

THE COMPETITION TRIBUNAL

IN THE MATTER OF THE *COMPETITION ACT*, R.S. 1985, c.C-34, as amended, and the *Competition Tribunal Rules*, SOR/94-290, as amended (the "*Rules*");

AND IN THE MATTER OF an inquiry pursuant to subsection 10(1)(b) of the *Competition Act* relating to the proposed acquisition of ICG Propane Inc. by Superior Propane Inc.;

AND IN THE MATTER OF an Application by the Commissioner for an order pursuant to s. 92 of the *Competition Act*.

B E T W E E N:

THE COMMISSIONER OF COMPETITION

Applicant

- and -

SUPERIOR PROPANE INC. *et al.*

Respondents

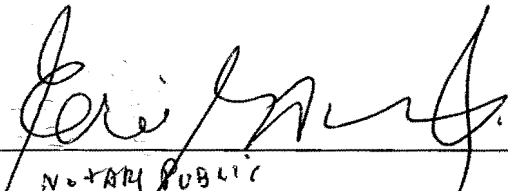
AFFIDAVIT OF PETER G.C. TOWNLEY

I, Dr. Peter G.C. Townley, of the County of Kings in the Province of Nova Scotia, MAKE OATH AND SAY:

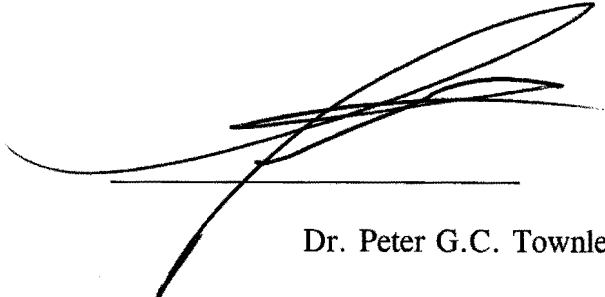
1. I hold the position of Professor of Economics at Acadia University. I have been retained by counsel for the Commissioner of Competition to provide an applied welfare economics perspective on the analysis of mergers in general and with respect to the proposed merger of Superior Propane and ICG Propane in particular.

2. Attached hereto as Exhibit "A" is a true copy of the Report that I prepared. The contents of Exhibit "A" and the findings and opinions expressed therein are true to the best of my knowledge, information and belief.
3. I have written extensively on several matters and issues within the domain of applied welfare economics including two textbooks, the first on microeconomic policy issues and the second on cost-benefit analysis. I have also given sworn testimony via affidavit in Federal Court, and I have prepared background reports and advised counsel in two cases involving expropriation.
4. Attached hereto and marked as Exhibit "B" is a true copy of my curriculum vitae.
5. I make this affidavit pursuant to Rule 47(1) of the *Competition Tribunal Rules*.

Sworn before me
at the Town of Wolfville in
the Province of Nova Scotia, on August 16, 1999



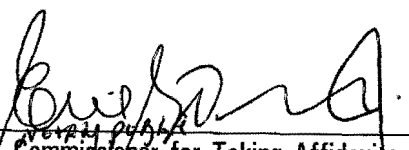
Notary Public
A Commissioner for Taking Oaths, etc.
ERIC G. DEMONT



Dr. Peter G.C. Townley

This is Exhibit "A" to the Affidavit of Peter G.C. Townley
sworn before me at the Town of Wolfville in the Province
of Nova Scotia this 16th day of August, 1999

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1999
AUG 16
WOLFVILLE
NOVA SCOTIA



A Commissioner for Taking Affidavits, etc.
ERIC G. DEMONT

EXHIBIT A

REPORT OF
PETER G.C. TOWNLEY

AUGUST, 1999

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Executive Summary

I have been requested by counsel for the Commissioner of Competition to provide an applied welfare economics perspective on the analysis of mergers in general and with respect to the proposed merger of Superior Propane and ICG Propane in particular.

Welfare economics is a branch of economics that deals with the normative assessment of economic policies and phenomena. Competition policy thus falls within its scope.

In my opinion, application of any standard — including a Total Surplus Standard, a Price Standard and a Consumer Surplus Standard — involves a value judgement regarding income-distributional issues. That is, an efficiency-equity tradeoff is not avoidable.

Application of a Total Surplus Standard without regard for distributional issues may allow mergers that are welfare-diminishing, and application of a Price Standard may prevent mergers that are potentially welfare-enhancing.

That both efficiency and equity issues are important in applied welfare analysis is widely supported in the literature. A value judgement is required to resolve the tradeoff arising when an event or act that would result in an increase in efficiency would also have negative distributional impacts (or *vice versa*). Moreover, the terms of the tradeoff are often not precise because of the existence of both quantitative and qualitative factors. Methods as to how this tradeoff might be framed are suggested.

In the specific case of the proposed merger of propane retailers, because distributional concerns arise, an assessment of this efficiency-equity tradeoff is unavoidable.

1. Introduction

I begin with the premise that a reasonable objective of merger policy would be to approve mergers that would contribute to the overall well-being (economic welfare) of Canadians and not to approve those which would diminish the economic well-being of Canadians. However, defining a standard consistent with this objective is a formidable task because of measurement and aggregation problems. Moreover, the choice of standard involves an efficiency-equity tradeoff and, thus, at least one value judgement is unavoidable.

A principal purpose of this report is to examine potential standards with respect to the above and various practical issues pertaining to the analysis of mergers. The next section provides a brief overview of the measurement and assessment of welfare change. Section 3 presents and assesses three well-known potential standards. Section 4 deals with the integration of equity and efficiency in merger analysis, and Section 5 provides a summary to that point. The case of the proposed merger of propane retailers in light of the previous discussion is the subject of Section 6. Section 7 concludes the report.

2. Criteria for Assessing Welfare Change

2.a The Pareto Improvement Criterion

The most basic criterion for assessing the impact of an event on economic well-being is the Pareto Improvement Criterion.

- *An event (policy, act) causes a Pareto improvement when at least one person is made better off and no person is made worse off.*

Because at least one person is made better off and no person is made worse off, it is absolutely clear that an event such as a merger that causes a Pareto improvement must enhance welfare. Note that to apply this criterion it is not necessary to measure by how much any person is made better off or worse off, nor is it necessary to compare changes in different individuals' or households' levels of well-being. Neither measurement of utility changes nor interpersonal comparison of them is required to apply this criterion.

Of course, if only one person is made worse off by an event it fails the Pareto Improvement Criterion; one is unable to determine if society would be worse off or better off if the event occurred in this case. Satisfaction of the Pareto Improvement Criterion is a sufficient (not a necessary) condition for an increase in social welfare, but failing the Pareto Improvement Criterion is only a necessary (not a sufficient) condition for a reduction in welfare.

Note that the Pareto Improvement Criterion is quite restrictive. Several people might gain if an event occurred, but if just one person lost the event would fail this criterion. What if the gainers actually compensated losers for their losses? If the winners were still winners after actual compensation, and by compensation potential losers were made indifferent to the event, a Pareto improvement would have been achieved.

However, actual compensation is not always possible. First, sometimes there is a problem identifying winners and losers. Second, large transactions costs may be involved in actually carrying out compensation.

If policymakers adhered strictly to the Pareto Improvement Criterion, and if compensation were not feasible, the potential exists for rejecting policies and projects that a reasonable person would deem welfare-enhancing. Therefore, another criterion is sometimes used. It is the Potential Pareto Improvement Criterion.

