

MINISTÈRE DES TRANSPORTS DU QUÉBEC

QUÉBEC/US TRADE STATISTICS: REVIEW OF METHODOLOGIES

FOCUS ON ADJUSTMENTS MADE BY
INSTITUT DE LA STATISTIQUE DU QUÉBEC

REPORT

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1. Context and Study Objectives

Québec's commodities trade (exports and imports) by truck statistics with Minnesota and US states members of the Eastern Border Transportation Coalition (Vermont, Maine, New York and Michigan) are estimated differently by the Bureau of Transportation Statistics (BTS), Statistics Canada (Stat Can) and the *Institut de la statistique du Québec* (ISQ). The *ministère des Transports du Québec* and the *Institut de la statistique du Québec* (ISQ) have mandated this study which seeks to explain differences between the three sets of data and to identify which one better estimates Québec's trade with these five US states.

There are two basic approaches to calculating import/export statistics. Their focus is either customs-based or macro-economic based. Trade data may therefore be:

- A measure of the physical traffic of goods at border crossings, as reflected on documents gathered by Customs offices, and which may or may not have details on the state/province of origin and destination;
- A calculation derived from demand (consumption) and production statistics, produced for the calculations of national accounts (as produced by Stat Can and the US Census Bureau for Canada and the US as a whole).

As will be seen, Stat Can and BTS use the customs-based approach whereas the ISQ tries to complete the customs-based approach and therefore adjust Stat Can data using elements of the economic method. Both approaches offer valid results, which may however differ substantially. This report presents the causes for this variance and focuses on the adjustments brought by the ISQ's approach.

The specific objectives of this study are then:

- To compare methodology used by Statistics Canada (Stat Can), Bureau of Transportation Statistics (BTS) and the *Institut de la statistique du Québec* (ISQ) in order to estimate trade by truck between Québec and the US states members of the Eastern Borders Transportation Coalition (Maine, Vermont, New York and Michigan) in addition to Minnesota.
- To document ISQ's methodology and explain the variances of data compared with other sources.

Figure 1

Data under Discussion
Québec's truck Imports/Exports statistics with 5 US states
for year 2000 (US\$)

	Québec Imports by truck from...					
Source	ME	VT	NY	MI	MN	5 states
Stat Can	315 504 305	1 228 681 807	1 400 681 807	77 636 605	44 415 685	3 066 920 209
BTS	325 326 846	2 034 908 501	1 453 935 476	75 714 160	46 438 202	3 936 323 185
ISQ	286 173 838	1 222 826 749	1 608 924 845	1 271 885 216	94 902 595	4 484 713 243

	Québec Exports by truck to...					
Source	ME	VT	NY	MI	MN	5 states
Stat Can	341 169 629	2 583 966 612	5 694 563 266	990 969 467	310 151 357	9 920 820 331
BTS	328 426 091	2 521 190 318	5 431 906 471	898 522 715	291 042 168	9 471 087 763
ISQ	341 169 629	2 583 966 612	5 694 563 266	990 969 467	310 151 357	9 920 820 331

Abbreviations:

Stat Can: Statistics Canada

BTS: Bureau of Transportation Statistics

ISQ: Institut de la statistique du Québec

ME: Maine

VT: Vermont

NY: New York

MI: Michigan

MN: Minnesota

2. Data under discussion

Figure 1 presents imports and exports data by truck for Québec in 2000 from/to Minnesota, Michigan, New York, Vermont and Maine according to the three different sources (Statistics Canada, Bureau of Transportation Statistics and *Institut de la statistique du Québec*)¹.

- Exchange rates fluctuations during the year and the use of different exchange rates explain to a large extent the differences between BTS and Stat Can data²;
- Exports data are identical for Stat Can and ISQ: ISQ does not modify Stat Can's exports data anymore (since 1999),
- Québec imports data from Stat Can and ISQ differ significantly (up to 2200% in the case of Michigan): ISQ modifies Stat Can's imports data as will be seen later.

The difference between BTS and Stat Can data is marginal (approx. 3%) – except for Vermont – and essentially explained by minor reporting problems or computational differences and are largely inevitable. On the opposite, the difference between ISQ data on one hand, and BTS and Stat Can data on the other, is significant (more than 30% for imports). It reflects voluntary adjustments that seek to reflect another economic reality than that relayed by customs-based data.

¹ The overall exchange rate used to convert Statistics Canada and Institut de la statistique du Québec data is 1CAD=0,67USD.

² With the exception of Québec imports from Vermont. Further investigation is needed to explain this particular gap between Stat Can (and ISQ) and BTS.

