollars, according to

Québec Economic Accounts. They are the "target data".

2. Data on the regional distribution are obtained from Revenu Québec, which extracts them from individual income tax returns: wages and salaries, by administrative region of residence and by Standard Industrial Classification (SIC) industry; NIUBs, by administrative region of residence and by SIC industry.

3. Revenu Québec place-of-residence fiscal data are converted to place-of-work data using home-to-work commuting tables by SIC industry (special tabulation by Statistics Canada, based on the 1996 population census).

4. Data by SIC industry are transposed to the North-American Industry Classification System (NAICS).

5. The table of NIUBs by NAICS industry and by region is adjusted, applying the minimum-information-gain method, so as to exploit all of the information in Revenu Québec's fiscal data, while taking into account the gaps it contains (a high rate of missing information relating to industry of origin). That procedure makes it possible to use NIUB data for which the region of residence is known, but not the industry.

6. Wages and salaries and adjusted NIUBs, by industry and by region, are used as allocators for the other components of VA: supplementary labour income is distributed in proportion to salaries; other components are distributed in proportion to the total of salaries, supplementary labour income, and NIUBs.

7. VA by administrative region (that is, regional GDP) is obtained by first summing the components within each industry, and then summing the VAs of industries.

The method ensures that estimated regional GDPs are consistent with provincial economic accounts.

In this paper, we consider successively: (1) source data used (target data on GDP by industry, and Revenu Québec fiscal data); (2) prior processing applied to Revenu Québec data to construct the allocators; and (3) application of the allocators to the target data. We conclude with a presentation of results obtained for the years 1997-2000.

2. SOURCE DATA

The estimation method for regional GDPs relies upon two types of data: target data on GDP by industry, which are the totals to be distributed between regions, and Revenu Québec data, which are used to construct the allocators.

2.1 Target data on GDP by industry

Data on GDP by industry and by component for Québec as a whole are the "target data" of the regional GDP estimation process. Indeed, the estimation results must be consistent with other official data. That consistency is ensured thanks to the fact that the totals distributed between regions with allocators correspond to the official figures. However, these target data are not drawn as

such from a single source; rather, they are constructed from **three main sources**:

- GDP at basic prices, by industry and by province, in constant and current dollars (Statistics Canada, *Provincial Gross Domestic Product by Industry, 1997-2002*, 15-203-XIE);

- GDP at basic prices, by component, for 18 industry groups, estimated by the Institut de la statistique du Québec *(Comptes économiques des revenus et dépenses du Québec);*

- Statistics Canada's Provincial Input-Output tables (IO) for Québec, 1997-2000.

Industry GDPs at basic prices in current dollars are consistent with Economic Accounts. So they are a good starting point for estimating regional GDPs by a top-down method. Indeed, the choice of estimating regional GDP in current, rather than constant, dollars was made with the purpose of obtaining a regional GDP which is consistent with Economic Accounts, since the latter are first produced in current dollars, before being translated into constant dollars. Moreover, the RGDP estimation method uses allocators based on Revenu Québec fiscal statistics, which are, obviously, in current dollars.

The level of aggregation chosen for the estimation of regional GDPs is 63 NAICS industries. At that level of detail, however, our first source does not disaggregate industry GDPs into their components. So if one were to rely on that single source, one would be forced to apply the same regional allocator to all of each industry's value added. For that reason, industry GDP data are used jointly with data from other sources.

In *Comptes économiques des revenus et dépenses du Québec*, the Institut de la statistique du Québec publishes the value of GDP at basic prices for 18 industry groups, with three components: total labour income (wages and salaries, plus supplementary labour income); gross operating surplus and miscellaneous adjustments; and the total of accrued net income of farm operators from farm production and net income of non-farm unincorporated business, including rent (mixed income).

These data are utilized jointly with the input-output tables, to overcome certain classification and Economic Account benchmarking problems, and to obtain the necessary information to distribute the GDP of the 63 industries between the three value added components mentioned earlier. The result of those adjustments constitutes what we call the "Economic Accounts target data", represented in Figure 1.

Figure 1 : Schematic representation of the Economic Accounts target data

	1	1	1
1			
	Vector of WSSLI[1] by NAICS industry	Vector of NIUB[2] by NAICS industry	Vector of OOS[3] by NAICS industry
63			

1. WSSLI : Wages and salaries, and supplementary labour income.

2. NIUB : Net income of unincorporated business.

3. OOS : Other operating surplus.

2.2 Revenu Québec fiscal data

Revenu Québec fiscal data on salaries and individual business income are used to distribute the target values between administrative regions. So they are the two main allocators utilized. Other allocators are used for special industries.

2.2.1 SALARIES

Fiscal data on salaries are compiled by Revenu Québec in a way that complies with the confidentiality rules relating to personal information. The data are extracted from R1 slips (equivalent to federal T4s). By combining the amounts of worker incomes according to the R1 slips, employer economic activity codes, and employees' postal codes, Revenu Québec produces an estimate of the amount of salaries by activity and by administrative region of employee residence.

