Groupe de recherche en économie
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CRITICAL ANALYSIS OF THE CONCEPT OF THE PRODUCER SUBSIDY EQUIVALENT IN THE DAIRY SECTOR (DAIRY PSE)

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SUMMARY

The concept of the producer subsidy equivalent (PSE) was popularized in the 1980s by the Organization for Economic Cooperation and Development (OECD) in the course of preparatory work for the Uruguay Round. Today, the PSE is used not only in trade negotiations but also in domestic debate in Canada. For example, the PSE can be used in the definition of domestic policies and programs, by the academic network to evaluate the comparative competitiveness of a given sector of the economy, or by the national press to estimate the transfers from consumers and taxpayers to agricultural producers.

Given the significant use made of the PSE both in the domestic debate to define agricultural policy, as well as in international discussions linked to multilateral negotiations, it would appear to be important that the Canadian dairy sector be capable of identifying the limitations of PSE measurements and of demonstrating their sensitivity to the assumptions underlying calculations of PSE.

The first point discussed is the use of milk prices at the farm in New Zealand as the reference price when calculating the dairy PSE. Thus, we have noted that the New Zealand price does not reflect the conditions of a market supply on an annual basis since some producers who milk during the winter months receive a premium which almost doubles the price received the rest of the year. Moreover, New Zealand is a price taker on the international market of prices set by the European Union to subsidize exports. Thus, New Zealand producers are the only ones to receive a price level reduced by the subsidies of other countries without themselves being subsidized by their national government or their consumers. In this sense, the level of subsidies to European exports determines the level of transfers by New Zealand's dairy producers to their own consumers.

In fact, use of the price of milk in New Zealand in the methodology developed by OECD has had the effect of overvaluing the transfer from consumers and taxpayers to milk producers. The dairy PSE is therefore not an adequate measurement of that transfer. It would better to select a reference price that would approximate as closely as possible a condition of free trade. According to a number of modeling exercises, the American price would be one way to approximate such a free-trade price.

The second point discussed concerns the use of exchange rates in calculating the dairy PSE. Using exchange rates to calculate PSEs moves through two stages. The first is to convert the reference price into the national currency so that the PSE can be stated in local money. The second step converts the PSE of each country into a common comparison currency.

Where conversion of reference price is concerned, use of the exchange rate seems to be the most appropriate solution. What this does is evaluate the cost at which consumers of a country can buy dairy products on the world market in real time. We have shown that a PSE expressed only in percentage of a value may suffice for this first conversion, and would thus pose few problems where conversion of currencies is concerned. In its original conception, as a basis for comparing changes in support over time in different countries, this expression of PSE appears adequate.

However, the PSE has been diverted from this first function to enable it to play a role in the direct comparison of levels of support between countries and, in this case, the absence of consideration by exchange rates of relative price levels between countries, and thus of the purchasing powers of the economic actors, is a major weakness. Use of a current exchange rate thus seems inadequate, which calls in question the real significance of PSE as a country-to-country indicator of comparative support. Purchasing power parity (PPP) appears to be the most appropriate conversion factor to correct this methodological weakness.

Accordingly, simulated PSE calculations using the American price and the PPP show that the PSE, as a measurement of support trends inside each country over time, has been found to be particularly sensitive to the hypotheses underlying the calculating methodology developed by the OECD, particularly those concerning the choice of reference country and the rates for converting national currency into a common comparison currency. Indeed, though the relative classification of the countries studied has been little affected, the Canadian dairy PSE for 1999 moved from US$ 202/tonne, according to OECD, to US$ 23/tonne, when calculated using our new assumptions.

To conclude, we have demonstrated that one of the main assumptions in calculating PSE – a situation of perfect competition downstream of the production sector – does not represent the reality in the dairy sector. In such a context, letting go of this hypothesis has in many cases brought to light the fact that the dairy PSE as calculated by OECD may be significantly overvalued. This holds particularly true for countries where the milk marketing structure allows dairy producers to corner a greater share of the

consumer's dollar, a share which in other countries is captured by processors without necessarily increasing the price to consumers.

In conclusion, theoretical and methodological limitations impose major restrictions on the use and interpretation of the results of calculations made using the PSE concept developed by the OECD. Our analysis leads us to conclude that a PSE as an absolute value gives few clues as to the real level of support that dairy producers benefit from. If theoretical and methodological problems of the same extent are also to be found in the OECD's method of calculation for other agricultural productions, and if the PSE as an absolute value has little meaning, then comparisons of levels of support from one type of production to the next using OECD results will be less meaningful still. As for comparison of support levels from one country to another using OECD results, the methodology for calculating PSE breaks down entirely over the exercise of market power, which may be different in each of the national markets. And yet, this exercise of a different market power can modify results at the level of the PSEs without affecting consumers in any way. Once again, the PSE is thus not pertinent as a comparative measurement of support levels from one country to another.

Finally, the PSE may have a certain use in measuring trends in support as percentages, or in the national currency, for a given production in one country, and solely within that country. But even in this case, the simulations we have made show that the variation in PSE in national currency upwards or downwards from one year to the next, is sensitive to the OECD methodological hypotheses. Thus, this indicator should only be used to diagnose a major rise or fall in support from one year to the next, since the PSE is unsuitable for capturing, accurately and definitively, marginal changes in support levels. Even in this restricted interpretation, an analysis of how the domestic market in a country operates for the product under analysis is required to know whether a variation in calculated PSE really reflects a variation in producer support, and not in the exercise of market power on that market by different actors, with no real impact on the costs of support for consumers and taxpayers.

1. INTRODUCTION

1.1. THE QUESTION

The question of agricultural supports was widely discussed in the Uruguay Round. More recently, the launch of a new negotiating cycle by the WTO provides a fresh confirmation that agricultural support levels are still a matter of concern for WTO member countries (WTO, 2001). If support of the agricultural sector and, more specifically, of the agricultural producer, is a subject of concern and negotiation, it is all the more necessary that measurements of support be made on bases that can be compared from one country to another. To do this, the concept of the producer subsidy equivalent[1] (PSE) was developed during the 1970s and popularized in the 1980s when OECD used it in preparatory work for the Uruguay Round. PSE is an indicator of the monetary value of transfers to producers originating from consumers and taxpayers, measured at the farm level (OECD, 2000).

Initially, the PSE was not conceived as an exact measurement of producer support, but was rather to have been considered as a common basis to compare trends in support over time, from one product to another and between one country and another (Cluff 2001; Tangermann et al. 1988). However, in recent years, PSE calculations have received more credit than they deserved. They are often used in discussions surrounding trade negotiations as if they were an exact measurement of distortions of trade. However, the PSE does not allow a discrimination to be made between the different types of support as a function of the distortions of trade each type of support actually causes. This is confirmed by an OECD study which notes that the effect of a given amount of support may differ substantially as a function of the measurements of support used to procure that support (Trade Directorate, 2000). But for the same level of support, one country may provoke few distortions of trade, while another may create a major distortion at the international level. These are important considerations if we note that the purpose of agreements signed under the WTO is not to eliminate agricultural supports but to reduce distortions of trade to a minimum (Doyon and Gouin, 1998).

More specifically, in the dairy sector, calculation and interpretation of dairy PSE are both subject to question on other points. The assumption of a perfect transmission of prices from the farm to the consumer, the use of New Zealand milk prices as an approximation of the world free-trade price, and the sensitivity of its results to the exchange rates used, all call for discussion. Modifying certain of the hypotheses underlying this method of calculation could reduce the level of the dairy PSE in Canada and change its position relative to other countries or to other Canadian agricultural products.

This are important considerations because the PSE is not used in trade negotiations solely, but in debate within Canada as well. For example, the PSE can be used in defining domestic policies and programs, by the academic network to evaluate the comparative competitiveness of a given sector of the economy, or by the national press to estimate transfers made to agricultural producers by consumers and taxpayers.

And so, given the wide recourse to PSE both at home and internationally, it would appear to be a good idea if Canada's dairy sector were able to identify where the limitations lie in measuring PSE, and to demonstrate its sensitivity to the assumptions underlying its calculation.

1.2. OBJECTIVES

The general objective of this study is to develop a critique of the assumptions underlying the OECD'S calculation of the producer subsidy equivalent, as well as of certain elements in the calculation itself, a critique founded on economic and publicly defensible bases.

The specific objectives are:

1- To analyze the theoretical impact of using the price of milk in New Zealand as an approximation of the pure and perfect competition equilibrium price for the world market in dairy products and to propose, if appropriate, an alternative method;

[1] The OECD also uses the term Producer Support Estimate, which has exactly the same meaning.

2- To analyze the theoretical impact of using the current exchange rate to convert the reference price into domestic currency and to compare PSEs in a common currency (the American dollar), and to propose, if appropriate, an alternative conversion method;

3- To evaluate the empirical impact on determining the dairy PSE on the alternative methods proposed, following the foregoing analyses;

4- To develop a critique of the assumption underlying the PSE calculation, that the transmission of dairy product prices between the farm and the consumer market is symmetrical. And in doing so, to verify that an asymmetry in transmission of prices from farm to consumer may cast doubt on the claim, which has generally been transformed into an assumption, that the price support policy causes a transfer from the consumer to the producer.

2. THE NEW ZEALAND PRICE AS REFERENCE PRICE

Estimates of PSEs take five categories of agricultural policy measurements into consideration (OECD, 1997, p. 23):

- Market price supports;
- Direct payments;
- Reduction of cost of inputs;
- Services of general interest;
- Other supports.

PSEs are primarily affected by market price supports. Table 2.1 shows the contribution made by different categories of policy measures on the overall PSE of all OECD countries. According to these calculations, price support measures are by far the largest contributors to PSE.

Table 2.1. Contribution of different measures to PSE (as % of total PSE), OECD, 1997-1999.

	1997	**1998**	**1999**
Market price supports	67.00	67.82	67.86
Production-based payments	2.71	3.77	5.81
Payments on basis of cultivated area or number of animals	12.03	11.63	10.17
Payments on basis of use of inputs	10.05	8.71	7.86
Other payments	8.21	8.07	8.31

Source: OECD, 2000, p. 158.

Definition of the PSE calculation is established as follows (OECD 1997, p. 24):

$$\text{Total gross PSE: } Q \,.\, (P - Pm_{mn}) + PD - PL + AS$$

where Q is the volume of production, P the domestic price of production, Pm_{mn} the world price (reference price) at the frontier, in national currency, PD direct payments, PL levies on production, and AS the other forms of support financed out of the budget.

The reference price is thus an important element in measuring PSE. The choice of reference of world price is a subject for some debate, as Cahill and Legg (1990) recognize:

> "The definition of the external reference price has been the most controversial issue because, in practice, it is the most important parameter in

> determining the magnitude and the trend in PSEs" (Cahill and Legg, 1990, p. 24).

According to the OECD, the gap between domestic and world prices represents an opportunity cost for consumers. In the absence of policies aimed at maintaining the domestic price of an agricultural product higher than the world price, the domestic price will equal the world price. As Cahill and Legg observe, "the choice of reference price should in principle be the opportunity cost at a country's border of the commodity in question" (1990, p. 25).

A methodological choice implicit in determining PSEs is that only small countries exist. This assumption means that no individual country affects the world price, including through its policies. But the reality is quite different. And as Cahill and Legg explain, the impacts on calculations of PSEs are not very significant for country-to-country comparisons:

> "The calculations of PSEs and CSEs assumes the *small-country* case. In other words no account is taken of the effect of any country's policies on the world market price. In reality, implementation of policies in some large OECD countries influences the level of world prices. Therefore, if a policy were altered it may result in offsetting changes in world prices which partially 'compensate' producers or consumers (in terms of the price gap) for that policy change. However, in so far as changes in world prices for a commodity affect all countries for which calculations are made, this maintains the correct relative level of assistance." (Cahill and Legg, 1990, p. 21).

In the case of the dairy sector, the homogeneity of the product makes it possible to use a single reference price. And though the object of trade is not so much fluid milk as dairy products, still such products have constant characteristics, at least in the case of those traded on the international market (butter, milk powder, cheese). The OECD regards New Zealand, which eliminated almost all farm support policies in the mid-1980s, as the preferred choice as external reference for the price of milk at the farm.

Consequently, calculation of the dairy PSE for any given country is based on the comparison of the price of milk at the farm in that country with the same price in New Zealand. Adjustments are made to account for different levels of butterfat in milk in different countries (Cahill and Legg, 1990, p. 25).

Equally important to note is that only in the dairy sector is a single reference price used. For many others, reference prices differ from one country to the next:

> "Attempts have been made to establish acceptable common reference prices, thereby ensuring that the price comparison for each country would be based on the same reference price. This price should, therefore, be representative of production in each country or of a sufficiently large proportion of production that it could be used as the basis of the estimate for the entire production. Unfortunately, few products proved sufficiently homogeneous for the single common refe2ence price approach to work." (Cahill and Legg, 1990, p. 25).

And finally, there is another important methodological choice to be made in the case at hand. Since farm policies can affect the world price, we must question the relevance of using a world price that results from those policies. The OECD believes that the observed world price is a better indicator than a "policy-free" price derived only from an estimate:

> "Moreover, any calculation of what the "policy free" world price would be requires an initial estimate of assistance as an essential input into a modelling exercise. It is important to bear in mind that the PSEs and CSEs measure the transfers to the agricultural sector from the rest of the economy arising from agricultural policies with a given set of prices and making adjustments for a "policy-free" world price would lead to incorrect transfer calculations." (Cahill and Legg, 1990, p. 21).

When comparing support measures between agricultural productions, this different should not be neglected. Variable methodological choices may very likely lead to results which can be problematic to compare.

And so, these different elements specify the choices made by the OECD for measuring PSE in the dairy sector. Four main paths have been analyzed to determine whether the New Zealand price is really the best reference to use in calculating PSEs. First, the situation in New Zealand is analyzed. Then, we return to the assumption made by the OECD, that is, that the New Zealand price is used because it is the price of the country which intervenes least to support its dairy sector. Finally, we will see what happens to price in the absence of policy.

2.1 HOW MILK PRICES AT THE FARM ARE FORMED IN NEW ZEALAND

New Zealand's dairy production is relatively small in relation to world production. With 2.3 % of world output, its production is in the same order of magnitude as Canada and Australia (Table 2.2).

Table 2.2. Shares of world production of cow milk for certain countries.