3. Canada-US Data Collection

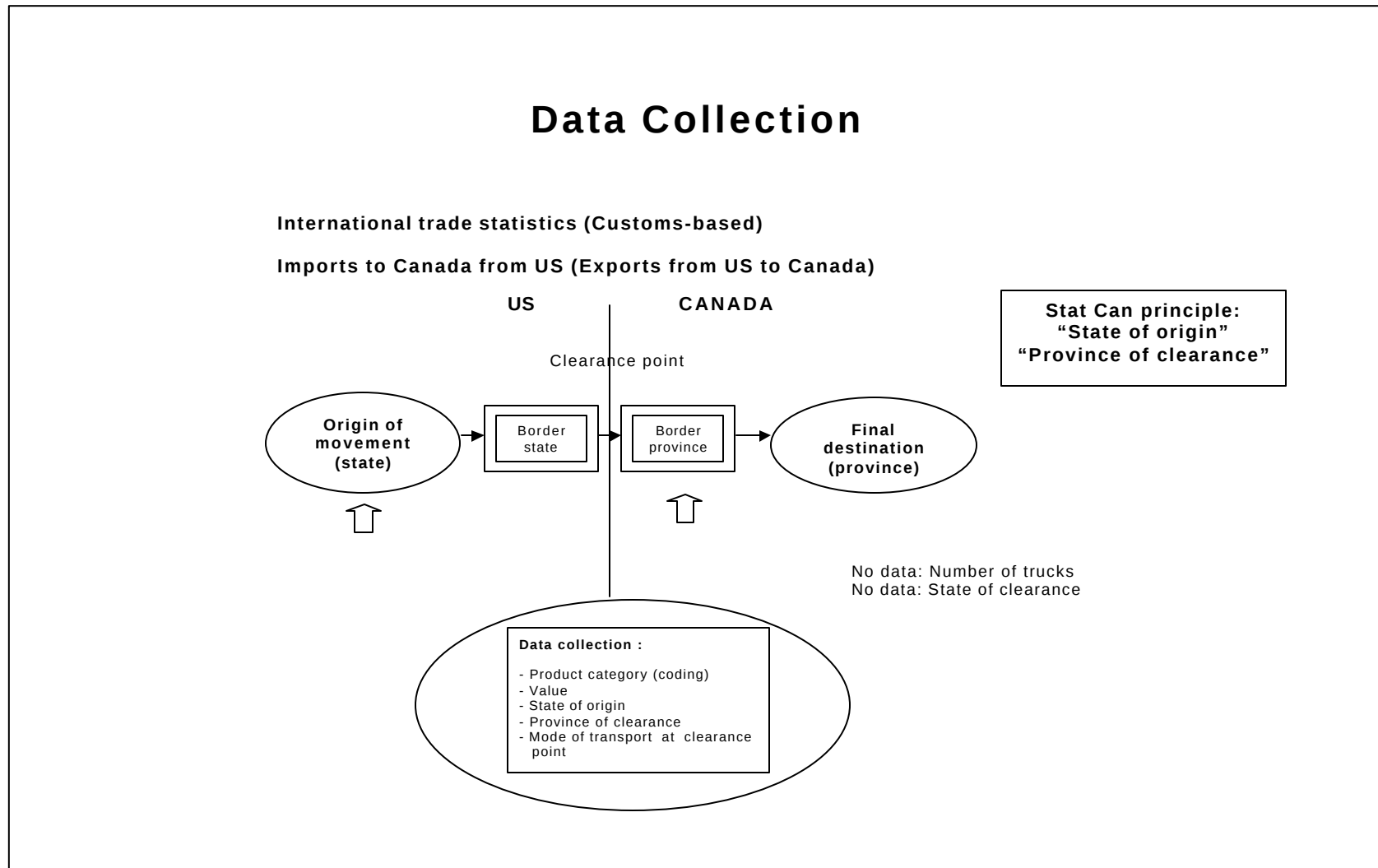
3.1 Key concepts

Although both Stat Can and BTS statistics are customs-based, they do not share the same data collection method. Trade data are not treated symmetrically from one country to the other, or when treating exports or imports. These differences are important for the upcoming analysis:

- Differing accuracy between imports and exports statistics. Customs-based trade statistics are more accurate and detailed when measuring imports than when measuring exports, since duties, if any, are levied on imports. There is not as much need, (or was, before NAFTA) to be as vigilant on exports. Because of this fact, and to avoid statistical inconsistencies, the Canadian and US statistical agencies exchange data since 1990³: each administration uses the other's imports data *in lieu* of its own exports data. The focus of this analysis - especially when it turns to data collection - is therefore on imports.
- Differing focus on import data collection methods between US and Canadian customs-based import data. In Canada, the data collection focus is on the state of origin and the province of clearance whereas in the US, data collection focuses on the states/provinces of origin and destination.

³ On January 1st 1990, Canada and the United States applied a Memorandum of Understanding (signed in 1987) concerning the exchange of imports data.

Figure 2



3.2 Data collection methods

Figure 2 presents the data collection sequence for imports into Canada.

Reminder:

- **Source: Custom based trade statistics:** Most of the information from which are derived Statistics Canada data is required for the purpose of Customs Administration.
- **US / Canada Data Exchange:** US exports are obtained through an exchange under which the US acquires the data Canada uses for its US imports. Canadian imports from the US therefore equal US exports to Canada and *vice-versa*.