Those data are quite complete. For instance, in 1997, Revenu Québec was able to determine taxpayer region of residence and employer industry for 93% of R1 slips, amounting to 95% of the total value of salary income according to Revenu Québec fiscal data. It is interesting to note that the total value of salaries according to Revenu Québec data is very close to the *Wages and salaries* component of GDP according to the Economic Accounts: the total value reported by Revenu Québec in 1997 represents 99.9% of wages and salaries (excluding supplementary labour income) according to the Economic Accounts.

The way Revenu Québec fiscal data are utilized is quite similar to what the United Kingdom's ONS does. But the ONS builds its estimates on the basis of the *1% sample of tax records,* compiled by *Inland Revenue.* In contrast, Revenu Québec fiscal data are based, not on a sample, but on all of the R1 slips.

2.2.2 NET INCOME OF UNINCORPORATED BUSINESS (NIUB)

The net income of unincorporated business (NIUB), also called mixed income, corresponds to net individual business income (*revenu net des particuliers en affaires –* RPA) in individual income tax returns. It is taken from form TP1 (equivalent to federal T1). It includes *accrued net*

income of farm operators from farm production as well as the net income from other types of unincorporated business. Fiscal data on NIUB's are compiled by Revenu Québec in a way that complies with the confidentiality rules relating to personal information.

However, in the year 1997, the completeness rate of the economic activity code was not very satisfactory for our purposes: the industry of origin could be identified for no more than 59% of taxpayers declaring individual business income (55% of the total value of individual business income declared). Moreover, when the two criteria, region of residence and activity code, are combined, data are complete for only 41% of taxpayers declaring individual business income (amounting to 41% of the total value of individual business income declared). Fortunately, the completeness rate has been improving year after year since 1997.

Let us mention that, for 1997 again, the total value of NIUBs according to Revenu Québec fiscal data represents 87% of mixed income according to the IO tables (after subtracting net rent imputed to owners occupying their own dwelling). But if we retain only the NIUBs for which the taxpayer's region of residence and activity code are known, we are left with only 35% of the Economic Account NIUBs.
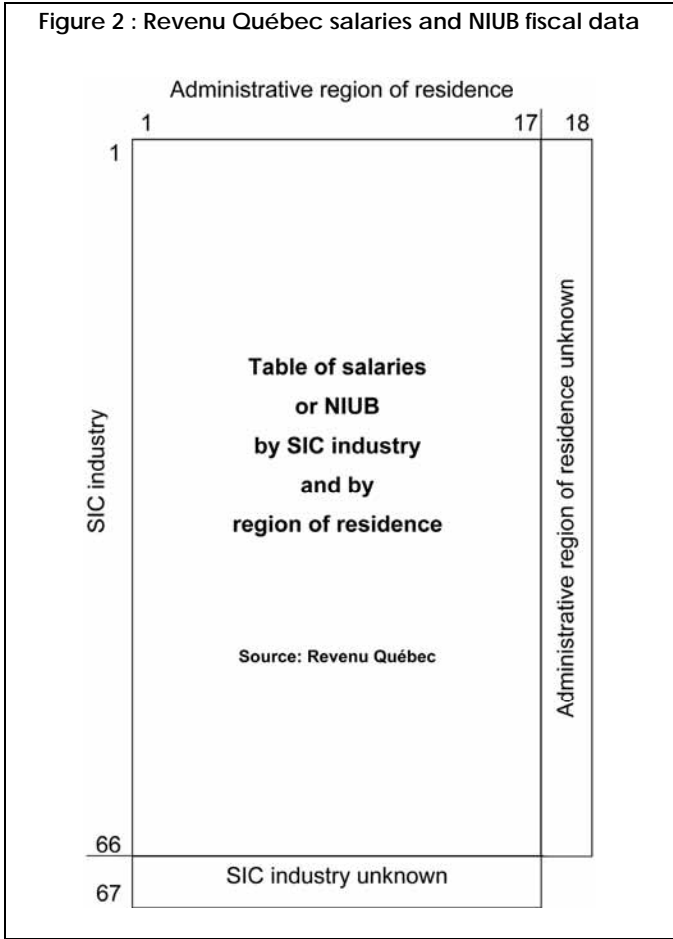
To try and compensate for the gaps in Revenu Québec NIUB fiscal data, we apply an adjustment procedure that allows us to use all the available information, including NIUBs for which the region of residence is known, but not

the economic activity code. That procedure is described below, in section 4.2.

3. PRIOR PROCESSING OF REVENU QUÉBEC FISCAL DATA

3.1 Transforming place-of-residence data into place-of-production data

The initial data on salaries and NIUBs by industry and region of residence must first be converted to data by region of production, using **home-to-work commuting tables by industry**, for different categories of workers. Those tables are provided by Statistics Canada, which computed them from the 20% sample of population filing the long Census questionnaire in 1996. The industrial classification applied then was the 1980 SIC. Commuting trips by salaried workers correspond to those of *Paid workers*, while commuting trips by unincorporated business operators correspond to those of the *Self-employed (unincorporated)*.