	1996	**1997**	**1998**	**1999**	**2000e**
European Union (15) (%)	26.14	25.90	25.60	25.51	25.12
Australia (%)	1.93	2.00	2.06	2.19	2.29
New Zealand (%)	2.08	2.28	2.32	2.20	2.45
Canada (%)	1.70	1.74	1.73	1.73	1.67
United States (%)	15.03	15.18	15.15	15.44	15.68
World ('000 t)	**464,858**	**466,427**	**471,000**	**478,000**	**484,000**

Source: IDF, 2000, p. 43.

On the other hand, New Zealand is a major exporter. With fewer than four million inhabitants, production far exceeds domestic requirements. It is a major player in the four main dairy products traded – butter, skim milk powder, whole-milk powder and cheese. Certainly, the European Union has a more dominant presence on world markets, but where production is concerned, New Zealand is the country that devotes the greatest share to exports (Table 2.3). According to the New Zealand Dairy Board (2000), more than 90 % of New Zealand dairy production is exported.

Until quite recently, the New Zealand Dairy Board (NZDB) was the organization responsible for all that country's dairy exports. A new payment system came into effect after the 1998/1999 dairy year. It supposed to permit better adjustment between the supply and the demands of the domestic and export markets. Thus, processors are paid as a function of the international market price. Each year, the New Zealand Dairy Board sets the price of a kg of milk solids[2]. Processors then use this price to pay producers, but there are differences between enterprises. This base remuneration proposed by the NZDB covers all industrial milk, whether for domestic consumption or for export.

Table 2.3. Shares in world (export) trade of main milk products.

	1996	**1997**	**1998**	**1999**	**2000e**
Butter					
European Union (15) (%)	24.84	25.03	20.50	21.79	19.48
United States (%)	2.76	2.40	1.38	0.83	0.26
Australia (%)	8.41	11.43	13.25	16.14	n.a.
New Zealand (%)	31.14	35.89	39.63	38.21	40.26
World ('000 t)	**761**	**875**	**800**	**725**	**770**

[2] This is the sum of milk protein and butterfat.

Table 2.3. Shares in world (export) trade of main milk products.

	1996	**1997**	**1998**	**1999**	**2000e**
Skim milk powder					
European Union (15) (%)	23.70	26.26	17.95	24.07	30.83
United States (%)	2.30	8.57	11.38	15.84	5.00
Australia (%)	17.54	19.09	20.41	21.06	20.00
New Zealand (%)	13.26	17.04	17.03	15.40	13.08
World ('000 t)	**958**	**1074**	**975**	**1130**	**1200**
Whole milk powder					
European Union (15) (%)	46.79	43.86	42.24	40.21	40.56
United States (%)	1.39	2.07	1.44	1.20	1.40
Australia (%)	8.06	8.37	7.90	9.79	
New Zealand (%)	24.09	26.19	25.79	25.49	25.87
World ('000 t)	**1154**	**1302**	**1392**	**1420**	**1430**
Cheese					
European Union (15) (%)	45.35	40.78	36.30	32.24	33.33
United States (%)	3.16	2.95	3.00	3.10	
Australia (%)	10.79	11.01	13.53	15.76	
New Zealand (%)	15.18	18.83	18.80	19.59	19.76
World ('000 t)	**1140**	**1253**	**1234**	**1225**	**1260**

Source: IDF, 2000, p. 50.

New Zealand dairy production, based mainly on grasslands, is rather unique among OECD countries. Ample pasturage means that production costs are extremely low. And so, as Novakovic (1995) observes, "New Zealand and Australia have real cost advantages against which no other supplier can compete without special help" (Novakovic, 1995, p. 2). Production is on a wide scale and production per cow is therefore low. For example, average production per cow in New Zealand is about 3200 kg as against nearly 7000 kg in Canada (GREPA, 2000, *Les faits saillants laitiers* ["Salient Dairy Facts"]).

However, two totally different situations must be distinguished if we are to understand correctly the nature of dairy production in New Zealand. The producers who supply exporters virtually shut down operations during the two winter months (June and July) (Table 2.4).

Table 2.4. Production of milk solids for processing (million kg).

	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000
June	1.0	1.2	1.4	1.1	1.9
July	3.4	3.8	3.6	3.1	3.8
August	42.5	44.8	48.8	45.9	47.8
September	88.8	96.4	113.3	107.1	121.4
October	114.7	129.5	143.1	134.5	153.1
November	112.7	122.4	134.2	125.9	133.1
December	103.8	115.5	117.0	118.2	130.8
January	94.7	109.4	104.5	98.8	121.0
February	76.4	83.8	72.1	83.2	96.8
March	75.2	83.7	73.0	67.2	82.6
April	54.3	65.8	58.2	47.5	51.4
May	20.0	24.0	21.3	17.1	26.2
Total	**787.7**	**880.4**	**890.6**	**849.6**	**969.9**

Source: New Zealand Dairy Board, 2000.

By contrast, producers supplying the home market with fresh milk produce all year round. This annual production means production cost is higher. Producers who supply milk during the winter months receive a premium to compensate them for the higher production cost they incur. But this production represents only 3 % of total production. According to Wharton (2001), there is no official publication of fluid milk prices. But according to Templeton (2001), of the New Zealand Dairy Group cooperative, contracts for winter supplies include a premium paid to producers, over and above the normal price. It amounts to about 25 cents NZ per liter. This premium is not tied to the price of milk solids (Templeton, 2001). Table 2.5 shows the magnitude of the winter milk premium paid producers in order to insure year-round supply of the domestic fresh-milk market.

Table 2.5. Effect of winter milk premium on farm milk prices in New Zealand

	Milk for processing (millions of liters)	Milk solids for processing (millions of kg)	Milk price at the farm C/kg milk solids	Milk price at the farm C/liter of standard milk	Price of winter milk [1]
1994-1995	8633	733	339.85	28.86	53.86
1995-1996	9325	788	399.43	33.75	58.75
1996-1997	10339	880	362.88	30.89	55.89
1997-1998	10651	892	341.65	28.61	53.61
1998-1999	10168	850	357.95	29.92	54.92

1999-2000	11480	970	377.80	31.92	56.92

[1] – calculated using a winter milk premium of 25 cents NZ per liter.
Source: New Zealand Dairy Board, 2000 and our own calculations.

This distinction is taken into account, however, in calculating the PSE. Thus, production volume is the sum of "town milk and manufacturing milk production" (PSE/CSE Database), "town milk" being milk produced for consumption. The value of production is the total value of milk sales made by producers. The average price at the farm is only the result of dividing these two indicators.

And so, we see that New Zealand's situation is specific: very low production costs, partly explained by a pastoral production mode, and the shutdown of operations during the two most difficult winter months. This very low production cost means that, despite the absence of policies in aid of dairy producers, New Zealand is a very big player on the international dairy market. However, producers supplying the domestic market receive a premium for doing so during the winter, to compensate them for the superior production costs they encounter.

The size of the premium processors offer to producers who guarantee year-round production shows the limits associated with milk production in New Zealand. Its abundant pasturage confers certain advantages. But this is only possible for a production over ten months, which is of course incompatible with having a year-round supply of fresh milk. The reference price used to calculate PSEs does not, therefore, reflect conditions for a year-round supply of the international market with fresh dairy products, and even less so for fluid milk.

2.2 THE ASSUMPTION THAT NEW ZEALAND "DICTATES" THE INTERNATIONAL MARKET PRICE

The OECD justifies its methodological choice of the New Zealand farm milk price as an indicator of the world price by the saying that New Zealand has the lowest level of milk producer support. This chapter will analyze that assumption.

After its radical 1980s reform of State support for agriculture, New Zealand has far and away the lowest farm subsidies of any OECD nation. Whatever the limitations of PSE measurements, the OECD results leave little doubt on the subject (Table 2.6). The trend since the mid-1980s has been

drastic for New Zealand. For New Zealand's dairy industry, the only support identified by OECD is in the form of "payments based on input use." This assumption cannot be disputed. New Zealand does in fact have the lowest farm subsidies in OECD.

Still, we must question the value of taking the New Zealand price of milk at the farm as an approximation of the world price. To begin with, world trade in this sector is comprised entirely of dairy products. Fluid milk is not traded owing to problems of conservation, and the fact that it consists mainly of water. Obviously, then, a world price refers to the price of dairy products on world markets.

Table 2.6. PSE total and dairy PSEs for different countries (as percentages).

	1986	1990	1994	1996	1997	1998	1999
New Zealand							
All products	20.4	3.1	2.1	1.9	1.9	1.4	1.7
Milk	14.1	1.1	0.5	0.4	0.4	0.4	0.4
European Union							
All products	46.1	44.7	41.9	55.6	38.1	45.3	49.1
Milk	62.6	59.6	55.0	50.1	48.4	56.3	58.2
United States							
All products	29.7	20.0	16.4	13.2	13.6	22.1	24.4
Milk	71.9	59.0	48.1	43.5	45.0	60.8	57.2
Canada							
All products	37.0	35.7	18.6	16.2	14.2	17.6	19.6
Milk	66.9	64.3	55.5	46.1	52.9	59.2	58.3
Australia							
All products	10.3	9.3	8.5	6.7	7.2	6.7	6.4
Milk	1.7	1.6	1.4	1.2	1.3	1.3	1.2

Source: OECD PSE/CSE database.

As noted earlier, the NZDB fixes the price of milk solid as a function of prices on export markets, and New Zealand is therefore a price taker. To get an idea of the world price, the prices of European dairy products produced for exports are used. For example, the USDA's Foreign Agricultural Service (FAS) uses prices FOB Western Europe as the world price of various dairy products (FAS internet site, 2001).

The International Dairy Federation uses the same indicator (IDF, 2000). This situation is easy to understand. The various measurements used by the European Union allow it to get rid of its surpluses by offering exporters dairy products at a very competitive price. The prices at which the EU exports its dairy products are a good deal lower than domestic prices. A recent study by Shaw and Love (2001) provides a useful overview of the gap between the domestic and world prices of dairy products (Table 2.7).

Table 2.7. Protection rate indicators, 1999.

		Skim milk powder	Whole milk powder	Butter	Cheese
World price	$ US/t	1301	1508	1435	1915
European Union					
Price difference[1]	%	68	80	125	62
United States					
Price difference	%	76	104	90	61
Canada					
Price difference	%	134	n.a.	156	n.a.
Japan					
Price difference	%	269	355	501	n.a.

[1] – Calculated as follows: 100 x [(wholesale price / world price) –1].
Source: Shaw and Love, 2001, p. 14.

The impact of farm policies on global market prices leaves little doubt that, as Zhu et al. stress: "Government policies typically generate various trade distortions that imply departures from competitive market equilibrium." (1999, p. 188). These same authors distinguish three major categories of farm policies: those linked to imports, those linked to exports and, finally, domestic policies. These three types of policy can cause a certain distortion of international trade and thus affect the price of products trade on world markets. We must then ask what the world dairy product market is really like, that is, whether the price is the result of perfect competition. One of the theoretical assumptions of perfect competition is that the enterprises consider the price at which they sell their product as a given:

> "The firm is assumed to be a price taker; that is the firm is assumed to act as though it can alter its rate of production and sales within any feasible range without such action having a significant effect on the price of the product it sells. Thus the firm must passively accept whatever price happens to be ruling on the market." (Lipsey et al., 1982, p. 186).

When we consider the marketing of dairy products at the world level, it makes sense to substitute a country for the firm. In the case of New Zealand, for example, the New Zealand Dairy Board is the organization that exports the totality of the dairy products of the country. In any case, the four major players – the European Union, the United States, New Zealand and Australia – dominate the dairy export market. The United States subsidizes exports of skim milk powder almost exclusively . They may have different policies for different products, but globally, these four players hold a very significant part of the dairy trade. That being the case, their farm policies have considerable impact.

First of all, in regard to policies that restrict imports, they have an indirect effect by reducing the demand on the international markets. Compared to export subsidy policies, which have direct consequences for export prices, this effect is limited. Take the case of the European Union. By allowing firms to benefit from dairy products at a subsidized price on international markets, the EU can sell its products at a price lower than it would have been able to offer in the absence of such measures. Without these export subsidies, for a given demand and supply, the price of dairy products on world markets would be higher. Thus Shaw and Love note that "the use of export subsidies by the European Union, the world's largest exporter of dairy products, significantly depresses world market prices" (2001, p. 22).

In this context, international prices of dairy products are dictated directly by European and American subsidies[3]. Countries that give their agriculture little support, such as New Zealand, behave like price takers on the international market. This means that New Zealand adapts to the offers of other exporters. Where prices are concerned, it is a "leader" and "follower" situation – a situation uniquely due to the EU's export subsidies. New Zealand, with its low production costs, can adapt to the offers of European exporters, who themselves need sizeable subventions to supply export markets at these price levels. However, the price obtained does not represent an economic equilibrium but rather is the result of the distortion arising from farm policies directly affecting international trade in dairy products.

In short, the New Zealand price reflects the international price, which is based on the subsidized EU price, and so the New Zealand farm price does not reflect a subsidy-free market or a perfect competition situation, as OECD suggests. Moreover, as we have already emphasized, to keep their costs as low as possible, New Zealand's dairy producers do not milk all the year round. In our view,

[3] Note that this finding casts doubt on the OECD's small-country assumption in calculating PSEs.

both these facts cast doubt on the choice of the New Zealand price as a based to be used for opportunity cost.

2.3 WHAT THE PSE MEANS FOR TRANSFERS TO PRODUCERS

As mentioned in the introduction, the OECD maintains that an estimate of what a price might be in the absence of policy will lead to an incorrect estimate of transfers to the agricultural sector. And again according to the OECD, given that policy changes causing modifications in the world price affect all countries, country-to-country comparison of PSE remains valid.

On this basis, the gap between world and domestic prices should be considered as an opportunity cost (Cahill and Legg, 1990, p. 25). If a consumer decides to meet his needs from the world market, he can in fact obtain his dairy products at the price of that market. In calculating the dairy PSE, the OECD makes the assumption that the price of milk in New Zealand represents the opportunity cost of the milk at the border of each of the countries concerned. This assumption is based on the fact that:

> "The New Zealand milk price is used because it is the least assisted of all OECD countries and is adjusted for transport costs based on milk products equivalents to each county (and hence effectively converted to a c.i.f. price)." (Cahill and Legg, 1990, p. 25-26).

If this calculation method remains valid for comparing PSE levels from country to country, it's quite another story when we come to use the PSE as a measurement of transfers from taxpayers and consumers towards dairy producers, or to make comparisons of support levels from one production to another. The method of calculating PSE from the price of milk in New Zealand implies that the gap between the reference and domestic prices is a transfer from taxpayers and consumers to the producers. However, as we will now demonstrate, such is not the case.