2.b The Potential Pareto Improvement Criterion

- *A potential Pareto improvement occurs if the gainers from an event are hypothetically able to compensate losers and still be better off, and if the losers from an event are hypothetically unable to compensate the potential gainers for forgoing the event.*

This is sometimes called, with some lack of precision, 'the cost-benefit analysis criterion'. If the gains exceed the losses, proceed. *Note that compensation is hypothetical only.*

There are a number of problems associated with the application of this criterion.

- (i) *The first part of the criterion requires that aggregate compensating variation be positive.*

This presumes that every individual's compensating variation can be measured (or a suitable proxy exists). In the case of a single price increase, an individual's compensating variation would be the answer to the following: *What is the least amount you would be willing to accept in order for you to tolerate the price increase?* This amount, if received, would just restore the individual to his or her pre-price-increase level of utility. In the case

of a single price decrease, an individual's compensating variation would be the answer to the following: *What is the maximum amount you would be willing to pay in order to ensure the price decrease?* This amount, if paid, would just maintain the individual at his or her pre-price-decrease level of utility.

- (ii) *The second part of the criterion requires that aggregate equivalent variation be positive.*

In the case of a single price increase, an individual's equivalent variation would be the answer to the following: *What is the maximum amount you would be willing to pay in order to prevent the price increase?* This amount, if paid, would just maintain the individual at his or her post-price-increase level of utility. In the case of a single price decrease, an individual's equivalent variation would be the answer to the following: *What is the minimum amount you would be willing to accept in order for you to forgo the price decrease?* This amount, if received, would just maintain the individual at his or her post-price-decrease level of utility.

Calculation of an individual's compensating or equivalent variation is an attempt to 'monetize' the impact of an event on the person's well-being or utility. (Utility is an ordinal measure whereas compensating and equivalent variations are cardinal in that they are measurable and can be stated in dollars.)

Consider one individual, say person i . Let individual i 's change in utility be denoted by ΔU_i , change in compensating variation by CV_i , and change in equivalent variation by EV_i . Compensating variation and utility changes are related in the following manner: if $CV_i > 0$, then $\Delta U_i > 0$; if $CV_i < 0$, then $\Delta U_i < 0$; and, if $CV_i = 0$, then $\Delta U_i = 0$. Equivalent variation and utility changes are related in the following manner: if $EV_i > 0$, then $\Delta U_i > 0$; if $EV_i < 0$, then $\Delta U_i < 0$; and, if $EV_i = 0$, then $\Delta U_i = 0$.

Compensating and equivalent variations are known as 'true' or 'exact' measures of welfare change. One notes that to satisfy the Pareto Improvement Criterion, $\Delta U_i \geq 0$ for all individuals and $\Delta U_i > 0$ for at least one individual. Therefore, $CV_i \geq 0$ for all individuals and $CV_i > 0$ for at least one individual would signal a Pareto improvement as would $EV_i \geq 0$ for all individuals and $EV_i > 0$ for at least one individual. If the sum of individuals' compensating and equivalent compensations are denoted by CV and EV, respectively, CV and EV would be strictly positive in the case of a Pareto improvement, and an increase in economic welfare would be assured.¹

In merger analysis one is often interested in the case where CV_i is positive for some economic agents and negative for others; that is, a circumstance when the Pareto Improvement Criterion is not satisfied. The same applies to equivalent variation.² In such instances the Potential Pareto Improvement Criterion is satisfied if $CV > 0$ and $EV > 0$. (Note that one would prefer to be able to sum individuals' changes in utility $[\Delta U_i]$ directly, but one cannot because of the ordinal nature of utility.) $CV > 0$ would be interpreted to mean that if the event in question (e.g., a merger) were to proceed, the gains of gainers would exceed the losses of losers such that the gainers could (hypothetically) compensate the losers and still be better off. $EV > 0$ would be interpreted to mean that the losers would (hypothetically) not be able to compensate potential gainers for forgoing the event. Importantly, unlike the Pareto Improvement Criterion, gains and losses must actually be measured and compared in order to apply the Potential Pareto Improvement Criterion.

¹ Note, however, that Boadway (1974) demonstrates the circumstances in which $CV > 0$ results even when no Pareto improvement occurs.

² As analysts are usually concerned with the impacts if a merger happens rather than if one is not allowed to happen, CV is more relevant than EV in the analysis of mergers. Still, I continue with both exact measures for greater generality.

One notes that if *actual* compensation were paid, $CV > 0$ and $EV > 0$ would mean that the event would, after compensation, cause a Pareto improvement. Therefore, with actual compensation $CV > 0$ and $EV > 0$ would unambiguously signal an increase in aggregate economic well-being.

However, the Potential Pareto Improvement Criterion requires *hypothetical* compensation only. Therein lies the crux of the problem: In what circumstances will $CV > 0$ and/or $EV > 0$ mean that economic welfare increases when actual compensation is not paid?

To calculate aggregate CV it is necessary to sum every individual's compensating variation, each expressed as a positive, negative or zero dollar value. In the case where no actual compensation is paid, this is only valid if individuals associate the same value with the dollars being summed. For example, if person A and person B treat a dollar as yielding equal utility, then a transfer of \$1 from A to B or *vice versa* would cancel. In this case $CV_A = -\$1$ and $CV_B = +\$1$. $CV = w_A \cdot CV_A + w_B \cdot CV_B = 0$, where w_A and w_B are the welfare weights associated with A and B, respectively, and set equal to one (explicitly or implicitly).³ To simply sum CV_A and CV_B is to treat w_A and w_B as if they are identical and equal to 1, and thus aggregate CV reduces to $CV_A + CV_B = 0$. However, the reason one would conclude that the overall welfare of A and B has not changed is that A's loss of utility is just matched by B's gain in utility; that is, $-\Delta U_A = \Delta U_B$. ($CV = 0$ reflects this, but only in this specific case where $w_A = w_B = 1$.) For individuals to associate the same value to a dollar requires that they have equal marginal utilities of income (and thus equal values are assigned to welfare weights). If this is so for all economic agents, $CV > 0$ truly indicates a

³ For the Potential Pareto Improvement Criterion, these weights are implicit only because they are identical and unitary. CV here is often called 'unweighted', although this really means that no differential weights have been applied. The reason I show these weights explicitly will become apparent.

welfare gain and $CV < 0$ truly indicates a welfare loss, assuming that EV bears the same sign, respectively.

However, one does not expect individuals' marginal utilities of income to be identical. Typically one expects diminishing marginal utility of income (or wealth). This simply means that a wealthy person is expected to attach less utility gain to an extra dollar than a poor person. Or, the fewer dollars one has, the greater the loss of utility one associates with the loss of a dollar. Like most commodities, the more one has the less one values additional units.

Suppose it is the case that a wealthy individual associates less utility change with a dollar gain or loss than a poor person. As above, assume that $CV_A = -\$1$ and $CV_B = +\$1$ such that aggregate CV is zero when simply summed ($w_A = w_B = 1$). However, if A is wealthier than B one would expect A's loss of utility to be more than offset by B's gain in utility. Therefore, even though $CV = 0$, economic welfare would increase. (That is $CV_A + CV_B = 0$, but $\Delta U_A + \Delta U_B > 0$.) On the other hand, if A is less wealthy than B, then A's loss of utility would be greater than B's gain in utility. In this case, even though $CV = 0$, economic welfare would decrease. (That is $CV_A + CV_B = 0$, but $\Delta U_A + \Delta U_B < 0$.)⁴

The main point is that when equal welfare weights are assigned, implicitly or explicitly, $CV > 0$ may not indicate a welfare gain and $CV < 0$ may not signal a welfare loss if individuals' marginal utilities of income differ. However, if appropriate welfare weights were assigned (that reflect this distributional concern), the weighted sum of individuals' compensating variations would indicate a welfare gain or loss accurately.