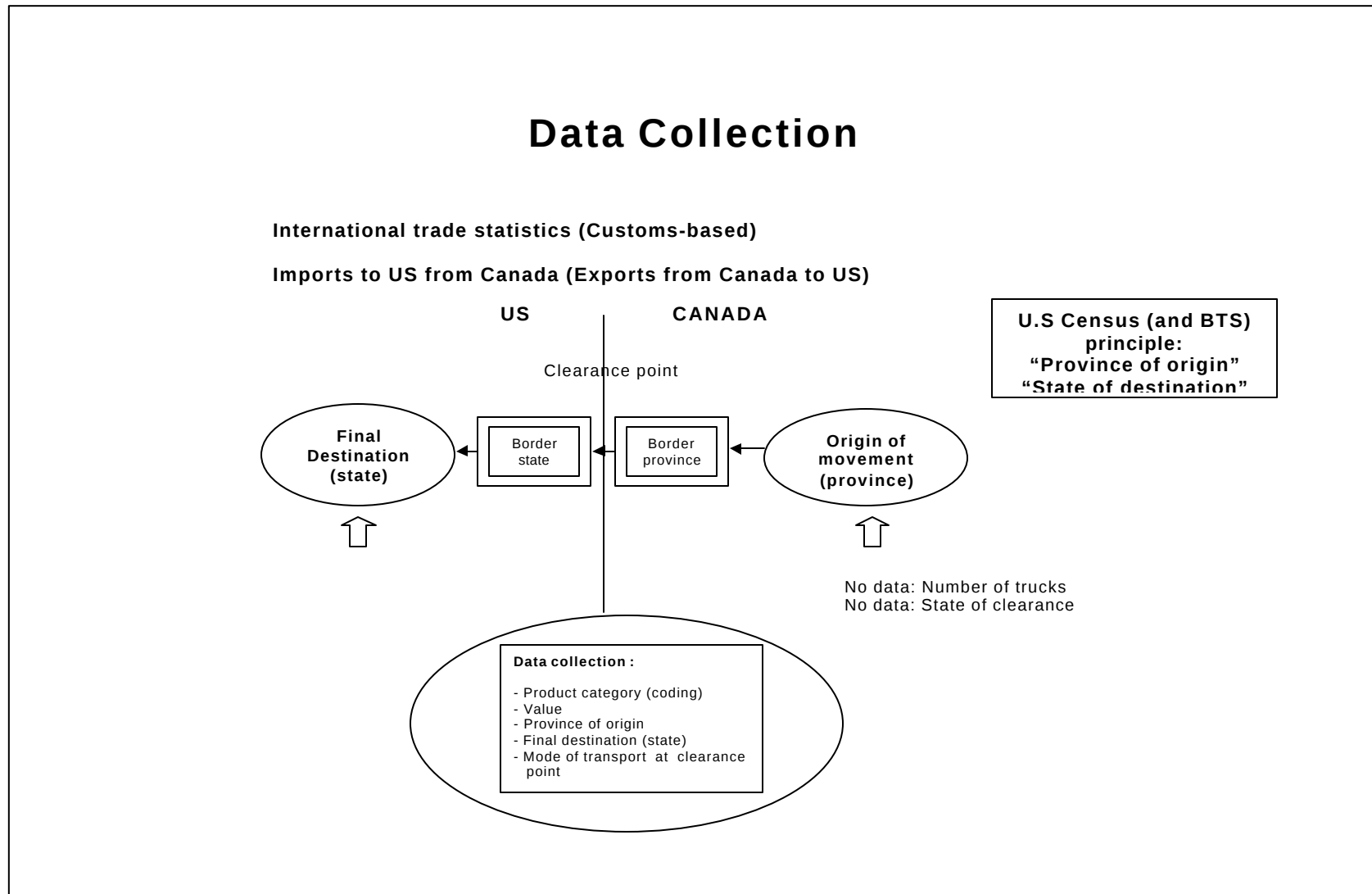
Principles:

- **US state of origin**⁴: Statistics indicate the state from which the merchandise starts its journey to the port of export. These data reflect the transportation origin of exports – and not the state from which the merchandise leaves the US and not necessarily the state where the exporter is located.
- **Province of clearance:** Statistics indicate the province in which the merchandise is cleared at the customs – i.e. not the province of final destination.
- **Mode of transportation:** Represents the mode of transport at the clearance point.

It must be stressed again that Canadian import data records traffic at the province of clearance. Due to Québec's relative position *vis-à-vis* major US exporting states (e.g. Michigan) with which it shares no common border, Québec's imports thereof are significantly underestimated by Stat Can data.

⁴ From the *Origin of Movement methodology* developed by the US Census Bureau. *Limitations:* In certain cases, the origin of movement is not the transportation origin (e.g. Louisiana and farm products). The original intention of the US Census Bureau (and BTS) – which developed the methodology – was to capture state of origin, that is, the state where the goods were grown, manufactured or otherwise produced. However, in practice, the state of origin information currently available in the dataset may or may not represent this type of origin. The state of origin may also represent the mailing address of the US exporter which may or may not be the actual physical state of origin. It may also represent the location of an intermediary such as the wholesaler, retailer, or distributor.

Figure 3



3.2 Data collection methods (cont'd)

Figure 3 presents the data collection sequence for imports into the US.

Reminder:

- **Source:** Most of the information is required for the purpose of Customs Administration⁵.
- **US / Canada Data Exchange:** Canadian exports are obtained through an exchange under which Canada acquires the data the US uses for its Canadian imports – i.e. US imports from Canada equals Canada exports to the US.

Principles:

- **Province of origin:** Statistics indicate the province from which the merchandise starts its journey to the port of export. These data reflect the transportation origin of imports – and not the province where the exporter is located nor the province from which the merchandise leaves Canada.
- **State of destination:** The US state of destination is taken from the importer's address. The importer of record for Customs purposes is the party responsible for paying the duties, if any⁶.
- **Mode of transportation:** Represents the last mode of transport by which the merchandise was transported to entry the US⁷.