Figure 2 : Revenu Québec salaries and NIUB fiscal data

Administrative region of residence

Table of salaries
or NIUB
by SIC industry
and by
region of residence

Source: Revenu Québec

Administrative region of residence unknown

SIC industry

SIC industry unknown

The **general principle** of the conversion is simple: the home-to-work commuting tables show how the production locations of residents of a given region who work in a given industry are distributed over the regions; the total income earned by those residents, according to Revenu Québec, is therefore distributed between regions

of production in the same proportions. The underlying hypothesis is that, for a given industry, the average income per worker (wages and salaries, or NIUB) is the same for all residents of a region, no matter which region they work in. Use of the commuting data is represented in Figures 3, 4 and 5. Conversion from place-of-residence data to place-of-production data is also illustrated in a fictitious numerical example below (Example I).
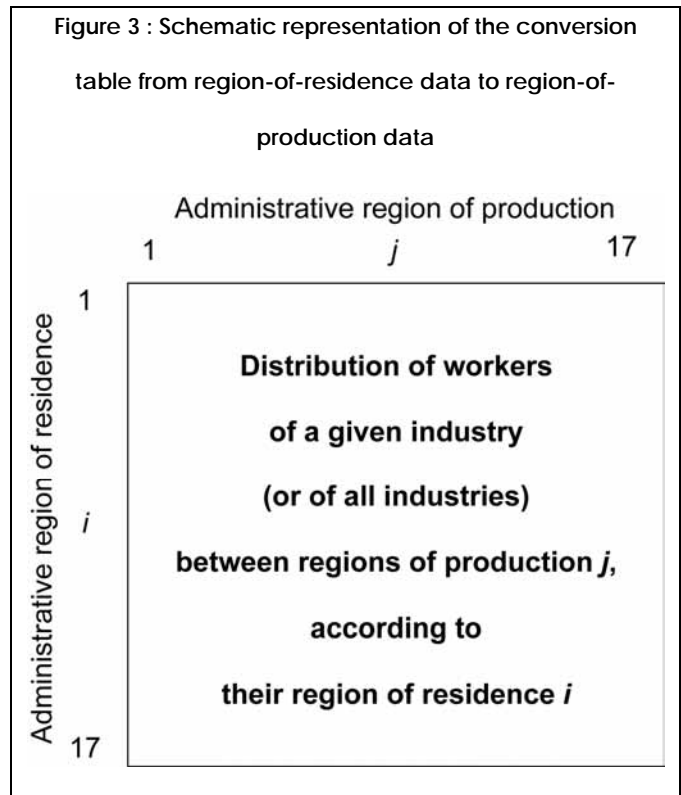

Figure 3 : Schematic representation of the conversion table from region-of-residence data to region-of-production data

Administrative region of production

Administrative region of residence

Distribution of workers of a given industry (or of all industries) between regions of production *j*, according to their region of residence *i*

Figure 4 : Conversion process of income earned (wages and salaries, or NIUB), from region of residence to region of production
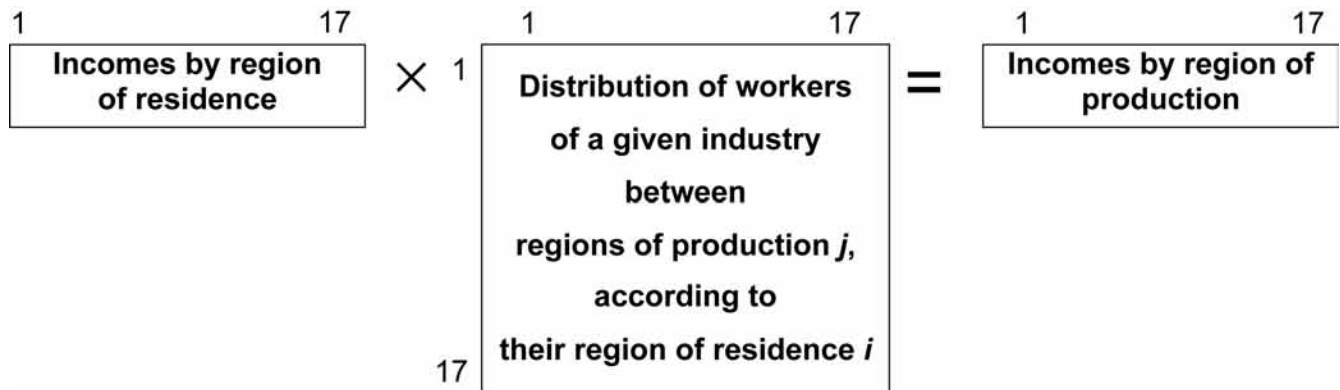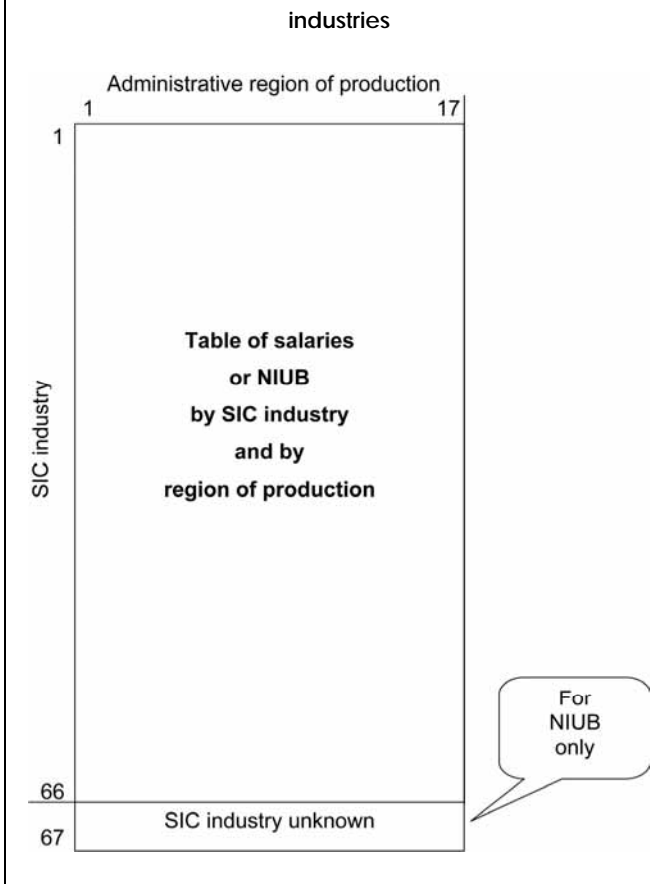