⁴ One notes that progressive tax-and-transfer systems are favoured by policymakers. Such systems are consistent with the idea that transferring dollars from the wealthy to the poor enhances overall well-being. This is consistent in the present context with the idea that the marginal utility of income of a poor person is greater than that of a wealthy one.

2.c Distributional (Welfare) Weights

Sugden and Williams (1978) provide an elementary discussion of the ethical foundations of using welfare weights, while Boardman *et al.* (1996) and Boadway and Bruce (1984) provide more sophisticated analyses. Examples of potential weighting schemes (where weights are a decreasing function of income level) can be found in Zerbe *et al.* (1994) and Pearce and Nash (1981). Weisbrod (1972) provides a case for integrating equity and efficiency in analyses, and he attempts to infer a set of distributional weights (based on income and race) from completed public sector projects.

There is much agreement that if welfare weights are to be used to aggregate gains and losses, these weights should be a decreasing function of income. However, there is also much agreement that using any set of weights, including the implicit case where they are all set to one, requires a value judgement.

Two scenarios for aggregating compensating or equivalent variations using equal weights (and thus applying the Potential Pareto Improvement Criterion with hypothetical compensation only) exist. The first is that a representative consumer exists; that is, that individuals are identical in all relevant economic aspects. For effective aggregation, this requires that preferences be identical and homothetic. I have no reason to believe this to be the case in most instances.

The second is that, in the background, a government exists which continuously and costlessly redistributes income *via* lump-sum taxes and transfers so as to keep marginal utilities of income equal. Governments in Canada do redistribute income, but I have not observed such activity to the extent required to meet the condition.

Indeed, lump-sum taxes and transfers are not generally used to effect redistribution. Governments typically rely on less efficient fiscal instruments such as income taxes and income-based transfers. Because of this, it costs an economy considerably more than one dollar to place an extra dollar in the hands of a relatively poor person. The reasons for this are that the transfer may have perverse incentive effects on the persons receiving the transfer (e.g., disincentive to labour effort); those being taxed have less incentive to earn income (the marginal excess burden of taxation); and, administrative costs are incurred in order to facilitate the transfer.

Regarding the marginal excess burden of taxation, Blomqvist *et al.* (1994: 516) cite Stuart (1984) who, on the basis of his computations for the USA deems 30% to 40% "the most likely range." They also report that Ballard *et al.* (1985) "provide estimates of between 17% to 56%, with their best estimate being roughly 33%." Campbell (1975), in a simple model, estimates an excess burden of taxation of 25% using Canadian data.

Blomqvist *et al.* add this excess burden of taxation to the disincentive effects on those receiving transfers and to the administrative costs incurred in order to formulate their 'leak in the transfer bucket'. They estimate this loss to be "somewhat more" than 50%. Indeed, they provide an example where the social cost of providing \$65 to a poor household is \$130 to society (a 50% leak) once induced deadweight losses and administrative costs are counted. (Similar discussion can be found in Raynauld *et al.* [1994]).

Therefore, any notion that a government can costlessly redistribute income so as to equate marginal utilities of income continuously is quite unrealistic.

If one were employing a social welfare function⁵ in order to analyze the impacts of an event, one could associate different distributional weights with different people according to income. This would require not only a value judgement regarding distributional weights but also arbitrary assumptions regarding functional forms.

Because of the ethical dimensions involved, economists are loathe to impose their own value judgements when assessing projects, policies and other economic phenomena. Nevertheless, Mishan (1972: 453), a rather famous author on the theory and practice of cost-benefit analysis, offers the following advice:

“In order, then, for a project to be socially acceptable, it is not enough to show that the outcome of a cost-benefit calculation is positive — allowing, always, that the evaluation of each of the component items has been thorough and consistent. It must also be established that the resulting distributional effects are not unduly regressive, and that no gross inequities are perpetrated.”

Further, concerning the use of distributional weights, Mishan (1976: 405) states:

“Although the device of incorporating utility weights into a cost-benefit analysis as a means of enforcing the claims of equity or distribution is evidently unsatisfactory, distributional and other social goals have to be respected by the economist who offers advice to society. The least he should do is point up the distributional implications wherever they appear significant.”

Many analysts appear to treat gains and losses symmetrically to whomever they accrue. However, it would also appear that many practitioners do not appreciate (a) that

⁵ A social welfare function is a mathematical device for expressing society's welfare as a function of individuals' or households' levels of utility (well-being). Pass *et al.* (1991: 553) note: “Once economists rejected the idea that utility was measurable ... they felt impelled to accept the idea that economic welfare is immeasurable, and any statement about welfare is a value judgement influenced by preferences and priorities of those making the judgment.” An example of a general social welfare function appears in Appendix A.

weights have been assigned, and (b) that a value judgement was necessary in order to obtain them. For example, if a merger that would cause consumer losses and producer gains is assessed by simply summing losses and gains, this is to assign equal weights across the board. It may be implicit, but aggregating as if 'a dollar is a dollar is a dollar' to whomever it accrues still involves a value judgement. That the economic impacts of a merger on every economic agent involved are treated as equally beneficial or harmful per dollar is to make a judgement that their marginal utilities of income are identical.

Still, the fact remains that distributional impacts are often not treated explicitly in many cost-benefit analyses of public sector projects. However, public sector projects and mergers are quite different.

One reason why differential weights are not applied explicitly in the evaluation of projects is that they are not needed because either distributional concerns are not important or they have been accounted for implicitly. For example, consider a dam project that provides flood protection and a public recreational area. The benefactors of dry basements and/or swimming opportunities are likely to be spread across a spectrum of income cohorts. However, to construct the dam requires (eventually) tax dollars. If the tax system is progressive, the relatively wealthy will contribute more to the financing of the dam than the relatively poor. If gross benefits are spread evenly, then if net losers exist they will be from the ranks of the relatively wealthy, thus accounting for distributional concerns.

Consider now a merger. In a situation where a merger would cause the price of the good in question to rise, consumers lose and merging firms gain. Unlike the dam case, the distinction between winners and losers is clear, and one would wish to assess relative income levels and impacts explicitly.

The main point is that when one aggregates individuals' gains and losses one should be aware of the assumptions and value judgements being made. Also, one should be aware that the Potential Pareto Improvement Criterion is used by public policy/applied welfare economists because it is often necessary to go beyond the Pareto Improvement Criterion in order to examine issues from an economic perspective. Applied welfare economists (including cost-benefit analysts) do so warily with much attention to the value judgements (and assumptions) necessary to proceed, hopefully in the most objective ways possible. Other methods exist to assess welfare change, but they require even stronger assumptions. Good methodology requires that any conclusions reached be assessed relative to the assumptions made.

2.d Summary

- (a) Satisfaction of the Pareto Improvement Criterion guarantees an increase in economic well-being. Failure to satisfy this criterion is a necessary condition (only) for a decrease in welfare.
- (b) Satisfaction of the Potential Pareto Improvement Criterion ($CV > 0$ and $EV > 0$) guarantees a welfare gain only if individuals' marginal utilities of income are identical. Similarly, failure to satisfy this criterion ($CV < 0$ and $EV < 0$) indicates a welfare loss only if individuals' marginal utilities of income are identical. Therefore, the sign of the sum of compensating variations of individuals affected by an event when both gainers and losers exist may not be indicative of the direction of welfare change. Aggregating in this manner ignores distributional concerns in that it is likely that individuals of different income levels attach different values to dollars gained and lost.