⁵ For imports from Canada (and Mexico), approximately 95 percent of the value of those imports are collected electronically via the Automated Broker Interface (ABI), a component of the US Customs Service's Automated Commercial System. Another source of import statistics is the Customs entry documents collected by the Customs Service and transmitted to the Census Bureau. Another source are tapes, sent directly by exporters to Census, that cover imports into foreign trade zones.

⁶ The state may not always represent the physical destination of import goods, since the importer address may not necessarily be the same state as the destination of the goods.

⁷ Less rigorously reviewed than value and commodity classification.

Figure 4

Data under Discussion

Data sources, exchanges and modifications

Statistics	Source of data used by...		
	Stat Can	BTS	ISQ
Canada (provincial) Imports from the US	Stat Can (Canadian Customs)	Stat Can (Canadian Customs)	-
Québec Imports from the US	Stat Can (Canadian Customs)	Stat Can (Canadian Customs)	Stat Can + modifications (adjustment factor)
Canada (provincial) Exports to the US	US Census (US Customs)	US Census (US Customs)	-
Québec Exports to the US	US Census (US Customs)	US Census (US Customs)	US Customs (via Stat Can)

3.3 Data exchange

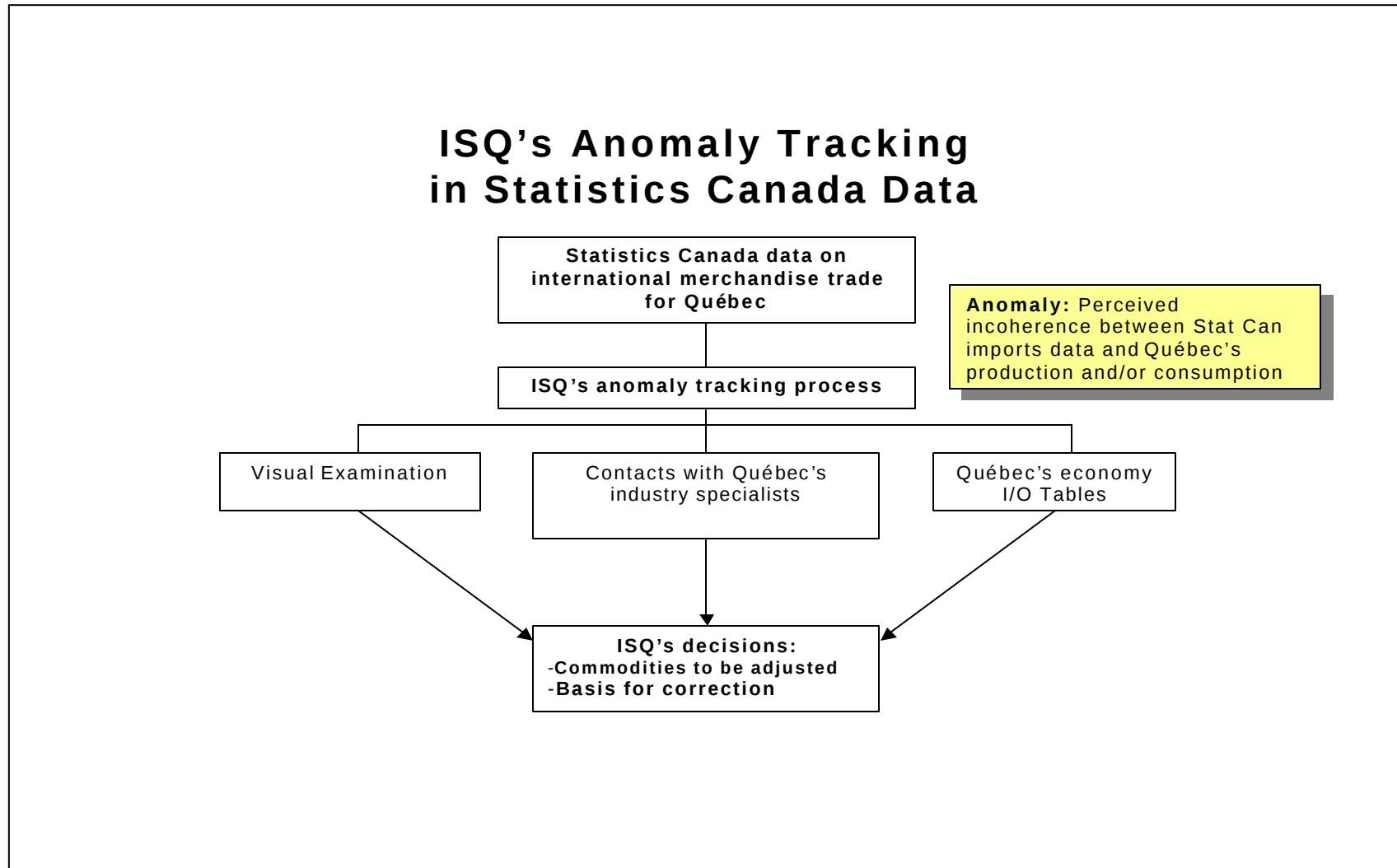
Figure 4 presents the source of Customs-based trade data for Statistics Canada, the Bureau of Transportation Statistics and the Institut de la statistique du Québec. It also points out data exchanges between Canada and the US.