Figure 5 : Schematic representation of the result of applying the conversion process of Figure 4 to all industries

Example I – Fictitious example

There are three regions : R1, R2 and R3. The salaries of workers in an industry, let us call it SIC1, by region of residence, are given in the following table.

Table 1

Salaries according to region of residence, for industry SIC1

M$

Region of residence			
R1	R2	R3	Total
100	50	200	350

On the other hand, according to (fictitious) census data, paid workers of industry SIC1 commute between their region of residence and their region of employment as indicated in Table 2.

13

Table 2

Number of paid workers of industry SIC1, according to their region of residence and region of production

Region of residence	Region of production			
	R1	R2	R3	Total
R1	525	350	2625	3500
R2	600	300	600	1500
R3	1300	1300	3900	6500
Total	2425	1950	7125	11500

This table indicates that, for instance, among the 1,500 workers who live in region R2, 600 work in region R1, 300 in region R2, etc. From these numbers can be computed the corresponding distributions : thus, 40% (= 600/1500) of the workers living in region R2 are employed in region R1, 20% (= 300/1500) in region R2, etc., as in Table 3.

Table 3

Distribution of paid workers between regions of production, according to region of residence

Region of residence	Region of production		
	R1	R2	R3
R1	0.15	0.10	0.75
R2	0.40	0.20	0.40
R3	0.20	0.20	0.60

From these distributions, we can calculate that, of the 10 million dollars of salaries of activity SIC1 received by residents of region R1, 15%, or 15 million, have been earned by producing in region R1; similarly, of the 50 million received by residents of R2, 40%, or 20 million, have been earned in R1; finally, of the 200 million of R3 residents, 20%, or 40 million, have been earned in region R1. So, in total, incomes generated by SIC1 production in region R1 equals 75 million dollars (15 + 20 + 40), as shown in Table 4.

Table 4

Wages and salaries of industry SIC 1, according to region of production

Region of production			
R1	R2	R3	Total
75	60	215	350

133 similar computations are performed: one for each industry's wages and salaries (66 times), one for each industry's NIUB (66 times), and, finally, one for all industries' NIUB (for use in the NIUB adjustment procedure described in section 4.2).

3.2 Transformation from the SIC to the NAICS

Revenu Québec fiscal data are then transformed from the 1980 SIC to the North American Industrial Classification System (NAICS 1997), to make them comparable to Economic Accounts target data : that way, Revenu Québec data for 66 SIC industries are converted to 63 NAICS industries.

Conversion from one classification system to another is never perfect. In principle, it could be, at a very fine level of detail. However, given the level of aggregation at which Revenu Québec fiscal data are available, the

correspondence is necessarily imperfect, particularly for service industries. Although every SIC industry corresponds mostly to one particular industry in the NAICS and vice-versa, parts of any SIC industry are usually distributed into several NAICS industries; conversely, each NAICS industry is generally made up of parts of several SIC industries. Thus, the conversion matrix can be considered a table of average distributions: **the value added produced by a given SIC industry is distributed between NAICS industries following its average distribution.**

Most of the conversion matrix data come from a Statistics Canada table based on data from the *Survey of Employment, Payrolls and Hours* (SEPH). That table has been constructed from survey data in each province, for two periods of three consecutive months in 1998, and for another three-month period in 1999, and also from information drawn from Statistics Canada's Business Register. Conversion data based on the SEPH were completed thanks to another one of Statistics Canada's conversion tables, concerning only manufacturing industries, and constructed from 1996 manufacturing shipments data.

The process of converting data from the SIC to the NAICS is illustrated in Figure 6, and further explained with the help of fictitious Example II.