The transfer of price from consumers to producers can be broken down as follows:

$$(P - Pm) = (P - Pe) + (Pe - Pm)$$

where P is the domestic price in a regulated market, Pm the world price, and Pe the equilibrium price in the absence of policy. The effects of policies on the world price are that P is greater than Pe and Pe is greater than Pm. Thus, the term (P – Pe) corresponds to the real transfer to agriculture on the part of taxpayers and consumers. On the other hand, the term (Pe – Pm) is the result of the distortion of the international dairy market caused by agricultural policies.

The OECD also makes the assumption that all countries are small countries, that is, no single one of them has any effect on the world price. This assumption may not correspond to reality, but it has the merit of simplicity, for if we take a single country that decides to deregulate its dairy sector, the world price is considered constant. For that country, the domestic price of dairy products would then become equal to that found on the international markets (Pm). In such a situation, the consumers would effectively recover the transfer represented by what was the domestic price with intervention, and what it had become with deregulation (P – Pm). On the other hand, if all the agricultural policies of all countries were abolished, the price on the world market would rise. For countries who support their agricultural production, only a part of the total transfer (P – Pm) would be recovered by consumers, that is (P – Pe). The other part of the transfer (Pe – Pm), included in the PSE calculation beforehand, will not be recovered by consumers or taxpayers because it is only an effect induced by policies and which will disappear when they do. Inversely, New Zealand consumers who function in a totally deregulated market and who benefit from a domestic price equal to Pm will, with the abolition of all support policies, have to face higher prices for dairy products because the international market price will become Pe which is superior to Pm.

Consequently, we can conclude that the PSE calculation as currently made by the OECD artificially amplifies the transfer made to producers by consumers and taxpayers. The gap between the domestic price and the world price contains two dimensions: the first, which corresponds to the gap between the domestic price and the equilibrium price in the absence of policy, is the transfers that taxpayers and consumers make to agricultural producers. The second, the gap between the equilibrium price in the absence of policy and the world price, is, on the other hand, only the result of the effects of policy distortions and cannot be considered as a transfer from taxpayers and consumers.

When a country decides not to support its farm sector while the major players support theirs massively (which is New Zealand's situation), the gap between domestic and world prices represents a transfer from agricultural producers towards consumers and taxpayers. In effect, it is the producers who assume the effects of the policies of other countries, to the benefit of New Zealand consumers and taxpayers.

PSE as currently calculated thus overvalues the transfer from consumers and taxpayers to agricultural producers. Only the part between an equilibrium price in the absence of policy and the domestic price constitutes a genuine transfer from consumers and taxpayers.

2.4 UNITED STATES MILK PRICES: A BETTER REFERENCE

And so the New Zealand price currently used as a reference poses a certain number of problems, the main one being that it overestimates the real transfer from consumers and taxpayers to dairy producers. From the foregoing analysis, it appears that a price in the absence of policy would be a more acceptable solution. And yet, the current choices offer a certain advantage. As mentioned earlier, the fact cannot be disputed that the New Zealand price is the price of the country which least supports its dairy producers. The use of a price in the absence of policy has the great disadvantage of being hypothetical, for it cannot be irrefutably determined what this price would be. Of course, simulations can be performed (and some already have been), but the result remains approximate. Despite this limitation, analysis of the results of simulations of liberalization of world trade in the dairy sector is interesting and helps us orient our thinking. As we will see, many simulations point in the same direction, which is that it is currently the price at the farm in the United States that is closer to the world price without intervention. Further, these same simulations indicate that the price of milk in New Zealand is a poor estimate of the same world price without intervention, since it will then be driven upward considerably.

A model has been developed at the University of Wisconsin to simulate liberalization of world trade in the dairy sector. This simulation of total market liberation envisages the abandonment of all policies:

> "In the free trade scenario, all tariffs, import quotas and export subsidies are eliminated. Domestic farm policies that can affect trade (e.g. price support and production quotas) are also eliminated. However, classified pricing policies in the U.S., Canada and Australia are maintained." (Zhu et al. 1999, p. 196).

Using this model, the results published by Zhu et al. (1999) indicate major variations in production prices in certain cases. Thus, the simulation shows that the price of milk at the farm in New Zealand would increase by more than 50 % in a totally free market situation. The price in the European Union ("Western Europe") would fall by more than 25 % and in Canada by more than 32 %. Prices in the United States, the Middle East and South Asia would be little affected by liberalization of trade. In the United States, production would drop by only 0.2 % in this simulation, but would rise by 21.4 % in New Zealand (Table 2.8).

Table 2.8. Consequences of the Uruguay Round agreements and total trade liberation on the price of milk at the farm.

	Average price of milk (reference) 89-94	Impact of Uruguay Round commitments		Total liberation hypothesis	
	$ US/t	%	$ US/t	%	$ US/t
Western Europe	412	-5.50	389.34	-25.80	305.70
Eastern Europe	191	1.60	194.06	25.90	240.47
East Asia	455	-0.70	451.82	-26.40	334.88
Japan	709	-1.50	698.37	-36.40	450.92
South Asia	219	0.00	219.00	0.20	219.44
Middle East	381	0.10	381.38	0.50	382.91
Oceania	185	2.10	188.89	35.50	250.68
Australia	213	-0.80	211.30	22.50	260.93
New Zealand	161	5.80	170.34	50.80	242.79
North America	302	-0.70	299.89	-4.90	287.20
Canada	414	-2.00	405.72	-32.30	280.28
United States	289	-0.50	287.56	-0.40	287.84
Latin America	287	1.80	292.17	-6.10	269.49
Mexico	342	-0.30	340.97	-17.30	282.83
South America, northern part	300	0.80	302.40	-7.80	276.60
South America, southern part	200	9.60	219.20	17.20	234.40
Remainder of the world	376	-0.10	375.62	0.40	377.50

Source: Zhu et al. 1999.

The results of Cox et al. (1999) were obtained using the same model. They make it possible to distinguish the effects of different policies on the farm price of milk. The simulations are based on the WTO requirements applied in 2000 and their extension linearly to 2005. The impact on the farm price of milk in New Zealand varies with the type of policy, but that impact continues to be major with a minimum increase of 7.3 %. The European Union would see its prices fall significantly under all hypotheses, but the continuation of reductions in export subsidies would have the most impact (a drop of 12.2 % in the farm price of milk). For the United States, effects are very small, ranging from minus 0.8 % (tariff quotas and export subsidies) to 0.1 % (tariff) (Table 2.9).

Table 2.9. Consequences for farm price of milk of continuing reduction of policies.

	OMC 2005 Tariff	OMC 2005 Tariff quota	OMC 2005 Tariff and tariff quota	OMC 2005 Export subsidies	OMC 2005 Total impact
Western Europe	-8.9	-6.1	-9.4	-12.2	-13.5
Eastern Europe	1.6	2.8	4.9	4.3	6.9
East Asia	-0.7	-0.6	-0.3	1.4	-0.3
Japan	-1.5	-1.4	-1.6	0.7	-1.6
South Asia	-0.2	0.0	-0.2	0.0	-0.3
Middle East	0.4	0.0	0.4	0.9	1.2
Oceania	5.4	3.2	5.8	5.5	8.5
Australia	1.3	0.1	1.7	1.2	2.7
New Zealand	10.6	7.3	11.1	11.0	15.8
North America	-0.3	-0.9	-0.5	-1.2	-1.0
Canada	-2.6	-1.7	-2.6	-3.7	-3.5
United States	0.1	-0.8	-0.2	-0.8	-0.6
Latin America	0.9	1.8	0.8	2.2	0.9
Mexico	-4.5	-0.6	-4.7	-0.4	-4.8
South America, northern part	-0.5	0.7	-0.5	1.3	-0.5
South America, southern part	14.2	10.0	14.4	10.6	15.1
Rest of world	-0.1	-0.1	0.0	1.1	1.5

Source: Cox et al. 1999, p. 177.

In using a non-spatial, multi-region model of the world dairy sector, Larivière and Meilke (1999) note that "world dairy product prices increase substantially with free trade, ranging from 14 % for skim milk powder to 43 % for cheese" (Larivière and Meilke, 1999, 71).

Table 2.10 presents the results obtained by Larivière and Meilke (1999) simulating a total liberalization of the dairy sector. The variations in prices of fats, non-fat solids and milk in the United States are very low, or even nil. But price reductions in the European Union are quite sizeable.

Table 2.10. Impact of trade liberalization on the farm price of milk.

	United States		European Union	
	Base in $US	**Variation in %**	**Base in Ecus**	**Variation in %**
Fat (/hl of milk)	8	1	12	-21
Non-fat solids (/hl of milk)	20	0	21	-16
Price of milk for consumption (/hl)	31	0	n.a.	n.a.
Price of milk for processing (/hl)	28	0	n.a.	n.a.
Price of milk – consumption and processing (/hl)	n.a.	n.a.	33	-18

Source: Larivière and Meilke, 1999, pp. 69 and 70.

Shaw and Love (2001) have also attempted to evaluated the impact of world trade liberalization on the dairy sector. To do this, they used the OECD's AGLINK model. Two different situations were envisaged. The first simulates the impact of freer access to different markets. To do this, all the tariff quotas were doubled and the rates applying (for imports both under a tariff quota and outside such a quota) were reduced by half. Reference year is 1999.

The second situation aims at evaluating the consequences of reducing subsidized exports. A reduction by half of subsidized exports is simulated taking as a base the exports actually subsidized in the year 1998-1999. In this case, the European Union would be limited to 88,000 tonnes of cheese, 138,000 tons of butter, 101,000 tonnes of skim milk powder and 201,000 tonnes of whole milk powder. For the United States, only skim milk powder would be affected with an authorized volume, in the simulation, of 51,000 tonnes.

Here again, the United States farm price is hardly affected at all. The result obtained for Canada ought to be regarded with caution, because domestic support policies (and thus management of supply) are not affected by the simulations performed (Table 2.11).

Table 2.11. Impact of increased access to markets and reductions of subsidized exports on farm price of milk (change as a percentage of base price, 1999).

	Price in 999	Increased access		Reduction in subsidized exports	
		Initial impact	With response in supply	Initial impact	With response in supply
European union (Euro/100 kg)	30	-1.4	-1.8	-4.9	-6.7
United States ($ US/100 kg)	32	-1.2	-1.1	0.0	-0.1
Canada ($CAN/hl)	56	0.0	0.0	0.0	0.0
Australia ($A/hl)	29	7.3	11.3	6.7	8.9
New Zealand ($NZ/hl)	31	9.0	13.0	9.4	11.4

Source: Shaw and Love, 2001, pp. 63, 64, 83 and 84.

The results of these different studies are unanimous as to the global implications. Liberalization of trade, either partial or total, would bring with it a net increase in the farm price of milk in New Zealand owing to the increase in export opportunities that would open up for that country. Milk prices in the United States would be less affected if various policies were eliminated.

2.5 CONCLUSION

Hence, using the price of milk in New Zealand poses a number of problems. First of all, by far the greater part of dairy production in that country goes for export. Further, the price paid producers to supply the domestic market during the winter months is clearly higher (nearly double) the price received for the rest of the year. While it is true that New Zealand is the country that least supports its farm sector, the world market in dairy products is strongly influenced by the policies of major players like the European Union, which means that the price obtained on the world market is not the result of an economic equilibrium. Though the OECD emphasizes the difficulty of correctly estimating a distortion-free reference price, we maintain that the current reference price poses just as many problems by including in it a transfer from the dairy producers of New Zealand to their consumers.

It would be preferable to choose a reference price that comes as close as possible to a free-trade situation. Various simulations obtained using different models all lead to the same results: the price of milk in the United States would be the least sensitive to trade liberalization and therefore more closely

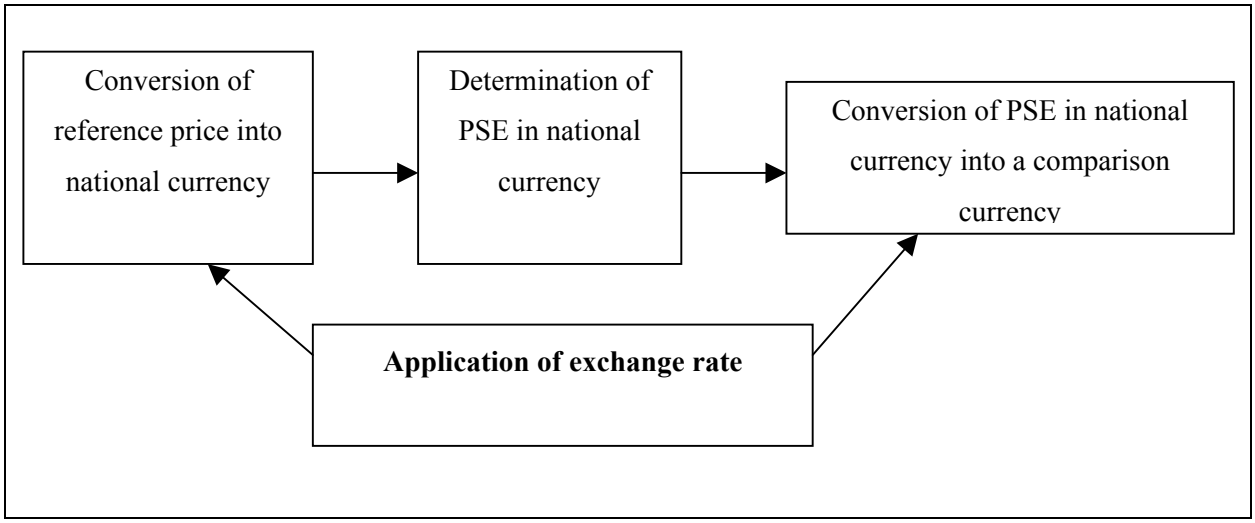
approaches what the world price would be without government intervention. However, taking into account the great volatility of the farm price in the United States, a volatility linked to the instability of the American domestic market in recent years, this price, too, is not an ideal reference.

The totality of our analysis leads us to conclude that the New Zealand price, used as an approximation of the world price in calculating the dairy PSE, is in fact a price that is the result of significant trade distortions. Use of this price in the methodology developed by the OECD has the effect of over-valuing the transfer from consumers and taxpayers to the producers. The dairy PSE is thus not an adequate measurement of this transfer.