- Data should be equivalent (between Stat Can and BTS and with ISQ's exports data) because of the exchange; even though trade figures between US and Canada mostly agree, there are differences due to:
 - Currency value transfers,
 - Adjustments⁸,
 - Each agency's own edit checks and revisions.
- Data users are cautioned by Stat Can and BTS that comparison of US exports with corresponding Canadian import data at detailed commodity and/or at state/province levels is not recommended. Adjustments, differences in classification interpretation and in editing and processing environments indeed make these comparisons hazardous.

These clarifications – data collection and comments – were necessary before turning the analysis to ISQ's methodology and adjustment factors calculation since Statistics Canada data are the basis of ISQ's data. From now on, the attention will be put on ISQ's approach. Stat Can and BTS will however serve as references in the assessment.

⁸ The use of Canada's import data to produce US export data requires some adjustments to make the two comparable. US exports are valued at the US seaport, airport, or border port of export in the US and include inland freight charges. Canadian imports are valued at the point of origin in the US and do not include inland freight to the US port of exit. To compensate, Canada adds an estimated 4.5 percent of the value to each transaction to cover inland freight (except for shipments where freight is not a consideration, e.g., large aircraft, vessels and drilling platforms.). Source: *US Census Bureau and Statistics Canada*

Figure 5



4. ISQ's methodology

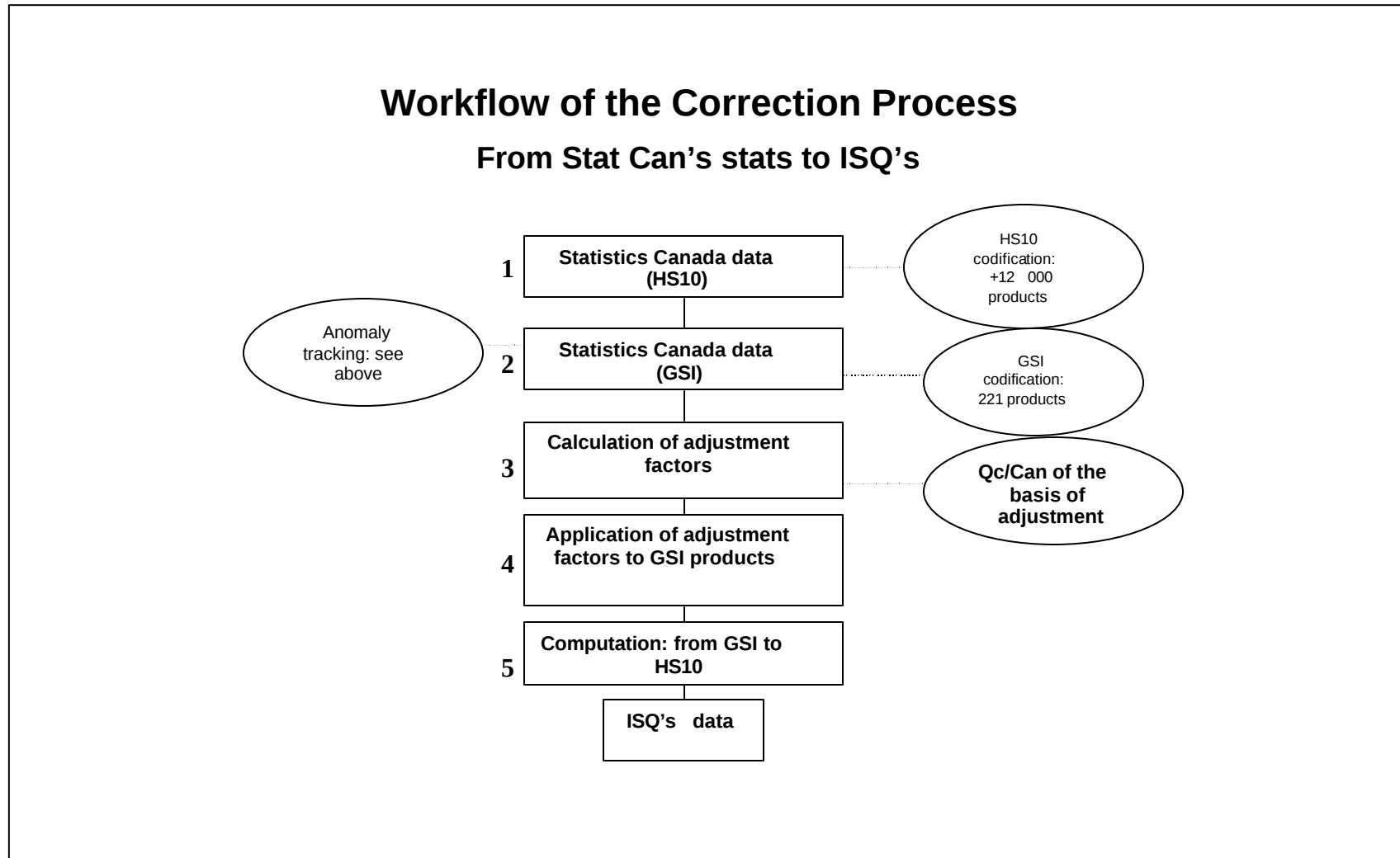
ISQ's methodology involves two consecutive processes. First, the anomaly tracking or identification process will be discussed. Second, the adjustment process is examined, with a specific attention to adjustments brought to imports from the US. Finally, an example will be used to illustrate both processes.

4.1 Anomaly tracking process

Figure 5 presents the process for identification of anomalies from Statistics Canada's international merchandise trade statistics for Québec. It leads to a selection of a basis for adjustment.