Figure 6 : Schematic representation of the passage from the SIC to the NAICS
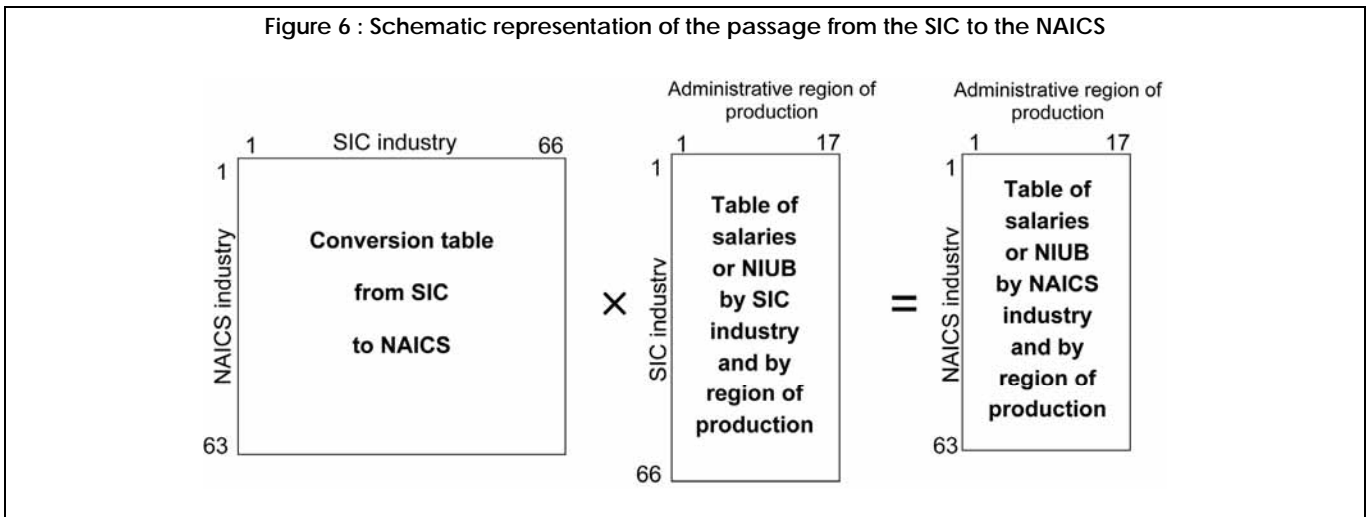
Example II – Fictitious example

Suppose there are three industries according to the Standard Industrial Classification (SIC1, SIC2, and SIC3), and imagine there are two according to the NAICS (NAICS1 and NAICS2). Our (fictitious) conversion matrix is as follows :

Table 5

Average distribution of SIC industries between NAICS industries

NAICS industry	SIC industry		
	SIC1	SIC2	SIC3
NAICS1	0.90	0.15	0.25
NAICS2	0.10	0.85	0.75
Total	1.00	1.00	1.00

This table indicates, for instance, that 90% of the value added of industry SIC1 is attributed to industry NAICS1, and the remainder, to NAICS2. Now, suppose we have the following table of wages and salaries by region of production and SIC industry (Table 6).

Table 6

Wages and salaries by region of production and SIC industry

SIC industry	Region of production			
	R1	R2	R3	Total
SIC1	75	60	215	350
SIC2	25	40	35	100
SIC3	60	40	100	200
Total	160	140	350	650

Given the average distributions of SIC industries into NAICS industries, we can compute wages and salaries by region of production and NAICS industry. So, of the 60 million in wages and salaries paid by industry SIC1 in region R2, 90% (54 million) are allocated to industry NAICS1; of the 40 million paid by industry SIC2 in region R2, 15% (6 million) go to industry NAICS1; finally, of the 40 million of SIC3 in R2, 25% (10 million) are attributed to NAICS1. All in all, wages and salaries paid by industry NAICS1 in region R2 amount to 70 million (54 + 6 + 10). Repeating that computation for all regions and all industries yields the table of wages and salaries by region of production and NAICS industry (Table 7). That is what is summarized in the matrix product represented in Figure 6 (preceding page).

Table 7

Wages and salaries by region of production and NAICS industry

NAICS industry	Region of production			
	R1	R2	R3	Total
NAICS1	86,25	70,00	223,75	380,00
NAICS2	73,75	70,00	126,25	270,00
Total	160,00	140,00	350,00	650,00

4. APPLYING ALLOCATORS TO GDP COMPONENTS

4.1 Distributing total labour income (wages and salaries and supplementary labour income) according to Revenu Québec regional data on salaries (except for three of the five special industries)

Thanks to fiscal data provided by Revenu Québec, we have built a table of salaries by SIC industry and by region of residence (Figure 2). After applying appropriate transformations, described in section 3, those data have become a table of salaries by NAICS industry and region of production (Figure 6).

The rows of that 63 row by 17 column table are used as allocators for total labour income (*wages and salaries*, plus *supplementary labour income*), by industry: for each industry, total labour income according to Economic Accounts target data is distributed among regions in proportion to the same industry's salaries in each region according to transformed Revenu Québec fiscal data.

That allocation procedure is applied to all industries but three of the five special industries: Construction;

Petroleum and coal products manufacturing; and Owner-occupied dwellings. Salaries in the two other special industries (Fishing, hunting and trapping, and Lessors of real estate property) are treated the same way as those of regular industries.