- (c) If a suitable set of distributional weights were applied to the aggregation of individuals' compensating and equivalent variations, the sign of these aggregates would indicate the direction of welfare change. However, the choice of a set of welfare weights involves an arbitrary value judgement.

3. Potential Standards

3.a The Total Surplus Standard

Williamson's (1968) 'naive' tradeoff model is the basis for the Total Surplus Standard. Consider a case where a merger would cause both price to increase and costs to decrease.⁶ Simplifying greatly (and assuming that the market has been defined *et cetera*), the following are among the steps that would be taken by an advocate of Williamson's approach:

- (a) estimate the loss of aggregate consumer surplus caused by the rise in price due to increased market power;
- (b) estimate the gain of aggregate producer surplus caused by the rise in price due to increased market power;
- (c) subtract (b) from (a) to derive the deadweight loss due to monopoly (the loss of allocative efficiency⁷); and,

⁶ Throughout it is assumed that the quality of the good in question does not change such that upward pressure on price is due only to increased monopoly power and downward pressure is exerted only by reduced marginal cost.

⁷ Allocative efficiency has three aspects. An allocation of resources is deemed (allocatively) efficient if (a) it is impossible to rearrange consumption such that at least one consumer can be made better off and no consumer be made worse off; (b) that firms cannot rearrange inputs such that at least one firm's output increases and no firm's output decreases; and, (c) that the mix of products cannot be rearranged that at least one consumer or producer is made better off while no consumer or producer is made worse off. Indeed, when economists speak of 'efficiency', they usually mean

- (d) compare (c) to cost savings to be attained because of the merger (the gain in technical efficiency).⁸

Figure 1 is useful for illustrating this approach. This diagram, except for labelling, is identical to that of Williamson (1968: 21).

Before the merger, average cost and marginal cost for competitive firms is given by AC_1 .⁹ Firms price competitively at P_1 , and Q_1 units are produced and consumed. (Here Q_1 refers to the output of at least two firms.)

The merger has two effects: price rises to P_2 because of monopoly power, and average (and marginal) cost falls to AC_2 because of cost savings. Monopoly output and consumption after the merger is Q_2 .

If one were to assess the change in total surplus in this case, the following calculations would be made.

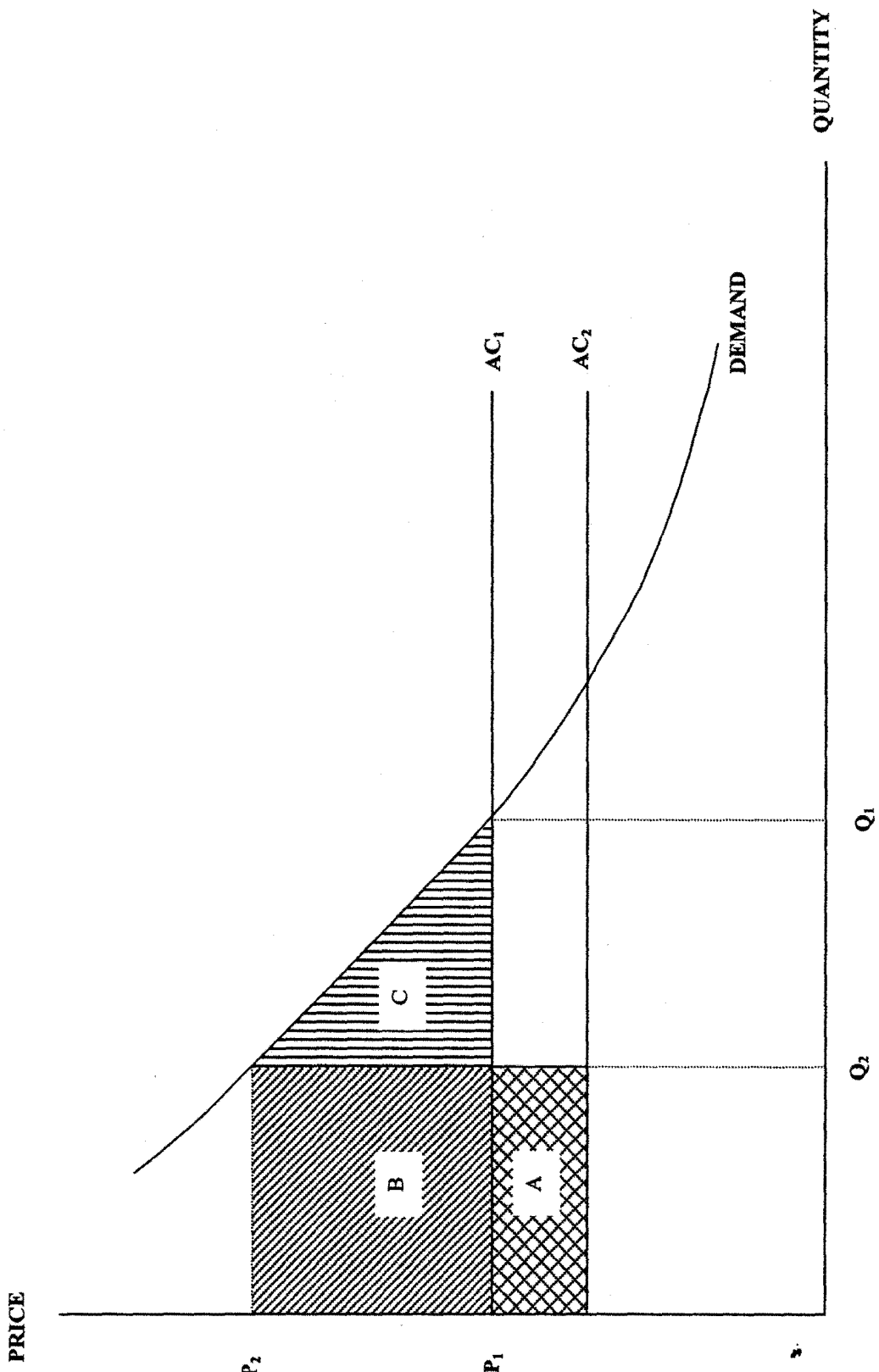
1. The loss of consumer surplus is given by area **(B + C)**;
2. The increase in producer surplus due to the higher price is given by area **B**;

allocative efficiency, especially in the sense of Vilfredo Pareto.

⁸ Technical (or technological) efficiency differs from allocative efficiency in that it refers to costs only. Technical efficiency concerns are satisfied when a given set of inputs is used to produce the maximum possible output, or a level of output is produced with the least inputs. A third 'efficiency' concept is dynamic efficiency, and this is concerned with the pace of innovation and invention in an industry.

⁹ Williamson assumes constant average cost, and this implies constant marginal cost. It is not clear whether he means long- or short-run average cost.

Figure 1



3. The 'efficiency' or cost savings due to the merger is given by area A;¹⁰
4. The deadweight loss due to monopolization of the market is given by (1) minus (2); that is, area C; and,
5. The change in total surplus is given by A - C.

If A - C were positive, the 'efficiency' gain exceeds the deadweight loss such that the Total Surplus Standard would be satisfied. That is, losses to consumers are less than gains to merging firms (assuming equal welfare weights). Of course, a merger would fail to satisfy this standard if A - C were negative.¹¹

Essentially, this method is an application of the Potential Pareto Improvement Criterion. Accordingly, there are a number of problems with this approach.