- Why the need to track anomalies? Imports data collected by Statistics Canada are based on the "province of clearance" principle. For example, Japanese cars enter Canada from the Vancouver port. All imports of Japanese cars will then be attributed to British Columbia: Japanese cars imports equal 0 for Québec, although Japanese cars are indeed sold and driven in Québec. The ISQ tries to solve such issues associated with the Statistics Canada's methodology. It does so in order to make sure imports data fit reality better, i.e. to take intra-Canada movements of imports of identified products in consideration. ISQ limits its work to Québec and does not re-evaluate other provinces or Canada numbers.
- Which products present anomalies? Anomalies tracked by ISQ are: clothing, shoes, automobiles, auto parts, auto engines, auto engine parts, trucks, TVs and radios, computers and telecommunication material and equipment.
- How is the basis for adjustment selected? The selection depends on the type of product and on the availability of other statistical data. For instance, the basis for adjustment will be :
 - Retail sales (Qc/Can) for clothing, shoes, automobiles, trucks, TV and radio, and telecom material and equipment (some);
 - Automobile production (Qc/Can) for automobile engines, automobile engine parts and automobile parts;
 - Input/Output Tables (Qc/Can) for computers).

Figure 6



4.2 Adjustment process to Stat Can imports data⁹

Figure 6 presents the ISQ's five-step adjustment process from Statistics Canada data.

Step 1. ISQ receives Statistics Canada data under the HS10 codification (more than 12 000 products).

Step 2. The data are transformed under GSI codification (211 products). The correspondence between both codification (GSI and HS10) brings problems because to one product under the GSI corresponds evidently more than one HS10 product and because one HS10 product may correspond to more than one GSI product (when proportion applied to a single GSI is less than 1)¹⁰.

Step 3. Calculation of adjustment factors (to imports from the US). For each product, the adjustment factor corresponds to the Québec/Canada ratio for the basis of adjustment.

GSI	Products	Adjustment factor (2000)
56010	Outwear, except knitted	26.36%
56020	Outwear, knitted	26.36%
56090	Other apparel and apparel accessories	26.36%
56110	Footwear	33.80%
52111	Motor vehicle and engines	4.57%
52113	Motor vehicle engine parts	4.57%
52120	Motor vehicle parts, except engine	4.57%
52029	Passenger automobiles and chassis	24.71%, 35.50% and 32.04% ¹¹
52030	Trucks, truck tractors and chassis	18.19%, 23.95% and 23.95% ¹²
52320	Televisions, radio sets and phonograph	26.14%
54261	Electronic computers	18.82%

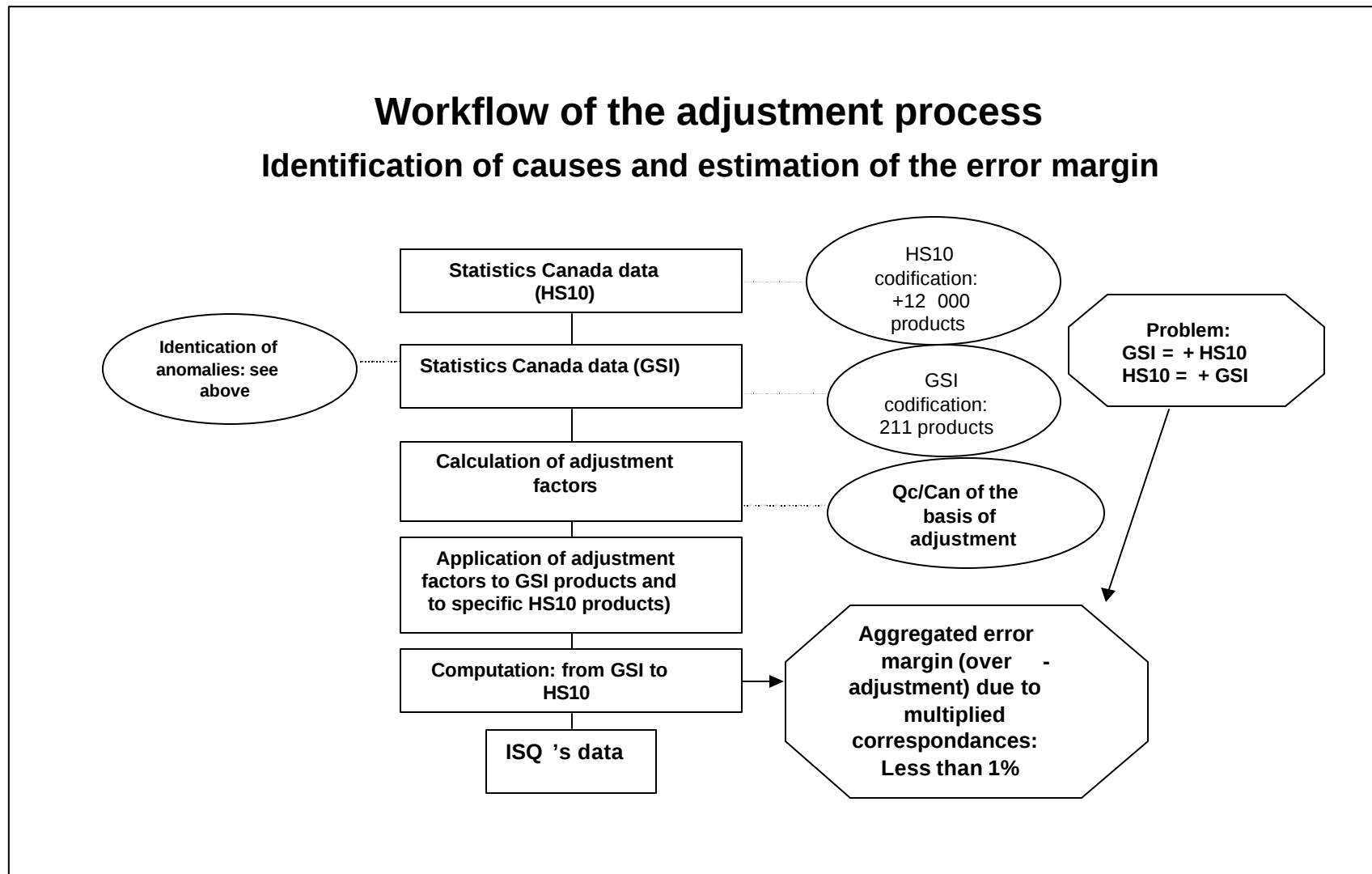
⁹ Adjustments on Statistics Canada data concern imports in Québec only. Exports data have not been modified since 1999 and past adjustments have been gradually removed in the years preceding.