4.2 Distributing NIUBs according to Revenu Québec regional data on NIUBs (except for the five special industries)

Thanks to fiscal data provided by Revenu Québec, we have also built a table of NIUB's by SIC industry and by region of residence (Figure 2). Recall that, in Revenu Québec's 1997 fiscal data, region of residence is known for 90% of taxpayers declaring individual business income (93% of the total amount of individual business income declared). But both region of residence and activity code are known for only 41% of taxpayers with individual business income (41% of the total amount declared). If we were to use only complete data, we would have to leave aside all the information contained in the 49% of tax returns for which region of residence is known, but not activity code.

In order to make full use of all the information contained in Revenu Québec fiscal data on NIUBs, we perform an adjustment based on **information theoretic principles**. But that is only after applying the two prior transformations already described: first, region-of-residence data were converted to region-of-production data (Figure 4); then, the data was converted from the SIC to the NAICS (Figure 6). Those prior transformations were applied, not only to NIUBs by industry (which, in 1997, covered 41% of

taxpayers declaring individual business income), but also to total NIUBs (including NIUBs for which industry is unknown, (in 1997, that covered 90% of taxpayers declaring individual business income). In the latter case, the home-to-work commuting table is the all-industries table of the *Self-employed (unincorporated).*

Once these prior transformations have been performed, the first step in the adjustment is to **hierarchize information**, according to reliability:

1. It is imperative to respect Economic Accounts **target data** concerning NIUB by industry: they are considered the most reliable figures.

2. In second place comes the distribution among production regions of **total NIUB** compiled by Revenu Québec, from 90% of taxpayer returns declaring individual business income (in 1997).

3. Last come the distributions among production regions of **NIUB by industry**, compiled by Revenu Québec from 41% of taxpayer returns declaring individual business income, for whom both region of residence and activity code are known (in 1997).

The hierarchy having been established, we proceed with the **adjustment itself**, taking into account, however, that the adjustment process excludes values relating to the five special industries. Second- and third-rank information is first made consistent with first-rank information by making proportional adjustments. At that stage, second- and third-rank data have not yet been harmonized with one another. At the next step, first-rank data (industry totals) and previously adjusted second-rank data (regional totals) act as constraints controlling third-rank

data adjustment. That final adjustment is performed following the **minimum information-gain principle**, which is an operational form of the rule of scientific neutrality.[4]

The rows of the 63 row by 17 column table resulting from that adjustment are used as allocators for NIUB by industry: for each industry, the Economic Accounts target NIUB is distributed among regions in proportion to same industry NIUB by region, according to transformed and adjusted Revenu Québec fiscal data.

The allocation procedure described here and in section 4.3 is applied to all industries but the five special industries cited previously.

4.3 Distributing other components of GDP

According to the Canadian system of economic accounts (Statistics Canada, 13-213-PPB), GDP at basic prices is made up of the following components: total labour income; accrued net income of farm operators from farm production; net income of non-farm unincorporated business, including rent; corporation profits before taxes; interest and miscellaneous investment income; inventory valuation adjustment; indirect taxes on production, net of subsidies on production (taxes and subsidies on *production* are not to be confused with taxes and subsidies on *products*; the latter are not taken into account in the calculation of GDP *at basic prices*); and, finally, capital consumption allowances (or depreciation).

4. André LEMELIN and Pierre MAINGUY (2005). *Estimation du produit intérieur brut régional des 17 régions administratives du Québec, 1997-2000*, Cahier technique et méthodologique, annexe 5, Institut de la statistique du Québec.

Until now, we have only dealt with the first three components (the second and third are included in the NIUB). The remaining components are aggregated under the label of "**Other operating surplus**" (OOS), and they are distributed among regions (by industry) using the **sum of total labour income (wages and salaries, and supplementary labour income) and NIUB** as an allocator.

4.4 Distributing the GDP of special industries

Five industries are dealt with in a special way. First, the estimation method applied to the other industries is inapplicable to Construction and to Owner-occupied dwellings, for reasons to be given below. As for the three other industries, it was decided to treat them, in part or totally, as special, on account of practical difficulties in applying the method.

Fishing, hunting and trapping. Wages and salaries, and supplementary labour income from this industry are distributed between regions just like those of other industries. But NIUB according to Revenu Québec fiscal data represents only 0.4% of Economic Accounts NIUB, while it makes up 48% of the value added of the industry. Given that the bulk of its value added comes from commercial fishing, its NIUB and OOS are distributed following the value of fish landed in each region (Fisheries and Oceans Canada, *Québec Marine Fisheries. Annual Statistics Review*, from 1996-1997 to 2002-2003).

Construction. By its very nature, that industry has a high percentage of workers without a fixed place of work, so that it would be inappropriate to distribute them proportionally to those whose place of work is known, all

the more since, even if the regional distribution of construction workers were known for 1996, it would most likely have changed, together with the location of construction projects, in 1997, 1998, 1999 and 2000.

Thus, we decided to distribute the value added of the construction industry using a special allocator: capital and repair expenditures, except on machinery and equipment, by administrative region.

Petroleum and coal products manufacturing. The value added of that industry is distributed between regions using estimations elaborated from the *Manufacturing Activities Survey* (MAS) microdata.