The first problem is that an individual's change in consumer surplus (ΔCS_i) is an approximation of the two 'true' measures of welfare change. Only in the case where the income effect of the single price change is zero will these three measures be identical. For a normal good, when a single price changes, $EV_i > \Delta CS_i > CV_i$, and *vice versa* for an inferior good.¹² The spread between EV_i and CV_i is a positive function of the absolute value of income effects.

¹⁰ This depends on whether AC_1 and AC_2 are long- or short-run average cost curves. If they are long-run cost curves, area A captures all cost savings. However, if they represent short-run costs, area A would measure savings in variable costs only, not fixed costs.

¹¹ See Bian and McFetridge (1997), Crampton (1993, 1994), McFetridge (1996, 1998) and Sanderson (1997) for arguments in support of this approach.

¹² Demand for a normal good increases (decreases) as income increases (decreases), whereas demand for an inferior good increases (decreases) as income decreases (increases).

The second problem arises when more than one price changes. CV_i and EV_i are still unique in this case (because the relevant questions involve only the income change required to restore a person to his or her pre- or post-change level of utility), but the value one calculates for ΔCS_i depends on the order in which one adds up effects. (There is an exception that would seem very improbable: when cross-price effects are exactly equal over all price changes the mathematical problem of line integrals is avoided.) Therefore, one could calculate a multitude of ΔCS_i values depending on the order of integration, but this provides no guidance as to their relative merits. Indeed, Boadway and Bruce (1984: 206) point out that some ΔCS_i calculations may lie outside EV_i and CV_i , unlike the case of a single price change.¹³

Third, if a merger causes price to rise, consumers will be worse off. Indeed, for the same price increase, one would suspect that poor consumers to be made worse off than wealthy consumers because their marginal utilities of income will be higher. Therefore, even if every individual's change in consumer surplus were a good approximation of his or her compensating variation, calculating the aggregate change in consumer surplus by summing individuals' (unweighted) changes in consumer surplus poses the same problems as summing individuals' compensating variations to yield aggregate compensating variation.

Fourth, suppose one now wishes to compare the loss of aggregate consumer surplus due to a price-increasing merger to merging firms' gain in producer surplus plus 'efficiency' gains. Does one give producers' gains the same weight as consumers' losses? That is, an additional aggregation problem may exist. If weights are assigned according to income, are consumers wealthier than the owners of merging firms or *vice versa*? In the extremes, would the merging firms be owned by a very wealthy individual or by several poor ones? It is

¹³ Slesnick (1998: 2108) states: "Despite its ubiquity, it is now widely accepted that consumer's surplus should not be used as a welfare measure, although there is less agreement as to why."

rather difficult to compare one person's gain with another's loss when marginal utilities of income differ.

Therefore, like aggregate compensating variation and aggregate equivalent variation, a positive (negative) change in total surplus measure need not indicate a welfare increase (decrease) when income distribution issues exist but are ignored in the analysis. The total surplus method employs equal welfare weights across individuals and firms, and this may not be appropriate. That is, if price rises but the Total Surplus Standard is satisfied in a situation where consumers are relatively less wealthy than producers, aggregate economic well-being may decrease despite an increase in total surplus.

Those who apply the Total Surplus Standard (Williamson's approach) assign equal and unitary distributional weights (usually implicitly). However, the 'Williamsonian' or total surplus approach only measures aggregate welfare change when all affected economic agents' marginal utilities are identical. If they are not, only application of a set of appropriate distributional weights could align the two.

It is worthwhile emphasizing that a positive sum of compensating variations does not guarantee an increase in economic welfare. A simple mathematical discussion (and example) of this fundamental problem is the subject of Appendix A.

3.a.i Williamson and Harberger on Distributional Impacts

Williamson (1968) is revealing. After he sets out what he calls (p. 21) the "naive tradeoff model," which forms the basis of the Total Surplus Standard, he considers equity issues. He states (1968: 28, italics added):

“For specific welfare valuations, however, we might not always wish to regard consumer and producer interests symmetrically — although since, arguably, antitrust is an activity better suited to promote allocative efficiency than income distribution objectives (the latter falling more clearly within the province of taxation, expenditure, and transfer payment activities), such income distribution adjustments might routinely be suppressed. If they are not, the tradeoff between efficiency gains and distributive losses needs explicitly to be expressed. *Thus, while economies would remain a defense, any undesirable income distribution effects associated with market power would be counted against the merger rather than enter neutrally as the naive model implies.*”

He continues (1968: 28):

“[T]he transfer involved could be regarded unfavorably not merely because it redistributes income in an undesirable way (increases the degree of inequality in the size distribution of income), but also because it produces social discontent. This latter has serious efficiency implications that the above [naive] analysis does not take explicitly into account.”

Williamson’s opinion that distributional issues are best treated by other means is considered below. For the present, I note his view that if distributional concerns are important, account should be made of them.

Williamson’s (1968) ‘naive’ model does not associate explicit distributional weights to consumers and producers. Although Williamson qualifies his approach (above), it is Harberger (1971) who lends support to the ‘unweighted’ approach. His is a powerful document, even though he (1971: 785) describes it “not as a scientific study” ... but rather as ... “an open letter to the profession.”

Harberger’s (1971: 785) three basic postulates are:

- (a) the competitive demand price for a given unit measures the value of that unit to the demander;

- (b) the competitive supply price for a given unit measures the value of that unit to the supplier; and,
- (c) when evaluating the net benefits or costs of a given action (project, program, or policy), the costs and benefits accruing to each member of the relevant group (e.g., a nation) should normally be added without regard to the individual(s) to whom they accrue.

Williamson's (1977: 74) view of these postulates is interesting:

"Although this approach represents a rather narrow view of economics, it often constitutes a useful beginning. Other factors, to the extent that they are thought to be relevant, usually can be introduced separately. Although the expertise required to make these subsequent adjustments often will be of an extraeconomic sort, economists need not disqualify themselves from any further involvement merely because the adjustments are not purely economic ones. Indeed, because these other factors frequently fall outside the purview of any single discipline, decisionmaking responsibilities revert to nonspecialists by default. Still, the lack of strictly professional qualifications ought to be noted."

One notes that it is this 'narrow' but 'useful' approach that proponents of Williamson adopt *via* the Total Surplus Standard, even though Williamson qualifies his method in light of potential distributional concerns.

Still, it is Harberger who is important because his 1971 article is broader in that it concerns applied welfare economics more generally than Williamson's (which is devoted to mergers only). Although Harberger has several reasons for putting forward his three postulates, I am concerned here with (c), which would accord all consumers and producers identical welfare (distributional) weights so that consumer and producer surpluses might be summed, both separately and together. Harberger's views with respect to distributional issues and his reasons for advocating postulate (c) are important.

First, Harberger recognizes that distributional impacts of any policy can be important. He states (1971: 785-6):

“These elements — income-distributional and national-defense aspects of any project or program, and probably its natural-beauty aspects as well — may be exceedingly important, perhaps even the dominant factors governing any policy decision, but they are not a part of that package of expertise that distinguishes the professional economist from the rest of humanity. [...] But this does mean that we need be silent on matters that lie outside the range of our professional expertise; economists should probably participate more rather than less in the public discussion of such matters, but hopefully in a context that recognizes the extra-professional nature of their intervention.”

Therefore, although Harberger recognizes that the distributional impacts of a policy can be very important, like most economists he wishes to avoid making value judgements concerning the nature of an equitable distribution of income. Of course, when Harberger advocates that gains and losses “should normally be added without regard to the individual(s) to whom they accrue,” he himself makes a value judgement. (Again, a value judgement is unavoidable, be it implicit or explicit.)