3. AN ALTERNATIVE TO USING A CURRENT EXCHANGE RATE IN CALCULATING THE PSE

Use of the exchange rate in calculating PSEs acts at two quite different levels as shown in Figure 3.1. The exchange rate is necessary to convert the reference (world price) into local currency. The second effect of the exchange rate is felt when PSEs in national currencies are converted into a single comparison currency, generally the U.S. dollar. These two exchange rate utilization levels are totally different in their nature and should therefore be considered independently.

Figure 3.1. Use of the exchange rate in calculating PSE.



3.1 CONVERSION OF REFERENCE PRICE INTO NATIONAL CURRENCY

The reference price is used to calculate the gap between the domestic price and the world price. This difference is attributed in its entirety to farm policies. As we have already seen, Cahill and Legg (1990) compare this gap to an opportunity cost.

Though we have already questioned the validity of using the New Zealand farm price as an estimate of world price in calculating the dairy PSE, here we will focus discussion solely on the impact of using a current exchange rate to determine the world market reference price in any given country, whether that

of New Zealand, as in the present case, or of any other country. What more particularly interests us is the gap between the domestic price and the world price, and hence the necessity to convert the world price into local currency.

In this specific case, the gap between domestic and world prices refers to the prevailing market situation. For any country supplying itself essentially from the world market, the price of dairy products will be directly influenced by the rate of exchange applying. The PSE calculation logic is to consider the gap between the price on the domestic market and the price on the world market as an indicator of the annual monetary value of the gross transfer from consumers to agricultural producers. The transfer in question here is directly related to the international market situation at any given moment. As with all real international trades, it is the exchange rate at the moment of transaction that must be considered. Whatever the variations in exchange rate, the consumers have to accept them if they decide to buy on the world market. To put it another way, what measures market price support (gap between the domestic and world prices) is the price that dairy products would cost a country if it decided to supply itself from the world market, taking into account the current exchange rate, which corresponds to the real market situation at any given moment.

Seen in this light, the current exchange rate is the conversion factor to use. There will be no need to seek indicators that compensate for short-term fluctuations in the exchange rate, since it is in fact exactly the current market situation indicator that should be reproduced in calculating PSE. When a good is imported, it is invoiced to the importing country at the rate of exchange prevailing on the day of the transaction. That is what the reference price reflects in the PSE calculation method.

Note that if the results of the PSE calculation were always given solely as a percentage of the value of the production, the demonstration could stop right here. In that case, the exchange rate would act only on the gap between the domestic price and the world price. By contrast, if the results of the PSE calculation are converted into a common comparison currency, the exchange rate comes into the picture a second time to complete that conversion. It is the scope of such a conversion that we are now going to analyze.

3.2 COMPARISON OF PSEs BASED ON A SINGLE CURRENCY

The PSE evaluates transfers made to agricultural producers by consumers and taxpayers. And so, a comparison of trends in the PSE not only from one year to the next but also between countries should be made in such a way as to guarantee that the results obtained are comparable. It is important that the conversion factors used translate as fairly as possible a situation in which a given transfer to a country's agricultural producers really represents an amount that can be compared (whether it is equal, lower, or higher, as the case may be) to that obtained by the producers in another country.

Still, the short-term volatility of poses a problem for calculating PSEs, which are supposed to measure transfers to farm producers from consumers and taxpayers. For instance, if a country makes no changes to its policies between year *n* and year *n+1*, and the reference price remains unchanged, just the variation of exchange rates with the comparison currency will bring a different result for the PSE. We can illustrate this problem using a dollars and cents example (Table 3.1). In this fictional example, an improvement in the exchange rate of the Canadian dollar against the U.S. dollar would produce an increase in the dairy PSE in Canada, all other things being equal. The expected interpretation of this increase in the dairy PSE in Canada would be that transfers by consumers and taxpayers to Canadian farm producers have increased in year *n+1* – which, of course, is an erroneous deduction. The use of a current exchange rate to compare PSEs in a common currency can thus lead to mistaken interpretations of trends in support policies from one country to another.

Choice of comparison currency also impacts on results. As Butault (2001) stresses, depending on whether PSE results are expressed in U.S. dollars or in Euros, the results – not only the PSE value, but also the ranking of countries by PSE level, differs according to the comparison currency used.

Table 3.1. Example of impact on PSE calculation of a variation in the rate of exchange with the comparison currency.

	Year n	Year n+1
Price on world market = farm price in New Zealand	$NZ 30/hl	$NZ 30/hl
Rate of exchange: 1$NZ = 0,90$CAN		
World market price in Canada	$CAN27/hl	$CAN 27/hl
Domestic market price in Canada	$CAN 55/hl	$CAN 55/hl
Transfer calculated for PSE	$CAN 28/hl	$CAN 28/hl
Conversion to comparison currency: 1$CAN =	$US 0.65	$US 0.72
Transfer calculated for PSE in comparison currency	$US 18.20/hl	$US 20.16/hl

The problems arising from using current exchanges rates in international comparisons of economic indicators is not exclusive to the calculation of the PSE. Publication of economic indicators goes on all the time, and international organizations frequently make comparisons between countries on the basis of these indicators. Of course, when comparing indicators between a number of countries, a comparison currency has to be adopted. The simplest way to do this, and one used for a long time, has been to take the current exchange rate as a basis. This solution poses certain problems as to the validity of the comparison, as we have shown above, and in a good many other cases as well. For example, when we compare the gross domestic products of several countries using the exchange rate, we do not take into consideration the difference in the price of the products in different countries. This difference between the exchange rate and the purchasing power of a currency is the main weakness in the use of the exchange rates to compare economic indicators between countries.

In the case of the PSEs, this problem is very much present. Since they are intended to measure transfers originating from taxpayers and consumers, the international comparison should translate the purchasing power dimension, which is not reflected in the exchange rate. Exchange rates have become ever more volatile since the end of the Bretton Woods system[4], which makes international comparisons of economic indicators difficult. As Vachris and Thomas put it:

> "…If a government or international organization were comparing national expenditures across different countries, merely collecting the gross domestic products (GDPs) of the countries and using exchange rates to convert them

[4] Agreements reached in 1944 between the forty-four countries then belonging to the U.N. forming the basis for the international monetary system that functioned until 1971, creating the exchange standard where the American dollar acted as the reserve currency on a par with gold.

> into a single currency would not yield an accurate comparison." (Vachris and Thomas, 1999, p. 3).

Causes in exchange rate variations must thus be spelled out. According to Lipsey et al. (1985, pp. 761-764), three major causes predominate:

- inflation, or, more accurately, differences in inflation between the two countries;
- movements of capital;
- structural changes in the economies.

These elements related to long-term trends in exchange rates. In the short-term, financial factors tend to affect exchange rate variations more sharply:

> "Most explanations of short term exchange rate volatility point to financial factors such as changes in portfolio preferences, short-term asset price bubbles and monetary shocks." (Rogoff, 1996, p. 647).

Short-term volatility thus does little or nothing to change the economic performance of nations. It is consequently tricky to use this indicator to make international comparisons whose results are heavily dependent on the exchange rate. Short-term variations in that rate do not necessarily represent changes in purchasing power, while if we talk about transfers from consumers and taxpayers, that becomes the dominant notion.

As well, comparisons between a "rich" country and a "poor" country are affected by the exchange rate owing to the Balassa-Samuelson effect:

> "A natural way of making such comparisons is to use exchange rates to convert national GDP data into units of the same reference currency. However, there are problems with this approach. In addition to being highly volatile, exchange rates also have an inherent bias. This is the so-called Balassa (1964) – Samuelson (1964) hypothesis, which states that exchange rates have a systematic tendency to undervalue the purchasing power of currencies in poorer countries relative to richer countries. This is because many services which tend to be relatively cheaper in poorer countries, generally are not traded internationally. The Balassa-Samuelson hypothesis implies that comparisons of real income across countries that use exchange rates tend to underestimate real income levels in poor countries." (Hill, 1995, pp. 1-2).

Thus there are several reasons why doubts persist about using the current exchange rate in international comparisons of economic indicators. And the same holds true for the PSE, which is itself such an indicator. When the method for calculating PSEs gives a result in the local currency, conversion into a common currency makes it possible to compare what that transfer is, but without taking into account

the real economic situation in the country in question. That situation is absolutely comparable to what happens when GDP and other economic measurements are compared.

3.3. PURCHASING POWER PARITY, AN ALTERNATIVE TO USING THE CURRENT EXCHANGE RATE

To resolve the problem raised by using the current exchange rate in international comparisons, a number of studies have been conducted to determine and evaluate which alternatives to put forward. The vast majority of studies tend to favor the concept of Purchasing Power Parity (PPP).

However, other options might be considered. For instance, the International Monetary Fund's SDRs (Special Drawing Rights) might present an interesting alternative. This is nothing more than a basket of currencies, which makes it possible to limit the fluctuations of one currency against another. Use of a fixed exchange rate might also be considered, as might a moving average of an exchange rate. Still, the main problem with the use of exchange rates, that is, that it ignores differences in purchasing powers of currencies, is quite unaffected by these approaches. These alternatives reduce solely the effect of short-term volatility. Not only that, but these different alternatives impose methodological choices which affect the outcome and which remain arbitrary. For example, in the case of the basket of currencies, which weightings affect which currencies? Take the fixed exchange rate: which initial value is selected, and from which base will we track it? And next, in the case of the moving average of the exchange rate, what period do we use? And last of all, which rule to we adopt to eliminate the effect of differences in inflation from country to country?

All these alternatives thus pose as many problems as they clear up. That is why none of the studies consulted proposes using any of them to achieve more acceptable international comparisons of economic indicators. By contrast, however, purchasing power parity has been the subject of significant study.

3.3.1. THE CONCEPT OF PURCHASING POWER PARITY

The concept of purchasing power parity was explicitly introduced by Gustav Cassel in 1916. At the conceptual level, it is relatively simple. Vachris and Thomas (1999) sum up PPPs very nicely:

> "Therefore, a PPP is the rate of currency conversion that equalizes purchasing power of different currencies and so has the dimensions of an exchange rate as well as price index." (Vachris and Thomas, 1999, p. 4).

The famous Big Mac index created by the very serious economic weekly, *The Economist*, is a simple application of the concept of purchasing power parity. All it does is compare the price of McDonald's famous hamburger among different countries to determine the rate that would make the price of this product equal in different countries. Table 3.2 shows results of the Big Mac index published in April 2000:

Table 3.2. Purchasing power parity according to the Big Mac index.

	PPP, American Big Mac	Exchange rate against American dollar	Under (-) or over (+) valuation against American dollar
Australia	1.03	1.68	-38 %
Euro Zone	0.98	0.93	-5 %
Canada	1.14	1.47	-23 %
New Zealand	1.35	2.01	-33 %
Switzerland	2.35	1.70	+39 %

Source: *The Economist*, 2000.

The most elementary concept of purchasing of purchasing power parity is based on the "Law of One Price", according to which the price of any product in a country "*i*" is equal to the price in a country "*j*" multiplied by the rate of exchange between the two currencies. Thus, the exchange rate is similar to the purchasing power parity rate for all products. As the Big Mac index shows, the reality is quite different. A range of factors explains the gap between the observed exchange rate and purchasing power parity, the most obvious being all the measures that restrain trade between two countries. Further, in the price of a Big Mac, certain elements which are not traded on the international market come into the picture, such as building or labor costs.

But the Law of One Price holds true for products that circulate easily. The price of gold, for example, is fixed relatively by using current exchange rates (Rogoff, 1996). The Law of One Price applies only

in such relatively rare cases. In the case of dairy products, several elements militate against the application of the law, such as trade barriers and the high transport costs. Consequently, no equivalence in dairy product prices can be obtained by using the exchange rate as a conversion factor.

The OECD publishes GDP per inhabitant, converted into American dollars at the exchange rate, but also using a purchasing power parity indicator[5]. The results are a good indication of how exchange rates can bring a bias into comparisons. Of course, for the United States, the result is identical since no conversion is required. For other countries, the gaps between these two measurements may be significant (Table 3.3).

Table 3.3. GDP per inhabitant in US$ converted using exchange rates and with Purchasing Power Parity.

	GDP per inhabitant – converted with exchange rates ❶	**GDP per inhabitant – converted using PPP** ❷	**Variation** ❷ / ❶
Canada	20 822	26 423	1.2690
United States	33 836	33 836	1.0000
Australia	21 492	25 721	1.1968
New Zealand	14 376	18 532	1.2891
European Union - 15	22 611	22 507	0.9954
Japan	35 517	25 590	0.7205

Source: OECD, 2001, National Accounts of OECD countries, Main aggregates, Volume 1 .

The concept of purchasing power parity suggests that the rate of exchange between two countries is in balance when purchasing powers at that rate are equivalent; that is, PPP is considered as the exchange rate in equilibrium. Over recent years, however, a number of studies have questioned that claim, particularly for comparisons between developed and emerging countries.

The convergence of PPP is of no particular interest for this study. The purpose of using PPP here is not to replace an equilibrium exchange rate, but to take into account the price of products in different countries. Vachris and Thomas (1999) are very clear about this:

> "It is important to note that the PPPs published by the Eurostat-OECD program are not intended to be used as proxies for equilibrium exchange rates. They are calculated to facilitate international comparisons of prices and

[5] Methodological problems arising from PPP are discussed further on. However, there is no single purchasing power party indicator.

> volumes for GDP and its components (...) The primary purpose of the Eurostat-OECD estimated PPPs, however is not to predict future exchange rate movements, but rather to convert national expenditure data into a common currency." (Vachris and Thomas, 1999, p. 7).

A number of international organizations now make use of PPP. For example, the United Nations Human Development Report uses only purchasing power parity to convert the results obtained in a local currency into a comparison currency[6]. The exchange rate is not one of the conversion factors used. The World Bank and the International Monetary Fund also use PPPs as a conversion factor in an increasing number of publications.

The OECD, which it also participates in the International Comparison Project (ICP), is also considering using PPPs . The ICP was launched at the end of the 1960s as a research project at the University of Pennsylvania which runs it jointly with the United Nations Statistics Division. The OECD PPP program was initiated in the early 1980s to perform international comparisons of economic indicators (OECD, 2001, internet site). The ICP has run into management and financing difficulties. Criticisms of the usefulness of such a program have not, however, been directed against its goals or results. In fact, a consultant of the United Nations Statistics Division has concluded that the ICP should be kept in operation, but that its results should be made more credible and useful (Ryten, 1998).