¹⁰ The GSI ("General System" for Imports) codification of products is Canadian. The HS ("Harmonized System") has been developed by the United Nations in order to facilitate international trade by standardizing classifications between economic partners. The codification is shared internationally for the first six digits (HS6). Each country is free to add digits (up to HS10) in order to detail products in a way which suits better its economic reality.

¹¹ Adjustment factors vary depending on the origin (USA, Japan, Rest of the world).

¹² *Ibidem*

Figure 7



4.2 Adjustment Process to Stat Can imports data (cont'd)

HS10 ¹³ (for all origin countries)	Products	Adjustment factor (2000)
8517191911 to 852510901	Various (audio-video equipment)	26.14%
8525301000 to 852910999	Various (audio-video equipment)	26.14%

Step 4. Application of the adjustment factor. Imports of the product for Canada (Stat Can) multiplied by the adjustment factor: This gives Québec imports of the identified product.

Step 5. Computation: From GSI to HS10. The corrected data under GSI codification (except for a small number of cases where adjustments apply to HS10 products) are then computed to be re-transformed into HS10. Over-adjustments due to the computation account to less than 1% of the adjustments total value (see Figure 7).

¹³ Some adjustments are made directly on HS10 products and not, as it is the case for all other products, on products codified as GSI. This is because ISQ considers this HS category (85) to be too detailed (i.e. the number of different products is too large) to be corrected from an aggregation (like GSI). Too many products are listed under this HS category and the correspondence to any GSI category is consequently impossible. Two selected groups of HS10 products (more than 600 different products) are selected (from 8517191911 to 852510901 and from 8525301000 to 852910999) and are on this form corrected.

Figure 8

ISQ: Adjustment Factor Calculation Example: North American Automobile Imports

	Québec	Canada
Imports – Province of Clearance	X 766,840,471\$	Z 10,099,634,832\$
North American Automobile Retail Sales	A 3,715,908,000\$	B 15,038,298,000\$
Adjustment Factor	A/B 24,71%	-
ISQ – Québec's calculated Imports of North American Automobiles	Z*(A/B) 2,495,619,767\$	Results are not recalculated for Canada and other provinces

4.3 Example

Figure 8 presents an example of the ISQ's adjustment factor calculation and its application to the Statistics Canada data. The result gives the ISQ data.

The example concerns the American automobile imports to Québec in 2000

1. According to Stat Can, the value of Québec's imports of North American automobiles is 766,840,471\$. For Canada this number is 10,099,634,832\$. It would therefore appear that only 7.6% of North American imported automobiles in Canada goes to Québec. This number leads to questioning since Québec represents approximately 23% of the Canadian population and since North American automobiles are driven in Québec as elsewhere in Canada. The per capita consumption could presumably be less in Québec than elsewhere in Canada but the difference cannot be that extreme.
2. When looking at another indicator, the North American automobile¹⁴ sales in Québec in Canada, it appears that 24.71% of cars sold in Canada are sold in Québec (a proportion indeed closer to the population share of Québec within Canada). This proportion will be used by ISQ as the adjustment factor to imports of American automobiles.
3. ISQ then applies this adjustment factor (24.71%) to the Canadian imports of North American automobiles (10,099,634,832\$).
4. The result is the ISQ's data for American automobile imports in Québec (2,495,619,767\$).

How to explain Statistics Canada data for imports of North American automobiles in Québec? Clearly, by the "province of clearance" method. Most of North American automobiles imported to Canada come from Michigan and they enter Canada from Ontario.

¹⁴ North American automobiles are produced in US, Canada and Mexico.

5. Assessment of ISQ's approach

5.1 Improvements over the province-of-clearance method

ISQ's data constitute the best available data to estimate total Québec international merchandise trade with the United States, when compared to Statistics Canada's and BTS's. When looking at the five states under consideration, it is particularly true for merchandise trade with the US states of Michigan and Minnesota with which Québec does not share borders. ISQ's adjustments bring major improvements to Statistics Canada data, correcting the 30% (approx.) underestimation.