Second, one of Harberger’s reasons for not applying differential weights to gains and losses is quite simple. He states (1971: 787, italics added):

“Hypothetically, one might contemplate a national income measure incorporating ‘distributional weights,’ but two obstacles stand in its way: first, the impossibility of achieving consensus with regard to the weights, and second, the fact that most of the data from which the national accounts are built are aggregates in the first place, and do not distinguish the individuals or groups whose dollars they represent. *Giving equal weight to all dollars of income is mathematically the simplest rule, and our data come that way in any event. In a sense, the second obstacle imposes, rather arbitrarily to be sure, a solution to the perplexing difficulties posed by the first.*”

The idea of imposing a 'consensus' because of data limitations given "the impossibility of achieving consensus" is somewhat confusing, perhaps contradictory, but certainly pragmatic. Of course, individuals who seek from Harberger (1971) an economic or ethical justification for not applying differential distributional weights may be disappointed.

Indeed, Harberger (1978) himself provides additional insights into the use of distributional weights. His main concern — like most applied welfare economists — is with the efficiency-equity tradeoff. (Policies that promote both efficiency and equity considerations are rare, and those which detract from both are possible and are sometimes undertaken [see below], while those that conflict are the most common.) Essentially, Harberger provides a perspective concerning the magnitudes of the tradeoffs involved. That is, the pursuit of any distributional objective usually involves a resource cost. Indeed, he sets out examples in order to demonstrate that efficiency losses grow as the range of distributional weights increases.

Harberger (1978: S113) summarizes:

"The dilemma, then, is that, when the differences in weights are small, distributional considerations are reflected only to a minor degree in the evaluation process. When, on the other hand, the differences in weights get to be large, it is all too easy for considerations of distribution to swamp those of efficiency altogether, and for grossly inefficient policies, programs, and projects to be deemed acceptable."

Harberger (1978: S113-4, italics added) seeks solutions to this dilemma:

"One sure way to avoid paying an exaggerated price in terms of lost efficiency for the redistributive benefits that a weighting scheme would bring into account *is simply to require that policies and projects should pass both tests — the pure efficiency test imposed by traditional applied welfare economics plus the weighted test that emerges when the welfare gains and losses of different groups are multiplied by designated weights before the balance is struck.*"

He adds (1978: S114),

“[T]he simultaneous application of both weighted and unweighted tests is not costless. Nonetheless, there is a sense in which this method minimizes the costs entailed in bringing distributional weights into the picture. That, indeed, is its chief virtue.”

3.a.ii Distributional Objectives

It is widely accepted (see Williamson and Harberger above) that distributional objectives should be pursued at least resource (efficiency) cost to society. One facet of this thinking is that the tax-and-transfer system chosen should create the least deadweight loss to society. Unfortunately, except for the lump-sum variety, both taxes and transfers are distortionary, resulting in deadweight losses, and administering taxes and transfers is not costless. The upshot of this is that the cost of transferring \$1 to a poor person costs society significantly more than \$1.

Another facet is that governments should not intervene in otherwise efficient markets in order to pursue equity objectives. Price ceilings, support prices and supply management schemes fall into this category; that is, prices are legislated either above or below what their competitive levels would be. Two concerns arise. First, large efficiency losses due to the intervention sometimes accrue, and economists would opt for cheaper ways to pursue equity objectives. Second, as Raynauld *et al.* (1994) elaborate, it is quite possible for such market intervention not only to cause efficiency losses, but also, because of market reactions, to take society *away* from its equity objectives — thus society loses on both counts. Therefore, if it is perceived that an income distribution problem exists, tax and transfer schemes that alter incomes are preferable to policies which would alter otherwise competitive prices.

Williamson's (1968: 28, cited fully above) comment that, “antitrust is an activity better suited to promote allocative efficiency than income distribution objectives” would

appear to be in this vein. I can even agree with Williamson's statement, but this does escape the issue that, like the imposition of price ceilings and floors, a price-increasing merger (almost by definition) takes a market (further) away from a competitive outcome. If the merger in question satisfies the Total Surplus Standard, the relevant question should be: Is the net efficiency gain worth the equity loss?¹⁴

3.a.iii Necessities and the Equity-Efficiency Tradeoff

Ceteris paribus, the smaller the deadweight loss caused by a merger, the greater the probability that a merger will satisfy the Total Surplus Standard. And, the more price-inelastic the good in question, the less quantity demanded will decrease because of a merger-induced price increase, and thus the smaller will be the deadweight loss. Therefore, the more price-inelastic the good in question is, the more likely it is that the Total Surplus Standard will be satisfied. (Using Williamson's [1968] mathematical approximation, the relationship between the Total Surplus Standard and price elasticity is shown in Appendix B.)

However, whereas efficiency gains may be substantial, equity issues may be of major concern because of the characteristics of some price-inelastic goods. One determinant of price elasticity is the number of substitutes a good has. Sometimes at issue is how close the good in question is to being a necessity.

A good such as *Wheaties* has many substitutes (all other breakfast cereals plus alternatives such as pancakes, bacon & eggs *et cetera*). Therefore, demand for *Wheaties* is likely quite price-elastic. That is, if the price of *Wheaties* rises, the quantity demanded will fall sharply as consumers switch to substitutes.

¹⁴ I use 'net efficiency' here because a price-increasing merger that satisfies the Total Surplus Standard but does not satisfy the Price Standard entails a loss of allocative efficiency and a gain in technical efficiency.

On the other hand, and at the other extreme, the demand for insulin by people suffering from diabetes may be essentially perfectly inelastic because it has no substitute. (Perfect price inelasticity means that the quantity demanded is absolutely insensitive to price changes.)

Governments tax goods like alcohol and tobacco precisely because demand for them is inelastic. Not only are deadweight losses due to taxation small but, because demand is insensitive to price, such taxes raise much revenue.

On the other hand, governments do not tax many goods — such as bread — that exhibit similar price inelasticity. That is, they forgo an ‘efficient’ tax. Presumably they do so because such a tax would be perceived to be inequitable. That is, relatively poor households spend proportionately more on necessities than relatively wealthy households. A tax on such goods would fall disproportionately on the poor, and thus be considered regressive.

Therefore, in the context of merger analysis, before one accepts application of the Total Surplus Standard, one should assess the nature of the good involved. This standard is more likely than not to be satisfied in the case of a price-inelastic good. However, in the face of modest efficiency gains, if the good involved is considered a necessity or near-necessity by society, application of this standard does not accord with accepted tax treatment of such goods. One presumes that the structure of the tax system, at least in part, reflects society’s views concerning the appropriate treatment of individuals according to income.

Therefore, if the good in question is regarded as a necessity, its demand will be price inelastic and a price-increasing merger will lead to a relatively small deadweight loss. However, it is precisely in this case that equity concerns are greatest. Accordingly, it would be prudent to take into account the nature of the good in question when assessing a merger.

Table 1 illustrates both how expenditures on necessities (water, fuel & electricity in one case and food in the other) increase as income increases but decrease as proportions of total household expenditure. Therefore, if the prices of these commodities were to rise, the impact of such would fall disproportionately on the poor. (Source: Statistics Canada (1998), Family Expenditure in Canada, 1996, [Catalogue: 62-555-XPB].)