IN 1996, another consultant, working for the OECD, analyzed the OECD-Eurostat PPP program. His findings on the need to adopt the PPP concept cannot be argued against:

> "[…], the OECD recognized many years ago that, without PPP measures, it is not possible to make valid price and volume comparisons between the economies of Member countries. Whilst this view has been maintained in the publications reporting the main results of the PPP benchmark studies – for example, the explanatory notes to the publications entitled *Purchasing Power Parities and Real Expenditures* state that PPPs, and not exchange rates, are the appropriate currency conversion rates with which to make international comparisons of output and expenditure in volume terms – it has not gained general acceptance, even within the OECD itself. On the contrary, a range of other OECD publications continue to use exchange rate conversions (to an equal or greater extent than PPP conversions) in making comparisons between economic quantities." (Castles, 1996, p. 9).

[6] "This year's Report systematically uses purchasing power parity (PPP) rates of exchange for comparing economic measures across countries." (United Nations, Human development Report 2001, p. 135).

3.3.2. DIFFERENT METHODS FOR DETERMINING PURCHASING POWER PARITY

Though conceptually PPP is relatively simple, it is quite otherwise when the time comes to determine how to calculate it. Without going too deeply into the technical details of these different measurements, it is important to identify the main criteria that PPP measurements used must satisfy. In a recent joint OECD-World Bank seminar, Sergueev (2001) reviewed these criteria and proposed five characteristics: "characteristicity," "base-country invariance," "transitivity," "additivity," and "commensurability."

- "**Characteristicity.** This property implies that the samples of items prices (or quantities) and weights (or common international prices) used in an international comparison are representative of all participating countries. This property is easier to satisfy in a bilateral comparison, especially if the two comparing countries are similar, than in a multilateral comparison when a wider group of countries is involved.
- **Base-country invariance.** This property requires a symmetrical treatment of all countries, so that it makes no difference for the final results which country is chosen as the base. The country selected as the base serves simply as a numéraire (point of reference).
- **Transitivity** (for multilateral comparisons only). This property requires that the indices (parities or volume ratios) between any pair of participating countries be the same whether derived from the direct comparison between them or from comparison of each of the two with any third participating country […]
- **Additivity** (for aggregation procedures only). This property, when satisfied, means that real values (comparable between all countries) for any country are directly comparable between categories or, in other words, countries' real values at any level of aggregation can be obtained as the sum of real values of lower categories of a given aggregate. Additivity requires a method to compare all countries using a common vector of prices (a vector of international prices).
- **Commensurability.** This property means that the results of the volume and price comparisons should be invariant to changes in the units of measurement for quantities and currencies." (Sergueev, 2001, p. 3).

Where aggregation methods are concerned, a number have been developed since economists first became interested in PPPs. The indices of Laspeyres and of Paasche generally form the point of departure for these methods. Fisher's index identifies the geometric mean of these indices, and Sidgwick's index their arithmetic mean. Two major families of multilateral aggregation methods exist:

- the average of bilateral indices (such as the EKS method);
- the use of average international prices (such as the Geary-Khamis method).

Sergueev (2001) succinctly sums up the main characteristics of these two most frequently used methods[7]. About the EKS method, he remarks that:

> "The EKS method attempts to guarantee equi-characteristicity of results. It ignores the differences in the size of countries compared and permits avoiding "Engel-Gerschenkron" type of distortions in the results. Also, EKS results have another attractive property, namely that relationships between countries are only marginally influenced by the composition of the group of countries compared due to minimization procedure applied. The main inconvenience of EKS is the lack of additivity. This means that the sum of real values obtained by EKS-type PPPs at the given aggregation level doesn't produce the EKS-type real value of higher level of aggregation. Consequently, the percentage distribution of these real values does not add up to 100 per cent. Therefore, the possibilities of structural analysis are limited. Moreover, the lack of additivity can lead to paradoxical results: the average index (or PPP) can be higher (or lower) as each of particular indices (this is the distortion so called "average test")." (Sergueev, 2001, p. 6).

He also notes the main properties of the Geary-Khamis method (Sergueev, 2001):

> "The Geary-Khamis method provides additivity, which is very desirable, if international comparisons are made at varying levels of aggregation (the comparisons of "ICP-type"). The main drawback of GK arises as a result of the fact that the GK common vector of international prices is obtained by taking a weighted average of the countries' price vectors. Hence the vector of the international prices tend to be closer to the price vectors faced by large (or rich) countries than small (or poor) countries. It is well-known that the volume of a country tend to sink as the prices used in the comparison becomes relatively more closeness to its own national prices as compared with the prices of other countries, or, in other words, the more characteristic the common price vector is for a given country, the more its volume index will tend to be underestimated. This bias caused by unequal relative closeness of used prices is usually referred to in literature as the Engel-Gerschenkron effect. The GK average prices calculated for a set of heterogeneous countries cannot be characteristic of outlying countries. This effect may significantly distort the comparative real product levels (especially in the developing countries, which are more sensitive to choice of used methods)." (Sergueev, 2001, p. 6). [*Tr. note*: this quotation is given exactly as it appears in the original.]

There have been numerous developments of aggregation methods to try to resolve their various weaknesses. Thus, for instance, Sergueev (2001) has recently proposed a new method which he calls "Maximal Possible Characteristic Prices". These developments aim at refining the methods. There is thus no single result for the PPP. However, the improvement in methods does allow us to obtain

[7] The reader wishing to learn more closely into different aggregation methods may consult Balk (2001), Kravis et al. (1982), and Rao (2001), to name a few.

results whose limitations are increasingly rectified. In the current state of methodological development, the Geary-Khamis may be used, but the joint OECD-Eurostat program for calculating PPPs is based on the EKS method (Sergueev, 2001, p. 8).

3.3.3. CHOOSING A PURCHASING POWER PARITY COMPATIBLE WITH THE PSE CONCEPT

Given that there is no single value for PPP, we must ensure that the value used meets the PSE criteria. Since PSEs represent transfers made by taxpayers and consumers, conversion should use an indicator that covers the whole of the economy as broadly as possible. To compare what is represented by transfers granted to the farm sector by taxpayers and consumers, those transfers must be compared to the goods and services of the economy as a whole. It would therefore be inappropriate to use a PPS based on agriculture alone. If the society of a country decides not to subsidize its farmers, the money spent on such support can be spent elsewhere in the economy. And so there must be some measurement of the average purchasing power of the moneys transferred if they were to be dedicated to the widest possible range of goods and services.

For that reason, the purchasing power parity of the GDP appears to be an interesting choice. This method for calculating PPP is based on the totality of economic activity.

3.4. CONCLUSION

Use of the exchange rate to determine PSEs is performed directly at two levels. First, the reference price is converted into local currency. Then, when the PSE has been determined in local currency, it is converted into a common comparison currency.

Where conversion of reference price is concerned, the most appropriate solution seems to be to use the exchange rate. This means, in effect, evaluating what it costs consumers of a country to buy dairy products on the world market in real time. We have shown that a PSE expressed only as a percentage of the value of the production may suffice for this first conversion and thus pose few problems when it

comes to conversion of currencies. In its original conception, as a basis for comparing trends in support over time in different countries, this expression of PSE seems adequate.

However, the PSE has been diverted from this first function in order to assign it a role in the direct comparison of support levels between countries and, in this case, failure to consider the relative exchange rates of prices between countries, and thus the purchasing powers of the economic actors, constitutes a very serious weakness. Use of a current exchange rate thus appears inadequate, which casts doubt on the real significance of the PSE as a comparative indicator of support from country to country.

Purchasing power parity would seem to be the most appropriate conversion factor for correcting this methodological flaw. Now that this concept is used more and more frequently in publications of various international organizations, the data required are easily available. Conversion of the PSE with purchasing power parity should lead to more pertinent results than those obtained with the current exchange rate of a common comparison currency.

4. A METHOD FOR CALCULATING A "REVISED AND CORRECTED" PSE: SOME SIMULATIONS

The foregoing chapters have questioned some of the methodological choices made by the OECD in calculating and PSEs, and have elaborated alternative proposals. This chapter will turn to the development of simulations of what are the consequences of the methods we propose for estimated values of PSE. Initially, we present reference price simulations. Next, simulations of exchange rate are presented. Finally, a joint simulation is performed in order to observe the cumulative effect of these two proposals.

In performing these simulations, we used the OECD PSE database, 2000 Edition. Also used were data processing tools supplied by OECD which detail the market price support calculation. Simulations were performed for the years 1992 to 1999, the period of observation being determined by the availability of data. As a matter of fact, purchasing power parity for the European Union was unavailable for years prior to 1992 and the 2000 Edition of the OECD database ends with the data for 1999.

Using these data, calculations were performed to determine what dairy PSE values would have been for some countries (Canada, the United States, Switzerland, Japan, the European Union, Australia and New Zealand). For the reference price, and on the basis of the earlier discussion, the American price was used as world price. As for the exchange rate, we have given preference to a purchasing power parity conversion rate rather than the current exchange rate of each of these currencies vis-à-vis American dollars for comparison of PSEs in a common currency.

4.1 A PSE CALCULATED USING THE AMERICAN REFERENCE PRICE

Use of the American reference price in calculating PSEs requires determination of the costs of transporting butter and skim milk powder from the United States, so that we can then calculate the world price of milk brought to the borders of the different countries under consideration. However, it was not possible to obtain the data needed to do this from the OECD. Nor did approaches to the USDA's Foreign Agricultural Service (FAS) yield more results. Table 4.1 presents per tonne transport

costs as calculated by the OECD on the basis of the costs of transporting button and skim milk powder between New Zealand and the different countries studied. The assumption made by OECD is that one tonne of milk contains 56 kg of butter and 82 kg of skim milk powder.

Evidently, costs of transport between New Zealand and Australia are lower, owing to the proximity of these two countries. For other destinations, costs of transport to the United States and Canada are identical, just as are those to Switzerland and the European Union, but overall, the differences are otherwise very small.

Table 4.1. Transport costs ($US/tonne) in equivalent tonne of milk between New Zealand and different countries.

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Australia	15.12	15.12	14.68	15.70	15.78	11.38	10.69	9.85
Canada	20.48	20.89	21.58	24.65	22.25	21.09	18.78	19.64
Switzerland	17.32	17.68	17.57	17.01	19.96	19.93	17.33	18.56
European Union	17.32	17.68	17.57	17.01	19.96	19.93	17.33	17.33
Japan	17.52	18.24	18.02	18.66	18.66	18.98	15.10	14.29
United States	20.48	20.89	21.58	24.65	22.25	21.09	18.78	19.64

Source: OECD, 2001.

These data are somewhat surprising. It turns out that distances between the principal cities of the different regions analyzed often give a good estimate of relative transport costs. For instance, the Great Circle distance between the airports of Auckland and Paris is more than 18,500 km. By way of comparison, the distance between New Zealand and Los Angeles is 9,800 km, little more than half. However, the transport costs used by the OECD to calculate PSEs are practically the same and even slightly lower for Europe. That having been said, the data used by the OECD were supplied by the New Zealand Dairy Board and are the sole source available.

To perform simulations, we applied identical transport costs between the United States and all the other countries, with the exception of Canada. We used the costs determined by the OECD between New Zealand and Japan, since the distance between those two countries is the one closest to the mean distance between the United States and the destinations analyzed. In the case of Canada, transport between the two countries is by land. We have imputed to this transport zero cost for purposes of comparison with the costs of transport towards the other countries. In reality, the United States has to pay a surface transport cost to bring its product to the shipping ports in addition to a maritime shipping

cost towards each country. We have assumed that this land portion of the transport, not taken into account in Table 4.1, was equivalent in terms of distance and costs of delivery to the Canadian market.

Of course, these data are only an estimate of transport costs, but the consequences of one error are relatively unimportant. Indeed, if we consider costs of transport towards countries other than Canada, they represent, on the average, 5.83 % of the price of milk in the United States, with a standard deviation of 0.88. The potential error related to transport costs thus has relatively few consequences for calculating market price support and the dairy PSE.

Once transport costs were estimated, it was possible to calculate the level for the different countries analyzed with the same method as used by the OECD, but using the American rather than the New Zealand price as the world market reference price.

To calculate PSEs, market price support was then recalculated using the information available in OECD databases. The values of other components of the Pse have not been recalculated, since the reference price does not come into the picture at this stage in the calculation. Table 4.2 presents dairy PSEs under both the additional scenario (New Zealand reference price) and the modified scenario (American reference price). The consequences of adopting the American reference price are decisive for the results of the calculation. More particularly, it leads to negative market price supports for countries where the price is lower than the American price, such as New Zealand and Australia. Portugal (2000) had already questioned the possibility of negative price supports and PSEs:

> "The notion of a "gross" PSE makes it possible to envision a case where support would be negative, for example, when agricultural policy measures tax producers in relation to what would happen in the absence of such measures, that is, if only general economic measures were applied. The typical example of negative support is a tax on exports or any other farm measure discouraging exports and imposing a price lower than the world price." (Portugal, 2000, p. 24).

Certainly, in the case of the dairy sector, there are no export taxes. However, relative levels of support correspond to choices made by the society so that domestic producers may be either penalized or favored in respect to those of other countries.

Table 4.2 Estimated dairy PSE per tonne in national currencies, 1992-1999

		1992	**1993**	**1994**	**1995**
Australia ($A/tonne)	NZ base price	105.50	83.90	83.10	71.80
	US base price	-140.75	-181.59	-153.33	-103.90
Canada ($CAN/tonne)	NZ base price	290.12	296.05	285.53	239.85
	US base price	117.22	113.92	98.96	106.86
Japan ('000Yen/tonne)	NZ base price	72.60	73.80	72.70	70.20
	US base price	51.71	55.61	56.40	58.76
New Zealand ($NZ/tonne)	NZ base price	1.40	1.30	1.40	1.40
	US base price	-431.16	-410.23	-377.95	-263.02
European Union (Euro/tonne)	NZ base price	167.70	172.50	167.20	163.80
	US base price	35.15	26.27	26.86	66.12
United States ($US/tonne)	NZ base price	151.20	148.10	142.10	102.00
	US base price	8.18	6.69	5.53	6.51
Switzerland (FCH/tonne)	NZ base price	1096.00	1097.90	1050.10	1035.20
	US base price	857.87	848.64	826.85	887.30
		1996	**1997**	**1998**	**1999**
Australia ($A/tonne)	NZ base price	58.10	69.00	59.00	48.40
	US base price	-160.47	-153.60	-318.18	-279.38
Canada ($CAN/tonne)	NZ base price	233.38	266.45	300.43	300.26
	US base price	47.38	91.43	0.67	41.47
Japan (Yen/tonne)	NZ base price	63.50	61.20	64.00	66.00
	US base price	46.11	43.06	34.44	43.42
New Zealand ($NZ/tonne)	NZ base price	1.10	1.10	1.10	1.10
	US base price	-309.44	-316.40	-598.52	-464.55
European Union (Euro/tonne)	NZ base price	157.10	151.20	173.10	178.10
	US base price	27.01	15.15	-33.12	-25.96
United States ($US/tonne)	NZ base price	145.90	136.80	214.20	190.90
	US base price	10.12	10.25	12.21	16.64
Switzerland (FCH/tonne)	NZ base price	1052.90	1019.20	974.50	941.30
	US base price	852.42	797.66	642.66	645.01

Sources: OECD, 2000 and our calculations.