If Statistics Canada were to use a methodology based on the province of "destination" instead of "clearance" in order to collect import data, ISQ's work would become unnecessary. ISQ's data therefore represents an attempt to correct the limitations of method used by Statistics Canada to collect statistics on imports in Québec.

It should be borne in mind that although ISQ data are estimates, they are based on a valid concept and on an acceptable application of this concept.

5.2 Limitations of ISQ's method

ISQ's over-adjustments represent less than 1% of the adjustments (see Figure 7), which is acceptable although improvements to the adjustment process are possible. For New York, Vermont and Maine, side-effects (see below) may lead to distortions. ISQ and Stat Can imports data from those three states are however broadly similar.

Limitations of ISQ's method are its side-effects and the fact that its data cannot be used for comparisons with other provinces since the modifications concern Québec only. The modifications are strictly intended to recalculate imports to Québec by considering its proportion in the Canadian consumption or production. Three side-effects need to be taken into consideration.

5.2 Limitations of ISQ' method (cont'd)

- **Side-effect on products.** Adjustments are based on *pro rata*. The adjustment factor applies to the GSI and the same factor will be used during the computation leading to HS10 codification. Every HS10 products related to the modified GSI will be corrected using the same factor. Even if the aggregate margin of error is estimated at less than 1% (for all products), the error margin for detailed products may be very high (although hard to estimate).

Illustrative example: ISQ wants to adjust imports for GSI A. To GSI A corresponds several HS10 products. But some HS10 products may not correspond entirely to a single GSI. For instance, for a given HS10 product, correspondence goes as this: 67% in GSI A and 33% in GSI B. When ISQ adjusts GSI A, computations from GSI leading to HS10 will consequently affect GSI B when later reversing the computation, even if the original intention was to make adjustments strictly on GSI A.

- **Side-effects on states of origin.** Again adjustments are made using the *pro rata* approach. They apply to every origin (the US as well as the whole world), with the exception of vehicle and vehicle parts the same way. Adjustments are made on products without considering origin. This can lead to distortions, especially when looking at specific states within the US. This is particularly true for states that share borders with Québec. Québec is then the major province of clearance. The distortions may in certain cases be major. Considering a positive adjustment: if Québec imports from a specific state are high in proportion of the Canadian imports from this state, the adjustments will affect negatively the imports from this state. This is the case with cars and trucks imports from Vermont. Other major distortions cases could be identified. The distortions will be compensated at the larger level. However, when looking at the state-province level for New York, Maine and Vermont, ISQ's adjustments may alter and not improve upon Stat Can data. This is probably even more so for Vermont and Maine, which share a border only with Québec.

Illustrative example: ISQ wants to adjust imports for a given product. Stat Can data on imports for this product is for example 1000 for Canada and 100 for Québec. Using a basis for adjustment, it evaluates imports that Québec "should have received" in proportion of Canada for this product. The adjustment is made as follows: ISQ applies this proportion to Canadian imports as evaluated by Stat Can. The result gives Québec's imports for this product. Assuming this proportion "should be" 25% according to the ISQ, Québec's imports data as estimated by ISQ for this product will be 250 ($1000 * 25\%$). If, according to Stat Can, Québec's imports of this product from a specific state (e.g. Vermont) are

60 and 100 for Canada (60%), the ISQ's adjustment will reduce this share from 60% to 25% as well. So if Stat Can imports data from Vermont in Canada are 100 and 60 in Québec, ISQ's adjustment will reduce this 60 to 25.

- **Side-effects on mode of transportation.** Again adjustments are made using the *pro rata* approach. The adjustments are made on products without considering the mode of transportation. This could lead to distortions in the same way that it has been shown for side-effects on origin.

Illustrative example: ISQ wants to adjust imports for a given product. Stat Can data on imports for this product is for example 1000 for Canada and 100 for Québec. Using a basis for adjustment, it evaluates imports that Québec "should have received" in proportion of Canada for this product. The adjustment is made as follows: ISQ applies this proportion to Canadian imports as evaluated by Stat Can. The result gives Québec's imports for this product. Assuming this proportion "should be" 25% according to the ISQ, Québec's imports data as estimated by ISQ for this product will be 250 ($1000 * 25\%$). If Stat Can data for Québec's imports are 50 by truck, 25 by train and 25 by plane, ISQ's data will then be 125 by truck, 62.5 by train and 62.5 by plane. Proportions have been kept but adjusted data may not represent reality in terms of mode of transportation.

These side-effects are to be further investigated, and especially side-effects on origin. In the case of side-effects on products, they are caused by the computations from one commodities classification to the other. It would be solved if the adjustments were made on HS-classified commodities instead of GSI. The different possibilities need to be explored and discussed. The side-effects on mode of transportation would be solved only if side-effects on origin were first eliminated. The side-effects on origin are the most important because a) they may be significant and b) they may make impossible the use of ISQ's data for a more detailed analysis of Québec trade with the US, in particular an analysis focusing on Québec's imports of a specific product from a specific state.

Conclusions

ISQ's method provides estimates which remove the bias due to the "province of clearance" principle of customs-based data collection. In doing so, however, the adjusted data cannot be compared with other Canadian provinces. However, although ISQ's method has some negative side-effects (on products, origin and mode of transportation) that may bring distortions in results looked at a more detailed level (product-specific analysis for trade with a specific state), ISQ's overall results provide better estimates of Québec's trade with Vermont, Maine, New York, Michigan and Minnesota than results provided by Stat Can or BTS.