TABLE 1**CANADA**

Year: 1996

Income Quintile	Total Expenditure per Household	Expenditure per Household on water, fuel and electricity	Expenditure per Household on water, fuel and electricity as a percentage of Total Household Expenditure	Expenditure per Household on food	Expenditure per Household on food as a percentage of Total Household Expenditure
Lowest	\$16,444	\$1,210	7.4%	\$3,049	18.5%
Second	\$29,250	\$1,539	5.3%	\$4,575	15.6%
Third	\$42,804	\$1,709	4.0%	\$5,855	13.7%
Fourth	\$59,696	\$1,942	3.3%	\$6,989	11.7%
Highest	\$97,145	\$2,302	2.4%	\$9,333	9.6%

3.b The Price Standard

Whereas the Total Surplus Standard is associated most closely with the Potential Pareto Improvement Criterion, to apply a Price Standard to merger analysis is to employ the Pareto Improvement Criterion.

If firms wish to merge, and if the merger would cause the price of the commodity in question to decrease, both consumers and firms would be better off than before the merger. That is, upward pressure on price is caused by increased market power while downward pressure is exerted by decreased marginal costs. If the latter is stronger than the former, then the potential for an overall price decrease exists, thus benefitting consumers. (If these forces balance, such that price is unaffected, the merger would make the owners of merging firms better off and consumers no worse off.)

If one limits his or her attention to consumers and firms, a merger that does not cause the price of the good in question to rise would achieve a Pareto improvement, and would thus enhance social welfare. Moreover, if the good is traded, exports would increase and/or imports would decrease if the price were to decrease.

On the other hand, if a merger caused the price in question to increase, it would fail the Price Standard and would not be allowed. Effectively, application of this standard assigns a distributional weight of zero to merging firms (or an infinitely large weight to consumers). The problem here is that application of this standard would disallow some mergers that are potentially welfare-enhancing.

It was noted above that strict application of the Pareto Improvement Criterion would rule out some projects or policies that a reasonable person would support. For example, a policy that would make most people better off but a single person worse off would fail this

criterion. Similarly, to rule against a merger that would involve only a slight price increase yet massive cost savings would seem unreasonable.

3.c The Consumer Surplus Standard

Figure 1 was used to illustrate the Total Surplus Standard. It is also useful for describing the Consumer Surplus Standard in the case of a merger characterized by a price increase and 'efficiency' gains.

Recall that under a Total Surplus Standard, if **A** is larger than **C**, 'efficiency' gains exceed the deadweight loss and the merger would be allowed. Of course, the proposed merger would fail to satisfy this standard if $A - C$ were negative.

Under a Price Standard, the merger illustrated is disallowed, regardless of the relative magnitudes of areas **A** and **C**, simply because price rises.

The Consumer Surplus Standard (or Transfer Standard) lies between these two. In this case, the loss of consumer surplus ($B + C$) is compared to the 'efficiency' gains (**A**). If the former exceeds the latter, the merger is disallowed and *vice versa*.

Unlike the Total Surplus Standard, gains to merging firms arising from the price increase due to monopoly power (area **B**) are not counted when the Consumer Surplus Standard is applied and thus do not offset this part of consumers' loss of consumer surplus.

Whereas the Price Standard is consistent with the Pareto Improvement Criterion and the Total Surplus Standard is consistent with the Potential Pareto Improvement Criterion, the Consumer Surplus Standard is not consistent with any traditional welfare criterion (at least to

my knowledge). Nevertheless, a few things can be said about this standard relative to the other two.

Use of the Total Surplus Standard involves assigning (implicitly or explicitly) identical (and unitary) welfare or distributional weights across the affected population. On the other hand, the Price Standard attributes zero weight to firms' gains (or, equivalently, infinite weight to consumers' losses). The Consumer Surplus Standard lies somewhere between these two. Here, producer gains due to cost savings are weighted the same as consumers' losses, but producer gains due to (price-increasing) acquisition of monopoly power are given a weight of zero (not counted). This would seem to involve the value judgement that exploitation of monopoly power is 'bad' but resource savings are 'good'. Such a judgement may have wide appeal.

Mergers that would fail the Price Standard may satisfy the Consumer Surplus Standard and the Total Surplus Standard. Of course, mergers satisfying the Total Surplus Standard may fail both the Price Standard and the Consumer Surplus Standard. Any merger that would satisfy both the Price Standard and the Total Surplus Standard would also satisfy the Consumer Surplus Standard.

4. Ways of Accounting for Efficiency and Equity

It was stated at the outset that a reasonable objective of merger policy would be to approve mergers that would contribute to the overall well-being (economic welfare) of Canadians and not to approve those which would diminish the economic well-being of Canadians. What one would like is a set of necessary and sufficient conditions to be met or not, while aware that at least one value judgement is unavoidable. Moreover, one has to deal with practical considerations such as data limitations and uncertainty with respect to measurement and estimation.

A reasonable first step may be to subject a proposed merger to a Price Standard. If it were to satisfy this test, merging firms would be made better off and consumers, at the very least, would be made no worse off if the merger were to proceed. If a merger failed to satisfy the Price Standard, a second step would be required.

A suitable second step would be to assess such a merger using the Total Surplus Standard. There would be little reason to proceed further in the consideration of a particular merger if it failed to satisfy this test. If the proposed merger were to satisfy the Total Surplus Standard, a third step would be to consider the distributional impacts of the merger.

If the Total Surplus Standard were satisfied (and the Price Standard not), and if distributional impacts were deemed important, an equity-efficiency tradeoff would have to be assessed. A value judgement would be necessary, so the question remains as to how one might frame this tradeoff. This is quite difficult because some aspects of the tradeoff are quantitative while others are qualitative. (Moreover, the choice of method likely involves an additional value judgement.)

4.a A Full Set of Distribution Weights

If a full set of distributional weights were available (perhaps decreed by government), and if all the data concerning individuals' gains and losses were known, one might heed Harberger's suggestion by assessing the merger with and without differential weights. If the merger passed both tests, the merger would proceed. However, usually one has neither a set of weights nor full information concerning each affected individual's gain or loss.

4.b The Consumer Surplus Standard

One could let the Consumer Surplus Standard 'break the tie' when a merger fails the

Price Standard but satisfies the Total Surplus Standard. The circumstances in which a merger would fail both the Price Standard and the Consumer Surplus Standard but satisfy the Total Surplus Standard would likely involve a relatively large price increase caused by monopoly power. If a merger satisfied both the Total Surplus Standard and the Consumer Surplus Standard but failed the Price Standard, it would likely involve a relatively small price increase due to monopoly power.

From a welfare perspective, assigning distributional weights according to the Consumer Surplus Standard may be appropriate if consumers of the product in question are relatively poor. However, what if those who consume the product of the merged firms are relatively wealthy? That is, what if the commodity in question is a luxury produced by firms owned by relatively poor individuals? (This is akin to legislating rent controls on luxury apartments when the tenants are wealthier than the landlords.) I have no notion as to how likely this situation may be, but a Consumer Surplus Standard does not allow the discretion required to deal with this type of case.

4.c Finding a Set of Balancing Weights

The Price Standard accords consumers infinite weight and/or firms zero weight, the Total Surplus Standard accords consumers' losses and producers' gains equal importance, and the Consumer Surplus Standard accords consumers a larger weight than firms. It may make sense to find the set of weights that just balances gains and losses and incorporate this set into the necessary value judgement depending on the specific circumstances of the merger.¹⁵

¹⁵ Here, it is assumed that all owners of merging firms and consumers are of the same nationality.