The data in Table 4.2 reveal major differences between the two methods of calculation. In effect, countries that have a domestic market price lower than the American price find themselves with

negative market price supports and thus negative PSEs. That is the case with New Zealand and Australia, as would have been expected.

By contrast, the increase in the American price over recent years changes the picture significantly, since even Canada and the European Union have found themselves with negative PSEs in some years. In both these cases, the production price is determined independently of the price of dairy products on the international market. In such a situation, upwards or downwards fluctuations of the world price vis-à-vis a fairly stable domestic price will increase or reduce the result of the PSE calculation. If the level of the dairy PSE is low in a given country, it may then be sometimes positive, sometimes negative. Such changes of sign were observed, for example, in Canada in 1998 and 1999, and in the European Union in 1997 and 1998. Changes of sign can arise from conditions external to the dairy sector of these two regions, such as variations in the exchange rate and variations in the farm price in the United States. As it turns out, applying the current exchange rate and the devaluation of the Euro and the Canadian collar against the American dollar have had the effect of inflating the American reference price against domestic currencies. And the volatility of the farm price in the United States, which was accentuated at the end of the 1990s, may have the same effect.

We should note that in an interpretation of the results limited to the original concept of the PSE, that is, to observe the trend in support over time within a given country, the results that we obtain with the American reference price may differ from those of the OECD in certain years. For instance, in Canada's case, analysis of the OECD results shows a growth in dairy PSE between 1997 and 1998, while our calculation method, using the American reference price, arrives at the opposite result. The interpretations derived from one or the other method as to trends in support to Canadian milk producers would thus be entirely contradictory. Such a situation would repeat itself many times and for all the countries.

4.2 A PSE CALCULATED USING PURCHASING POWER PARITY

For purposes of comparison, it is indispensable to convert PSEs in national currencies into a common currency. The analysis made earlier led to the conclusion that use of purchasing power parity (PPP) responded to the limitations associated with the use of exchange rates. Exchange rates used are those supplied by the OECD for Australia, Canada, Japan, Europe and Switzerland. For New Zealand, we

used an annual average obtained from the monthly average published by the Federal Reserve Bank of St-Louis.

Table 4.3 presents results of PSEs calculated using the New Zealand reference price but converted into American dollars at the current exchange rate, and also using PPPs. It must be admitted that use of the PPPs does not significantly change the results. We can even see that the gap between the results for Japan and Switzerland and those of other countries shrinks when PPP rather than the current exchange rate is used. That in no way changes the relative ranking of either of these countries, which have the highest dairy PSEs in both cases, and in every year. Inversely, New Zealand always posts the lowest PSE, followed by Australia, for every year, regardless of the conversion rate used. And finally, Canada, the European Union and the United States find themselves in an intermediate situation with PSEs that are relatively similar to each other. For these countries, however, their relative rankings in terms of level of PSE is modified by the use of one or the other of the conversion rates, for four of the eight years analyzed: 1995, 1996, 1998 and 1999.

In this simulation, as in the preceding one, evolution of PSEs from one year to the next in each country is sometimes contradictory, depending on the calculation method used. The PSE calculation methodology is thus not particularly reliable, since it is sensitive to changes in its underlying assumptions, even in its most restricted interpretation.

Table 4.3. Dairy PSE in $US per tonne using current exchange rate and Purchasing Power Parity conversion, 1992-1999.

		1992	**1993**	**1994**	**1995**
Australia	Exchange rate	77.4	57.0	60.7	53.2
	PPP	76.9	62.0	62.1	55.8
Canada	Exchange rate	240.0	229.5	209.0	174.8
	PPP	226.4	234.4	228.3	202.8
Japan	Exchange rate	573.1	663.8	711.2	746.3
	PPP	385.8	400.4	402.6	413.1
New Zealand	Exchange rate	0.8	0.7	0.8	0.9
	PPP	0.9	0.9	0.9	1.0
European Union	Exchange rate	217.0	202.1	198.3	214.1
	PPP	183.1	186.3	180.8	176.1
United States	Exchange rate	151.2	148.1	142.1	102.0
	PPP	151.2	148.1	142.1	102.0
Switzerland	Exchange rate	779.5	743.3	768.2	875.8
	PPP	506.8	515.1	500.7	514.8
		1996	**1997**	**1998**	**1999**
Australia	Exchange rate	45.5	51.2	37.1	31.2
	PPP	44.7	52.3	45.2	37.4
Canada	Exchange rate	171.1	192.4	202.5	202.1
	PPP	196.9	224.7	258.0	256.5
Japan	Exchange rate	583.5	505.8	488.9	579.5
	PPP	383.4	370.8	392.9	417.5
New Zealand	Exchange rate	0.8	0.7	0.6	0.6
	PPP	0.7	0.7	0.7	0.8
European Union	Exchange rate	199.4	171.4	193.6	189.8
	PPP	168.7	163.3	187.5	194.2
United States	Exchange rate	145.9	136.8	214.2	190.9
	PPP	145.9	136.8	214.2	190.9
Switzerland	Exchange rate	851.9	702.9	672.2	626.4
	PPP	513.0	513.1	497.7	496.1

Sources: OECD, 2000 and our calculations.

4.3. A PSE CALCULATED USING THE AMERICAN REFERENCE PRICE AND IN PURCHASING POWER PARITY

After having assessed the consequences of using the American price rather than the New Zealand price as reference price, and of using PPP to convert PSEs into a common comparison currency, we will now present the cumulative effect of these two methodological changes. To do so, Table 4.5 compares results of the OECD methodology PSEs with what we propose. Let us recall that the OECD determines dairy PSEs per tonne on the basis of the New Zealand reference price, and converted into American dollars at the current rates of exchange, while we propose to estimate dairy PSEs per tonne with the American reference price, and converted into American dollars using the PPPs.

The modifications made to the method for calculating PSEs certainly lead to profound changes, but always in the same direction, that is to reduce appreciably the level of dairy PSEs for all the countries analyzed. New Zealand and Australia obtain, always and in the same order, the lowest dairy PSEs, while Japan and Switzerland come in highest, whatever the method used. Canada, the United States and the European Union change places in the intermediate ranking but this time, both methods give exactly the same ranking for all years except one, 1995. Table 4.4 shows the ranking of countries for the year 1999 using both calculation methods.

However, as in the two preceding simulations, and in contrast to the OECD method, ours modifies the trend in PSEs from one year to another within each of the countries.

Table 4.4. Ranking of countries by PSE level, using OECD and GREPA methodologies, 1999.

	OECD Method	**GREPA Method**	
New Zealand	0.6	-316.9	New Zealand
Australia	31.2	-215.7	Australia
European Union	189.8	-28.3	European Union
United States	190.9	16.6	United States
Canada	202.1	22.9	Canada
Japan	579.5	274.6	Japan
Switzerland	626.4	340.0	Switzerland

Sources: OECD, 2000 and our calculations

Tableau 4.5. Dairy PSE in $ US per tonne according to OECD and GREPA methods, 1992-1999.

		1992	**1993**	**1994**	**1995**
Australia	OECD method	77.4	57.0	60.7	53.2
	GREPA method	-102.6	-134.2	-114.6	-80.7
Canada	OECD method	240.0	229.5	209.0	174.8
	GREPA method	77.2	74.7	63.0	73.7
Japan	OECD method	573.1	663.8	711.2	746.3
	GREPA method	274.8	301.7	312.3	345.8
New Zealand	OECD method	0.8	0.7	0.8	0.9
	GREPA method	-285.2	-271.4	-251.7	-179.3
European Union	OECD method	217.0	202.1	198.3	214.1
	GREPA method	38.4	28.4	29.0	71.1
United States	OECD method	151.2	148.1	142.1	102.0
	GREPA method	8.2	6.7	5.5	6.5
Switzerland	OECD method	779.5	743.3	768.2	875.8
	GREPA method	396.6	398.1	394.2	441.2
		1996	**1997**	**1998**	**1999**
Australia	OECD method	45.5	51.2	37.1	31.2
	GREPA method	-123.5	-116.3	-243.9	-215.7
Canada	OECD method	171.1	192.4	202.5	202.1
	GREPA method	21.6	63.7	-13.1	22.9
Japan	OECD method	583.5	505.8	488.9	579.5
	GREPA method	278.4	260.9	211.4	274.6
New Zealand	OECD method	0.8	0.7	0.6	0.6
	GREPA method	-209.4	-214.9	-406.0	-316.9
European Union	OECD method	199.4	171.4	193.6	189.8
	GREPA method	29.0	16.4	-35.9	-28.3
United States	OECD method	145.9	136.8	214.2	190.9
	GREPA method	10.1	10.2	12.2	16.6
Switzerland	OECD method	851.9	702.9	672.2	626.4
	GREPA method	415.3	401.6	328.2	340.0

Sources: OECD 2000 and our calculations.

4.4. CONCLUSION

All the results we obtain on quantification of PSEs lead us to question the interpretations that can be drawn as to the monetary value of transfers to producers made by consumers and taxpayers. First of all, the PSE, as a measurement of trends in support over time within each country, has turned out to be particularly sensitive to the assumptions underlying the calculation method developed by the OECD, especially in respect of choice of reference country and rates for converting national currencies into a common comparison currency.

Secondly, the radical reduction of the dairy PSE we obtain in using the American rather than the New Zealand reference price raises serious questions about the current OECD results as to support levels as compared from one production to another. Though the same level of methodological questions are not frequently posed in other agricultural productions, we do know, for example, that such is the case for OECD calculations of the European pork PSE (Nolet and Gouin, 1999), and that comparisons between productions published by the OECD are, to say the least, questionable.

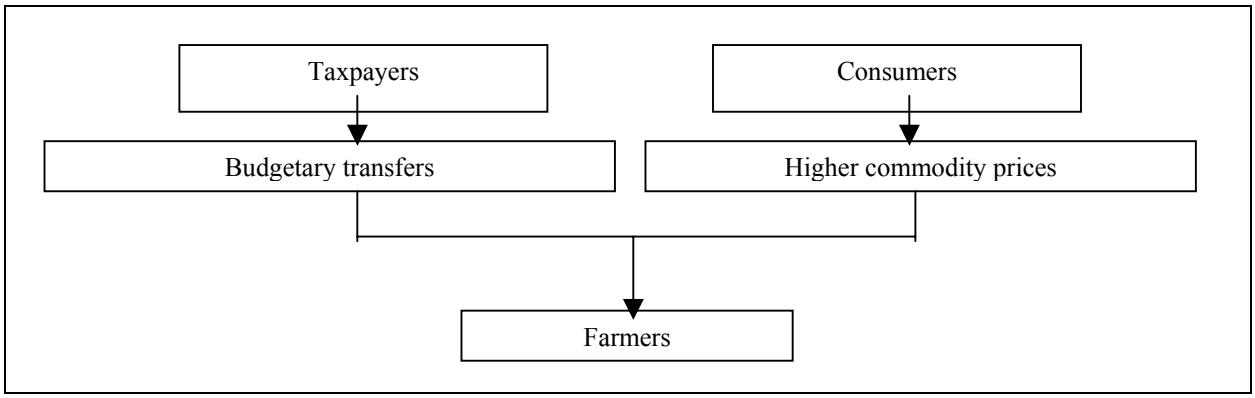
Third, ranking countries by their levels of support measured by the PSE appears to stand up better than the other possible interpretations. At least, that is the case for the ranking of countries where extreme PSE levels are the rule. For those countries whose results vary within a relatively restricted range – the United States, Canada and the European Union – the variability of results from one year to the next should caution us to be very prudent about interpreting their relative ranking.

Finally, can the PSE be interpreted as an adequate estimate of the monetary transfers from which agricultural and dairy producers benefit? Its sensitivity, which we have just demonstrated, to different methodological assumptions on which its calculation is based, leads us to answer that question in the negative. Not only that, but certain theoretical assumptions underlying the calculations of the PSE reinforce our negation, as will be seen in the next chapter.

5. A METHOD FOR CALCULATING PSE BASED ON THE ASSUMPTION OF PERFECT COMPETITION, BUT APPLIED TO AN IMPERFECT MARKET

We will recall that the OECD defines producer subsidy equivalents (PSEs) as an indicator of the gross monetary value of the transfers consumers and producers make to agricultural producers, measured at the level of the farm, and regardless of their nature, purposes, or impact on farm income or production levels. The PSE thus measures support to agricultural producers, whether coming from consumers though higher prices for agricultural commodities, or from taxpayers by means of budgetary transfers (OECD, 2000). Figure 5.1 illustrates the transfers captured by the calculation of PSE.

Figure 5.1. The two types of transfers making up the PSE calculation.



5.1 SENSITIVITY OF THE CALCULATION OF THE PSE TO THE PERFECT COMPETITION ASSUMPTION

At this point we will turn our attention exclusively to the transfer to farmers made by the consumer. Calculation of this transfer rests on comparison of domestic prices with a base price, as Cahill and Legg point out:

> "For a given level of domestic price maintained above that on the world market, the unit rate of PSE from these policies is measured by the price gap, irrespective of whether the country is an exporter or importer." (Cahill and Legg, 1990, p.18).

We will recall that the PSE, however, implies a comparison of prices at the farm. But for a number of commodities there is no world reference price at the farm, but rather a reference market for a partially or completely processed commodity. That is the case with the sugar market, for example. To deal with this problem, the difference in price between refined sugar in one country and the international price is converted into a sugar beet or sugarcane equivalent. According to Cahill and Legg, that can generate some difficulties:

> "This presents computational difficulties when the commodity is semi- or highly-processed. The comparison between domestic wholesale prices and the border price generates price gaps which are then converted to their equivalents at the primary sector level using appropriate technical coefficients." (Cahill and Legg, 1990, p. 26).