Lessors of real estate property. In some regions, that industry's NIUB has an ups-and-downs pattern, even jumping from positive to negative values from one year to the next. And because of the peculiar structure of value added in that industry, such instability would result in rather wild fluctuations. So the wages and salaries of that industry are distributed in the same way as in other industries, but the NIUB and OOS are distributed according to total real estate tax base by administrative region (the database "Évaluations foncières des municipalités du Québec" is provided to the Institut de la statistique du Québec by the ministère des Affaires municipales et des Régions).

Owner-occupied dwellings. There is no Revenu Québec fiscal data whatsoever relating to that industry, because the imputed rents of owner-occupied dwellings are just that: imputed. That industry is bound to be a special one. Also, the stock of dwellings changes from year to year, at

different rates in different regions. To take these factors into account, the value added of owner-occupied dwellings is divided into two or more components, depending on the number of years since the last population census: **(1)** the industry's GDP **for the census year** (1996) is distributed proportionately to the **value of owner-occupied dwellings** in each region, according to the 1996 population census (special compilation by Statistics Canada, on the basis of the 20% sample responding to the long form of the census questionnaire may be consulted on the Institut de la statistique du Québec Website); **(2)** the increase of that industry's GDP between the last census (1996) and the current year is distributed, year by year, proportionately to the **value of residential building permits for the current and preceding years**, so as to take into account the time lag between permit emission and building completion (data published on the Institut de la statistique du Québec Website). Finally, the regional value added of owner-occupied dwellings is simply the sum of its components.

4.5 Final calibration

From the outset, the method described so far ensures that estimated regional GDPs are consistent, both with *Gross domestic product by industry in Québec*, and with Québec Economic Accounts.

CONCLUSION

The two graphs at the end of the paper illustrate the results of our estimation method. Figure 7 displays GDP at basic prices, by administrative region, for the years 1997-

2000. Figure 8 displays per capita GDP for the same regions, calculated using Institut de la statistique du Québec annual population figures.

Figure 7 shows that, from 1997 to 2000, **GDP increases in every region**. It is quite striking that more than a third of Québec's GDP is produced on the Island of Montréal. In Figure 8, per capita GDP also increases in every region.

The **conceptual difference between personal income and domestic product** is quite obvious from Figure 8. Indeed, personal income is the income that residents of a given territory receive, no matter where production took place; on the other hand, domestic product is the total value of what has been produced in a given territory, no matter where those who receive the income live. Therefore, per capita GDP is strongly influenced by home-to-work commuting :

- The high per capita GDP of Montréal and, to a lesser degree, of the Capitale-Nationale region (Québec City) is explained by the large number of residents of neighboyring regions who come to work there.

- Conversely, the rather weak per capita GDP of Lanaudière, for instance, duly reflects that region's status as a residential area, and the fact that a large proportion of its workers have a job in Montréal.

- The high per capita GDP of some resource regions reflects the presence of capital intensive industries, whose shareholders do not necessarily live there.