This conversion is performed simply by using the ratio of the price to producers of sugar beets or cane / the domestic price of sugar. The following example illustrates how this is done:

Table 5.1. Typical example of the world whole price is converted into the estimated price to production, on the world market.

Country A:

Price paid to sugarcane producers	100monetary units (m.u.)
Wholesale price of sugar	195 m.u.

International:

Wholesale price of sugar on world market	75 m.u.

Calculation of the farm price gap:

100 .m.u./195 m.u. = 0.513	this ratio is then multiplied by the world price
0.513 * 75 m.u. = 38.46 m.u.	which is the estimated world price to producers

Thus the farm price gap between domestic markets and the world market is:

100 m.u. – 38.46 m.u. = 61.54 m.u.

The main assumption supporting this calculation is that the gap between the wholesale domestic and international prices for a processed agricultural commodity can be proportionally transferred to the price at the farm. In other words, calculation of the PSE assumes that the actors in a certain line of agriculture downstream of production are operating in a context of perfect competition, and thus do not capture part of the transfer. This assumption is discussed by Cahill and Legg:

> "Unless there is explicit evidence to the contrary, the transfer implied by a price gap is assumed to accrue to primary producers, an assumption which depends on the relevant elasticities of supply and demand and which may not hold if the processing and distribution sectors, because they have monopolistic or oligopolistic structures, succeed in capturing a part of the transfers." (Cahill and Legg, 1990, p.26).

In Chapter 2 we mentioned that the small countries assumption is not respected in the world dairy products market. To put it another way, certain players in the market are so important – the European Union, notably – that their individual action, for example export subsidies, changes market outcomes. Right away, this fact calls in question the assumption of perfect competition on the individual market. But this perfect competition hypothesis is carried over into the operation of each of the domestic markets of the countries for which the dairy PSE is calculated. Now we shall turn to a discussion of this second level of the perfect competition hypothesis.

If the perfect competition assumption is not respected, the basis for calculating the PSE, which is the difference between the farm price on the domestic market and the estimate price at the farm on the international market, may be invalidated. Let's take the case illustrated in Table 5.2 where the wholesale price of sugar on the domestic market is the only variable changed as compared to the example given in Table 5.1. Thus, the world price, like the price to domestic producers, is unchanged. The increase in the domestic wholesale price by 50 monetary units without changing the price paid to producers thus reflects an exercise of market power on the part of the intermediaries downstream. In this example, the method for calculating PSE shows the farm price gap between the domestic market and world market grows from 61.54 monetary units to 66.67 monetary units, without producers thereby seeing an increase in the price received, or any movement in the world price.

The calculation of PSE that would result from such a situation would show an increase in PSE for the producers of that country when in fact it is the intermediaries downstream who would capture a transfer originating with consumers.

Table 5.2. Example of the impact of an imperfect market situation on the domestic market in the calculation of an estimate price to producers on the world market.

Country A:

Price paid to sugarcane producers	100 monetary units (m.u.)
Wholesale sugar price	225 m.u. (rather than the 195 m.u. in Table 5.1)

International:

Wholesale sugar price on the world market	75 m.u.

Calculation of the farm price gap:

100 m.u./225 m.u. = 0.44	this ratio is then multiplied by the world price
0.44 * 75 m.u. = 33.33 m.u.	which is the estimated world price to producers

Thus, the farm price gap between domestic and world markets is :

100 m.u. – 33.33 m.u. = 66.67 m.u.

However, the dairy sector is unique because it is the only commodity for which a common farm reference price was adopted for calculating the PSE (Cahill and Legg, 1990, p. 25-26). As we have seen, this reference price is the price of milk on the farm in New Zealand. In this case, and contrary to the case of sugar as shown in the table above, the existing price gap between the farm price in New Zealand and the farm price in another country is correctly measured. Since the prices being compared are at the same level, the farm, no assumption on the structure of markets downstream of production is consequently necessary.

In the case of milk, however, it is important to realize that another assumption has been posed. In reality, the difference between the price at the farm in a country like Canada and the farm price in New Zealand is considered as if it were a transfer from the consumer to the dairy producer. If Canadian producers have collectively more market power than those of New Zealand, it is possible that a fraction of the farm price gap observed in favor of Canadian producers would not derive directly from the consumer, but rather from a reduction in the margin of the intermediaries. In such case, the calculation of dairy PSE in Canada would be overestimated, since, according to the OECD, the PSE is an indicator of the value of the transfers the consumers and taxpayers of a country make to their domestic producers, a higher price at the farm leading automatically to the determination of a higher PSE, even if there were no change in the price to the consumer.

This situation is illustrated by the calculations given in the following two tables. In Table 5.3, the consumer of country A pays 10 monetary units more than the one in the reference country. Since the country A dairy producer also received 10 m.u. more than his counterpart in the reference country, there has in fact been a transfer of 10 m.u. to the dairy producer, which is correctly captured by the method of calculating the PSE. Margins of processors and retailers are identical in both countries.

Table 5.3. Example of the impact of calculating PSE of a transfer from the consumer to the producer originating in a higher retail price.

Price of fluid milk in monetary units (m.u.)

	Reference country		Country A	
Retail price	170		180	
(margin)		(30)		(30)
Wholesale price	140		150	
(margin)		(100)		(100)
Farm price	40		50	
Calculated transfer for PSE:		**50 – 40 = 10**		
Retail price gap:		180 – 170 = 10		

By contrast, in the in the example given in Table 5.4, the consumer always pays 10 m.u. more in Country A than in the reference country, but the producer in Country A receives 30 m.u. more. The gap observed, relative to Table 5.3, between the comparison or prices to consumers and to producers, is simply explained by a lower margin to processors, or the difference between wholesale price and the price at the farm in Country A.

Table 5.4. Example on impact of calculating PSE of an increase in price at the farm and an equivalent reduction in intermediaries' margin.

Price of fluid milk in monetary units (m.u.)

	Reference country		Country A	
Retail price	170		180	
(margin)		(30)		(30)
Wholesale price	140		150	
(margin)		(100)		(80)
Farm price	40		70	
Calculated transfer for PSE:		**70 – 40 = 30**		
Retail price gap:		180 – 170 = 10		

Comparison of the examples of Tables 5.4 and 5.4 allows us to take notice of the bias that calculation of PSE can introduce, even when a common reference price at the farm exists. In effect, in Table 5.3, in respect of the reference country, the farm price gap represents a real transfer by the consumers of Country A to their domestic producers. However, in the Table 5.4 example, we note an increase in the gap between the Country A and reference country farm prices, without the consumer price thereby changing . If that is the case, it would thus be mistaken make the farm price gap equal to the consumer to producer transfer, as the PSE calculation implies.

In the same order of ideas, a reduction in the cost of transactions on the domestic market would have essentially the same effect. For example, the low transaction costs of Country A compared to the reference country could explain a higher farm price in Country A, without the transfer by the consumer to the producer being increased in the process. The competitive and regulatory structure of the dairy industry in each country would have an impact of the transaction costs of intermediaries downstream from production. As Camilio Lisio, former CEO of Saputo Inc, a leading cheese processor in the United States and Canada, noted during a conference in Seattle in October 1999, transaction costs are much lower in Canada than in the United States (Doyon, 2000). This explains the fact that with supply management and the market organization stemming from it, decisions on the transport and allocation of milk are centralized in each provincial marketing agency. Such a marketing agency makes possible a significant reduction in transaction costs, given the guarantees of supply that exist in Canada, the

rationalization of milk transport from the farm to the processing plant, and the smaller number of interlocutors to negotiate all the marketing conditions.

The preceding calculations thus demonstrate that the result of calculating PSE, which rests on the assumption of perfect competition, is sensitive to the easing of that assumption. It therefore seems important to turn now to the question of the perfect or imperfect behavior of the dairy market.

5.2 THE DAIRY SECTOR, AN IMPERFECT MARKET

The concept of perfect competition is an ideal representation of a market having the following characteristics:

- homogenous products;
- perfect information;
- full mobility of resources;
- absence of artificial constraints;
- a large number of buyers and sellers.

A homogenous product does not necessarily imply that all the goods in a market are identical, but rather that there is a certain standardization in the goods exchanged. This role is often played by a classification system. The condition of perfect information means that all the pertinent market information is available, and that each participant in the market has the same information as all the others. Full mobility of resources means that there are no barriers to entering or leaving the field of activity, and that assets are therefore liquid and accessible. Absence of artificial constraints refers to absence of transaction costs and absence of externalities. The last condition, a large number of buyers and sellers, it not sufficiently important to individually affect market variables such as prices and quantities.

It seems rather improbable that the actors downstream from production in an agricultural sector would ever face these conditions. Indeed, the condition of perfect information appears to be increasingly problematic in agriculture, since a limited number of enterprises buy or incorporate a large share of what is produced. By way of illustration, the USDA recently forced American livestock processors to divulge their live animal purchase prices (USDA, 2001 p. 7). This action was deemed necessary since a

large share of transactions are now carried out by private contract. It leads to another condition that is difficult to meet: a large number of buyers and sellers. Indeed, major concentrations in food processing and distribution have taken place in the West in recent years. For instance, the CR_3 of pork processing in Quebec is 85% (Doyon et al. 2001), while three companies vie for dominance in Canadian dairy processing (Doyon, 2001) and two food distributors have captured almost half of the Canadian market (Doyon et al. 2001). In short, without including the numerous artificial constraints, such as barriers to trade in farm commodities, the different branches of agricultural production do not appear to be operating under perfect competition.

In fact, most markets are not perfectly competitive, since companies have a certain margin in setting price policy (Carlton and Perloff, 2000). The dominant market structure is generally monopolistic competition (Frank, 1994).

Monopolistic competition can be seen as a mixture of perfect competition and market power. Since the products sold are not perfect substitutes, or at least are not perceived as perfect substitutes, a firm can increase its price against a rival who sells a similar product which is not perceived as identical, without thereby losing customers (as would be the case in perfect competition). This, therefore, is an exercise of market power. It is partly the desire to exercise market power that motivates firms to differentiate their products by physical attributes external to the products (such as packaging) and by promotion and advertising. Without that motivation, which does not exist in a perfect competitive structure, the consumer would have much less choice. Just think, for example, of the different types of bread or of cheddar cheese or of the great variety of breakfast cereals based on oats, and on the mass of brands for each of these products.

In the dairy sector, the exercise of market power has historically led to intervention by the public powers by market regulation. In the 1930s and 1940s several Western governments took legislative action to give milk producers a chance to counterbalance the market power of the processors (Doyon et al. 1999; Erba and Novakovic, 1995). In the United States this legislation eventually gave birth to State (California) and Federal orders (Federal Milk Marketing Orders), and to management of supply in Canada, and to the Milk Marketing Board in Great Britain. This government interventions were motivated by the fact that milk is a perishable product, costly to transport, and which numerous producers were already selling to a small number of suppliers. Producers thus found themselves in a position of weakness relative to the buyers.

Though some authors in the early 1980s did question the legitimacy of government interventions in the dairy industry (Masson and DeBrock, 1980; Masson and Eisenstat, 1980), several studies have since demonstrated that in the absence of regulation in the United States, prices paid to producers have declined (Cox and Jesse, 1995; Stephenson and Novakovic, 1997). More recently, a study using experimental economics concluded that, if there were no Federal orders, American processors would reduce the price at the farm to a level less than the perfect competition situation, at the same time increasing their share of the economic surplus captured, at the expense of producers (Doyon, 2001).

Given the competitive and regulatory structure of the dairy industry that characterizes each country, we are entitled to believe that the level of market power of the intermediaries downstream would vary considerably from one country to the next. To put it another way, differences in market power from one country to another would signify that a lower price at the farm in one country would not necessarily lead to a lower consumer price in that country, as compared to another. The result depends on the margins of the intermediaries and therefore on their market power. Consequently, a higher farm price does not necessarily correspond to a larger transfer by consumers to producers, but may just as well translate quite simply into a reduction of the intermediaries' margins.

If indeed the intermediaries' margins differ from one country to another, that would introduce a potential bias in estimating the transfer the consumer makes to the producer using the method for calculating the PSE. An empirical verification of the relation between the price at the farm and the price to consumers is therefore essential if we are to validate or invalidate use of the PSE as a measurement of consumer-to-producer transfers.

5.3 IMPERFECT TRANSMISSION OF PRICES IN THE DAIRY SECTOR

Analysis of movements in the price of milk at the farm and in the retail price of dairy products would allow verification of whether there is a direct link between prices paid to producers and prices of dairy products paid by consumers. If the existing links are not direct, in other words, if the transmission of the farm price to the consumer is incomplete, then it is possible that a higher farm price or a higher consumer price would not correspond to a larger transfer by consumers to producers, but rather to a different level of intermediary margins.

To perform this comparative analysis, we use data on the relative development of the farm price of milk and of the retail price of certain dairy products for some OECD countries. Obviously, our prime interest is in Canada, as well as the United States which, owing to its proximity, is often used as a basis for comparison. New Zealand and Australia are added to the analysis as dairy countries very active in export markets, as well as Great Britain, as part of the European Union, another major player in the international market for dairy products.

Owing to their availability in national statistics, we have chosen to use the indices for milk price at the farm and for dairy product retail prices. The link between farm prices and retail dairy product prices is reflected in changes in the margin of the intermediaries. To estimate the development of that margin in each of the countries analyzed, the farm milk price index is subtracted from the price of the dairy products. A positive result would indicate that the farm price of milk is increasing less rapidly than dairy product retail prices or, to put it another way, the intermediaries' margin has increased. Inversely, a negative result would mean that the intermediaries' margin has become smaller.

Table 5.5 presents the results of our calculations on the development of intermediaries' margins in Canada and the United States. For all dairy products in Canada, the intermediaries' margin posted a minus 4.24 maximum deterioration in 1996, but it subsequently improved to a minus 1.47 in 2000. This is thus a slight differences, indicating that the margins of intermediaries downstream are fairly stable in Canada. This result for all Canadian dairy products masks different results for the fluid milk market, where there has been a reduction in intermediaries' margin, and for the cheese market, where it has been increased, but in both cases with relatively low amplitudes compared to the American results.

But the situation in the United States is quite different. The gap between farm milk price indices and retail dairy product indices has grown continually since the early 1990s and has been positive all the time. That means that the margin of the actors downstream of American dairy production is growing, which means that the manufacturers are charging the consumer increasingly higher prices compared to what they pay for their raw material. This situation holds as true for cheese as it does for fluid milk.

Table 5.5. Development of margins of intermediaries[1] for all dairy products, fluid milk and cheese, Canada and United States, 1991-2000.

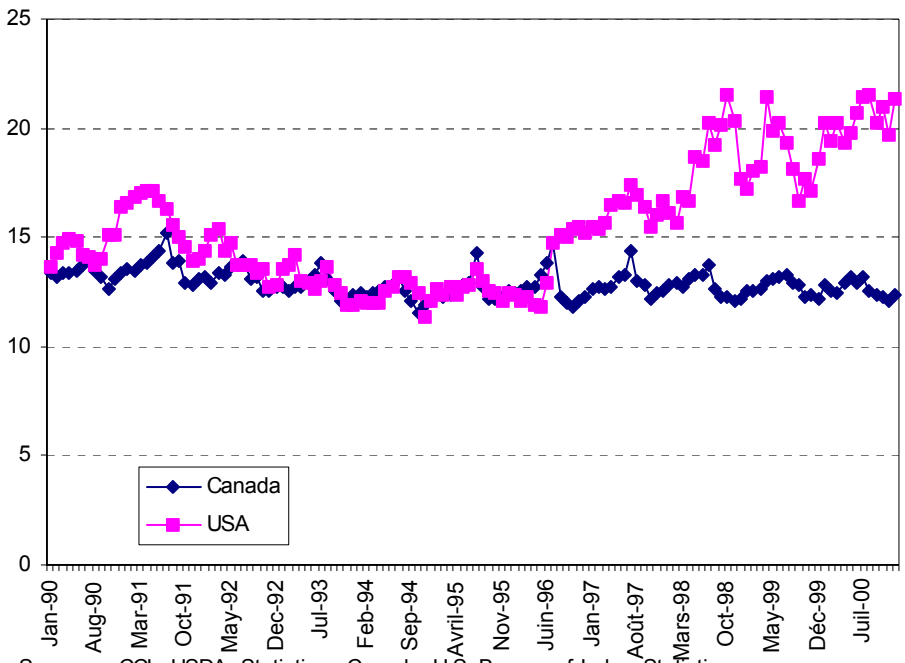
	All dairy products		Fluid milk		Cheese	
	Canada	**USA**	**Canada**	**USA**	**Canada**	**USA**
1991	0.77	8.32	0.86	6.07	1.00	10.69
1992	0.32	4.28	-0.13	2.53	2.03	5.99
1993	-1.60	5.62	-2.68	4.34	1.69	6.54
1994	-4.03	5.80	-6.47	5.22	1.13	5.69
1995	-3.94	8.07	-7.20	6.60	1.14	8.18
1996	-4.24	2.62	-8.02	1.72	1.54	0.59
1997	-2.58	16.31	-6.30	14.11	3.44	13.92
1998	-2.54	2.81	-6.37	0.43	4.11	-0.28
1999	-1.79	24.29	-6.26	21.49	4.90	22.14
2000	-1.47	30.08	-4.90	26.99	3.83	27.21

Note 1: Obtained by the difference between the farm milk price index and of dairy products to the consumer (Index 100 = 1990).
Sources: CCL, USDA, Statistics Canada, U.S. Bureau of Labor Statistics, and our calculations.

In short, the results in Table 5.5 indicate that in Canada, variations in the farm price are better transmitted and that the intermediaries' margin is clearly more stable than in the United States. And so a farm price in Canada higher than in the United States does not necessarily mean a higher price to the Canadian consumer than to his American counterpart. The intermediaries' margin in Canada has declined slightly over the entire period in review, while it has increased significantly in the United States.

We note that while indices were used in our analysis because of their availability and ease of use, the same type of comparison can be made using milk and dairy product prices. By way of example, Graph 5.1 presents the results of calculating the ratio between retail prices and farm prices for Canada and the United States, in the case of butter. It goes without saying that the results show the same trends as when the price indices were used, that is, that the intermediaries' margin is relatively steady in Canada while it has risen decisively and regularly in the United States, especially since 1996.

Graph 5.1. Trends in ratio between retail price of butter and farm price of milk, Canada and the United States, 1990-2000



Sources : CCL, USDA, Statistique Canada, U.S. Bureau of Labor Statistics and our calculations.

The situation prevailing in the United States exists in other OECD countries as well. Australia is an excellent example of this, since the margins of intermediaries downstream from production are sharply on the rise (Table 5.6). Although that is the case for all dairy products, this increase in margins is particularly marked in the case of fluid milk, with a positive difference of 68 index points in 2000. Australian milk producers are thus being paid a smaller and smaller share of the consumer's dollar, unlike Canadian producers, but that in no way translates into benefits for the Australian consumer.

In the case of New Zealand, the gap between the farm price index and the index for all dairy products shows a certain variability (Table 5.7). The calculated difference has varied from minus 7 points to plus 15 index points between 1998 and 2000. For fluid milk, the trend shows a growth in intermediary margins since 1996. In both cases, the transmission of variations in farm prices to retail prices appears less stable in New Zealand than in Canada.

Table 5.6. Changes in the margin of intermediaries[1] for all dairy products, fluid milk and cheese, Australia, 1991-2000.

	Dairy products	Fluid milk	Cheese

1991	27.57	28.62	26.94
1992	28.64	32.36	26.24
1993	12.28	16.65	9.83
1994	21.49	27.71	14.91
1995	28.02	36.57	17.94
1996	17.92	28.59	4.64
1997	31.52	43.49	14.54
1998	35.20	49.54	13.49
1999	44.05	58.79	21.99
2000	51.82	68.31	25.71

Note 1: Obtained by the difference between the farm price index and the index for consumer dairy products (Index 100 = 1990).
Sources: Australian Bureau of Agricultural and Resource Economics, Australian Bureau of Statistics and our calculations.

Table 5.7. Changes in the margin of intermediaries[1] for all dairy products and for fluid milk, New Zealand, 1994-2000.

	Dairy products	**Fluid milk**
1994	6.81	7.15
1995	-4.98	-1.50
1996	-0.67	6.57
1997	13.40	21.50
1998	14.80	28.83
1999	11.26	28.33
2000	-7.25	11.37

Note 1: Obtained from the difference between the farm milk price index and the indices of consumer dairy products for the month of September of each year (Index 100 = 1994).
Sources: Statistics New Zealand and our calculations.

As for Great Britain, the margin of intermediaries downstream has posted clear increases since 1996, and for all dairy products as well as for butter and cheese (Table 5.8). It is interesting to note that the period 1995-1996 corresponds to the date on which a new deregulated milk marketing system was implemented in Great Britain. On first glance, our summary analysis appears to demonstrate that the consumers of Great Britain have received little benefit from this dairy deregulation. But in fact, closer analysis of the data shows that dairy product prices have been relatively stable in Great Britain for the period 1996-2000, while the farm price of milk fell almost 40 index points during the same period. In this specific case, a calculation of PSE would have measured a steel decline in the transfers by consumers to producers, while in reality the decline in transfers measured was simply diverted towards intermediaries downstream.

Table 5.8. Changes in the margin of intermediaries[1] for all dairy products, butter and cheese, Great Britain, 1991-2000.

	Dairy products	Butter	Cheese
1991	13.26	-0.02	0.26
1992	9.89	-0.72	5.19
1993	10.21	3.04	10.48
1994	4.43	-0.75	8.26
1995	-3.97	2.10	3.62
1996	-3.44	14.74	12.14
1997	13.19	35.19	36.39
1998	28.74	54.57	46.94
1999	30.56	57.44	49.29
2000	66.60	92.58	82.83

Note 1: Obtained by the difference between the farm price index and indices of consumer dairy products (Index 100 = 1987).
Sources: Department for Environment, Food & Rural Affairs, Office of National Statistics and our calculations.

The data presented in Tables 5.5 to 5.8 show that the margins of downstream intermediaries are changing in vastly different ways from one country to another. Thus we see that in Canada farm and retail prices are essentially following the same path, indicating a good transmission of farm price to retail. Thus, the relationship between milk prices at the different levels of the industry in Canada lends itself well to the PSE calculation assumptions. On the other hand, the American, Australian, British and, to a lesser degree, New Zealand dairy sectors do not demonstrate good transmission of farm milk prices to retail, since the gap between the retail and farm prices is growing. In a similar context, when the farm price of milk in Canada is compared to the same price in the United States, Australia, Great Britain or New Zealand, a positive gap in Canada's favor does not necessarily imply that the Canadian consumer has transmitted a sum to Canadian consumers of the same order of magnitude as the measured gap, as the PSE calculation implies.

A number of studies corroborate the results we have obtained. More specifically, in a study on the impact of marketing systems on retail and farm prices, Doyon et al. (1999) indicate that in 1994 Quebec dairy producers were receiving a price 133 % higher than their New Zealand colleagues while the New Zealand consumer was only paying 16% less than the Quebec consumer on the basis of purchasing power parity. Several other works have shown that in agriculture, and more particularly in the dairy sector, asymmetrical price transmission prevails (Kinnucan and Forker, 1987; Novakovic, 1991; Emerick, 1994; Hansen et al. 1994; von Cramon-Taubadel, 1998). In each case, increases in farm prices were fully transmitted to retail, while price reductions were not fully transmitted.

There is a close link between exercise of market power, increase in intermediary margins and the a symmetrical transmission of prices. Thus, Hansen et al. (1994) indicate that asymmetrical transmission of prices is one of the principal reasons explaining the growth of the farm-retail price gap in the United States since the 1980s. Azzam (1999) has also demonstrated that an increase in the degree of competition at the local level increases the farm-retail price gap. More recently, Romain et al. empirically demonstrated that an increase in the level of competition in fluid milk in New York City had the effect of reducing the both farm-retail price gap and asymmetrical price transmission. Finally, a study by Frigon (1999) concludes that in Quebec there is no asymmetrical price transmission in fluid milk, mainly because of the regulation in place, which imposes a framework for establishing intermediary margins.

5.4 CONCLUSION

The preceding demonstration confirms that the dairy PSE is sensitive to an expression of market power by producers and intermediaries, even if the consumer is unaffected by it. Where producers benefit from collective marking, they may capture a larger share of the consumer dollar, a share which is otherwise in the hands of the intermediaries. In such case, the PSE calculation method is erroneously assigned a higher result, that is, a dairy PSE superior to the country where the producers are capable of exercising a certain market power, even if the consumer price is not higher than it is elsewhere.

To apply, as the PSE does, a calculation method based on the hypothesis of perfect competition, to a market that functions imperfectly, may thus lead to results that are open to discussion and to biased interpretations of those results.

6. THE PSE: A SUPPORT INDICATOR WITH MAJOR THEORETICAL AND METHODOLOGICAL LIMITATIONS

In conclusion, it seems important to sum up the main limitations of using the production subsidy equivalent (PSE) to analyze support given dairy producers in different countries.

To begin with, we showed that the New Zealand farm price used as reference price is not the best available indicator of what the world price would be in the absence of market distortion. From a theoretical viewpoint, New Zealand cannot be considered to be the dairy economy that dictates dairy product prices on the international market. Rather, it is a price taker on the market. Numerous studies agree that, without the market distortions caused by dairy policies in force in the principal dairy countries, the world market price would be higher than the price currently received by New Zealand dairy producers. These studies all conclude that the farm price in the United States approaches more closely to the theoretical equilibrium free competition price on the international market. The simulations we conducted using this basis and using the American price as a reference price have led to a drastic reduction in estimates of absolute dairy PSE levels in all the countries analyzed.

We next went on to discuss the impact of using the current exchange rate to move the dairy PSEs calculated for each country onto the basis of a common comparison currency. We then demonstrated that the variation in exchange rates from one year to the next affected the rise or fall in a country's dairy PSE calculated in a common comparison currency without there in fact being any variation in the level of transfers to producers from consumers and taxpayers in that same country. Volatility in exchange rates thus fosters a false interpretation of changes in the PSE in a common comparison currency. We therefore proposed using a conversion rate based on purchasing power parity, which is in any case an indicator used more and more widely by international agencies, and even in the OECD itself, for international comparison of economic indicators. Simulations performed using that indicator demonstrated no significant variations in the absolute levels of dairy PSEs in any of the countries analyzed. However, the ranking against each other of countries for which the results are relatively close might change from one year to the next when using this calculation method, as opposed to the OECD method using current exchange rates.

In the final part of our study, we demonstrate that, more fundamentally, it is the very idea of comparing dairy PSEs in a common unit that is not based on a theoretical point of view. The OECD method for determining PSEs is based on the assumption of perfectly functioning markets in dairy products inside each of the countries. We have theoretically demonstrated that the results of PSE calculations are very sensitive to this assumption or, to put it another way, a relaxation of this assumption invalidates the results obtained. Thus the exercise or not of market power within a country may cause intermediary margins, and thus prices to dairy producers, to vary considerably, without affecting the price to the consumer. However, in such case, PSE results will vary, for example upwards if the producers exercise collective marketing power which allows them to increase the price received at the farm while reducing intermediary margins, even if in the event consumers still pay the same price for their dairy products. The PSE calculation method thus erroneously leads to an increase in the PSE, even if the consumer incurs no additional transfer to the dairy producers.

These theoretical and methodological limitations place important restrictions on the use and interpretation of the results of calculations produced under the PSE concept as developed by the OECD. Our analysis leads us to conclude that the PSE as an absolute value tells little about the actual level of support received by dairy producers. Whatever theoretical and methodological problems may be present in OECD's calculation method for other kinds of production, if the PSE as an absolute value has little meaning, comparisons of support level from one type of production to another using the OECD results have still less. As for inter-country comparisons of support for a given production sector, the PSE calculation method comes to a dead end on the exercise of market power, which may well be different for each national market. However, that exercise of market power may modify results regarding levels of PSE without the consumer being affected in any way in the process. Once more, the PSE is not relevant as a comparative measurement of support from one country to the next.

Finally, the PSE can be of limited use to measure trends in support as a percentage or in the national currency for a given production within a single country, and only within that one country. Even in this case, the simulations we have performed show that the positive or negative variation of PSE in national currency from one year to the next is sensitive to OECD's methodological assumptions. This indicator should thus only be used to diagnose a major rise or fall in support from one year to the next, since the PSE is unsuitable for capturing, reliably and with certainty, marginal changes in support levels. Even in this limited interpretation, an analysis by product of the operation of the domestic market of the country is required to verify whether a variation in calculated PSE really reflects a variation in

producer support and not a change in the exercise of market power by the actors in the market, with no real impact on the costs of support borne by consumers or taxpayers.

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