**Figure 7 : GDP at basic prices,
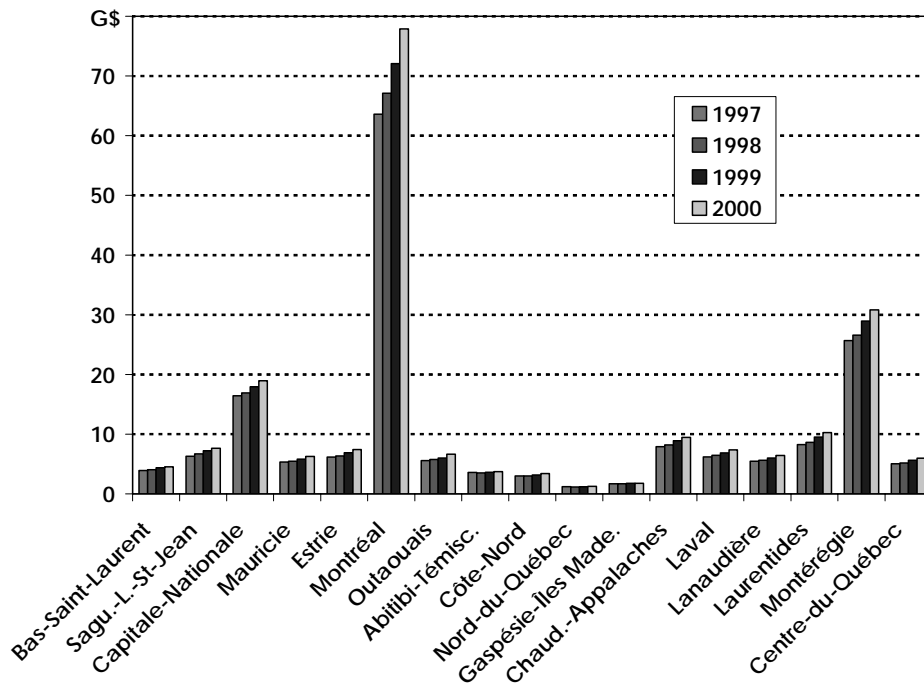administrative regions, 1997-2000**

**Figure 8 : Per capita GDP at basic prices, Québec and
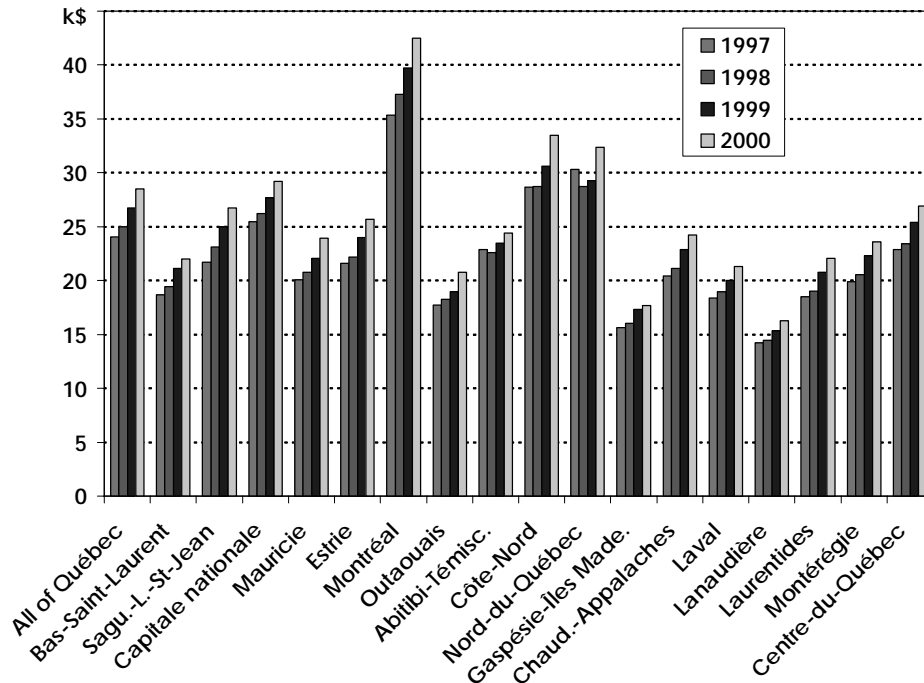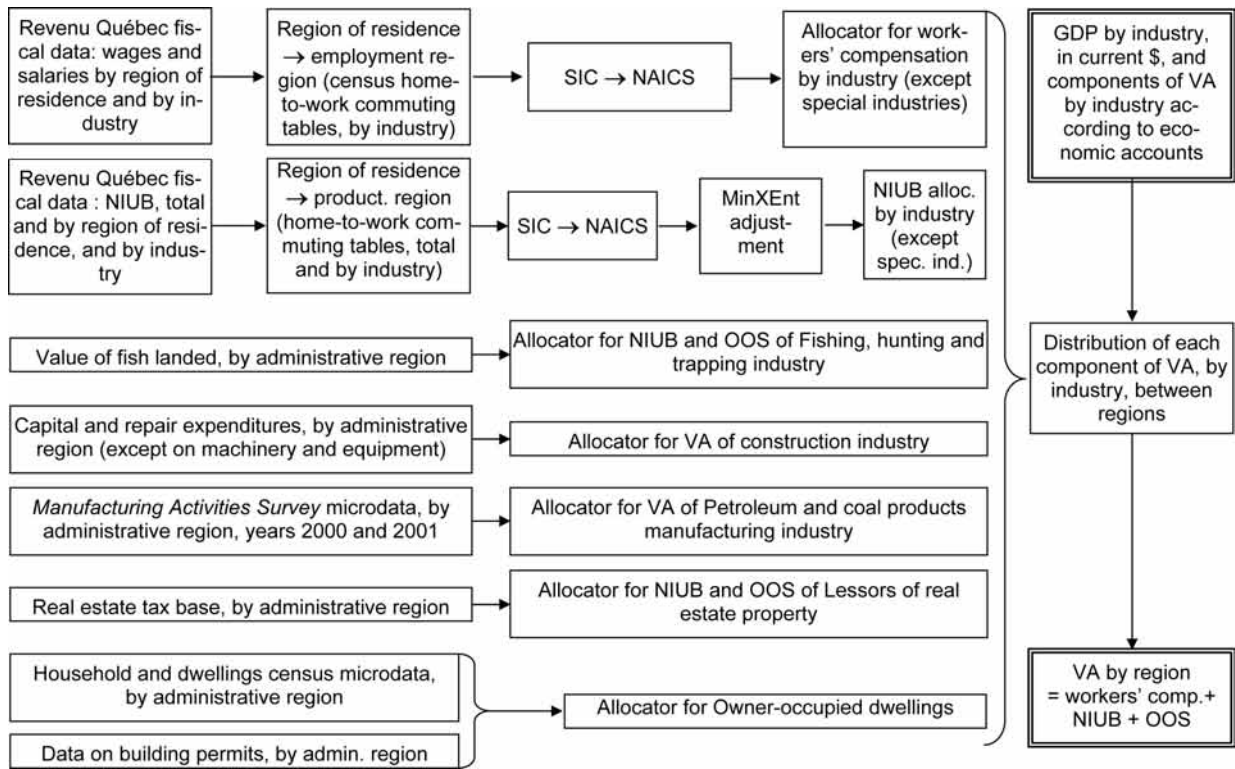administrative regions, 1997-2000**

Figure 9 : Flowchart of the method

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