One way to deal with this would be to apply a common weight to all consumers (because information on individual affected consumers is lacking), assign a weight of one to the merging entity as a reference point, then compute the aggregate consumer weight that would just balance consumer losses and producer gains (that would cause the change in weighted total surplus to be equal to zero). Based on whatever quantitative and qualitative information is available regarding the distributional impacts of a merger, one would contemplate whether the computed balancing weight is higher or lower than what is considered reasonable. To be sure, a value judgement is required, but at least the tradeoff between equity and efficiency would be reduced to a single datum. Of course, this number would be subject to measurement and estimation errors. Moreover, it would account for only those things that can be quantified, so it would have to be assessed in light of qualitative factors.

Referring again to Figure 1, this would be the solution (w) to

$$0 = (1) \cdot (\mathbf{B}) + (1) \cdot (\mathbf{A}) - (w) \cdot (\mathbf{B}) - (w) \cdot (\mathbf{C}).$$

Appendix C consists of an example of a merger where application of the Total Surplus Standard, the Price Standard, the Consumer Surplus Standard, and the calculation of the 'balancing weight' is illustrated.

5. Summary

It would be desirable to have a test for mergers that, if passed, would ensure an increase in economic welfare and, if failed, would unambiguously indicate that the merger would be welfare-diminishing. It is my view that no single test achieves both objectives. Therefore, perhaps coming as close as one can to this ideal in a reasonable manner is the best one can do, especially given informational and measurement constraints.

The fundamental problem with the Price Standard is that it may rule out potentially welfare-improving mergers. The most important problem with the Total Surplus Standard is that it does not account for distributional impacts when, indeed, they may be important. Therefore, a merger that satisfies the Total Surplus Standard may be welfare-decreasing in reasonable circumstances. The Consumer Surplus Standard favours consumers relative to the Total Surplus Standard but not to the extreme degree of the Price Standard.

The only case in which the Price Standard and the Total Surplus Standard are in substantial conflict occurs when a merger would increase price but cost savings would be greater than the ensuing deadweight loss. If firm owners are relatively wealthier than consumers, there is a distributional problem in that the merger might reduce economic welfare even though the Total Surplus Standard would indicate otherwise. Moreover, if the good in question is a necessity or near-necessity, the deadweight loss due to the merger is likely to be small whereas equity concerns would be major.

The three-step process suggested may be useful and reasonable. A proposed merger would be subjected to the Price Standard then, if necessary, the Total Surplus Standard then, if still necessary, distributional impacts would be assessed.

If this third step were necessary, resolution of this efficiency-equity tradeoff requires a value judgement. One way would be to compute the set of distributional weights that would just balance the merging firms' gains and consumer losses. This method may be useful for framing the equity-efficiency tradeoff in stark terms. Still, one must appreciate that the terms of this tradeoff will not be precise given informational constraints, measurement error and data limitations.

6. The Case of Propane

According to the three-step procedure outlined above, if the proposed merger of Superior and ICG would cause the price of propane to decrease, no further analysis would be required as the merger would be approved. Similarly, if the proposed merger fails the Price Standard and the Total Surplus Standard, the merger would not be allowed.

To go further, I assume that the proposed merger satisfies the (unweighted) Total Surplus Standard but fails the Price Standard. Therefore, in line with Harberger's, Mishan's and Williamson's advices above, potential distributional impacts are to be assessed.

Ideally, information regarding all the impacts of a price increase of propane, both as a final and an intermediate good would be desirable, as well all distributional impacts as the price increase works through the market system. Such a general equilibrium approach is beyond the scope of the analysis and, in any case, the cost of obtaining such information would be prohibitive. Indeed, the available data is quite limited. Nevertheless, some indicators exist.

6.a Statistics Canada's Household Survey (1996)

Data from Statistics Canada's Family Expenditure in Canada, 1996 was used to construct Table 1. The same source has been used to formulate Table 2 concerning household consumption of bottled propane.

First, throughout Table 1, household expenditure on water, fuel and electricity and food increases as income levels increase across the board. Moreover, expenditure on these items as a percentage of total expenditure falls as income levels increase. This is what one expects to observe of necessities.

The data reveal a different phenomenon in the case of bottled propane. If one examines Table 2, one notes that although expenditure on bottled propane as a percentage of total expenditure decreases as income levels increase, absolute expenditure levels neither uniformly increase nor decrease as income levels change. There would seem to be no set pattern. Still, the fact that expenditure on bottled propane as a percentage of total expenditure decreases as income levels increase indicates that a price increase would have a relatively larger impact the lower one's income.

One notes from Table 2 that average household expenditure on bottled propane as a percentage of total household expenditure nation-wide is only 0.23%. Usually, such a small figure would lead us to believe that even a substantial price increase would have little impact on households. However, I cannot conclude this here. Part of the problem is that these data are based on an estimated 1,907,587 (17.5% of 10,900,500) households using propane without distinguishing households that use propane only to run a gas barbecue from those who heat their homes with it. That is, the range in household expenditure on propane may range on the order of less than \$20 per year to several thousands of dollars annually. Moreover, Statistics Canada counts propane used to heat farmhouses as 'agricultural use' and not 'residential use', although I do not know if this distinction applies to the household survey cited.

TABLE 2**CANADA**

Year: 1996

Estimated Number of households: 10,900,500

Quintile	Total Expenditure per Household	Percentage of Households Consuming Bottled Propane	Average Expenditure per Consuming Household	Household Expenditure on Bottled Propane as a Percentage of Total Expenditure
All	\$49,068	17.5%	\$114	0.23%
Lowest	\$16,444	4.7%	\$277	1.68%
Second	\$29,250	11.1%	\$216	0.74%
Third	\$42,804	17.0%	\$88	0.21%
Fourth	\$59,696	25.5%	\$98	0.16%
Highest	\$97,145	29.1%	\$72	0.07%

The Propane Gas Association of Canada Inc. (1998) reports: "Statistics Canada estimates 102,000 Canadian households are fuelled by propane." Even if one were to consider this figure to be a rough approximation, it is still on the order of one-twentieth of the households estimated to use propane in the household survey (1,907,587). Therefore, Table 2 would grossly underestimate absolute expenditure on propane and expenditure on propane as a percentage of total expenditure for these approximately 102,000 Canadian households who are major consumers of propane. That is, household expenditure data in the Statistics Canada survey is heavily skewed toward minor consumers.

6.b Propane Customer Profiles

A survey prepared for Superior Propane by Canadian Market Research Ltd. (CMR) in 1997, "Defining Pricing Strategy in the Context of Customer Value Analysis (Commercial and Residential Markets): Research Report," offers much greater detail concerning the type of households and businesses that consume propane. Superior's commercial and residential customers in Atlantic Canada, Ontario and Québec (only) were surveyed. Therefore, the data reported below do not include the rest of Canada.

Regarding commercial sales, CMR notes (p.1, italics added): "*As Superior is aware, the commercial propane market concentrates in rural areas. In addition, propane users epitomize a small business market.*" Of Superior's commercial customers who responded to the survey (p.2), 47% used propane to operate a furnace, boiler or space heater, 49% used propane for cooking, 31% ran a propane hot water heater, 10% used it to operate a clothes dryer, 8% burned propane in a fireplace, and 1% heated a swimming pool with propane. Average annual expenditure on propane by commercial customers was \$4,917 in 1997, and 75% of these commercial establishments employed ten or fewer persons. 78% of these businesses were in the service, manufacturing or retail sector.

Regarding residential customers, CMR states (p.9):

“As Superior is aware, the residential propane market also concentrates in rural areas (74%). ...

“Overall, the respondent profile shows Superior is serving rural populations that are characterized by an older age skew. As a result of this older age skew, the customer base tends to be less educated (formally), not employed (retired) and lower income.”

CMR reports (p.10) that 53% of Superior's residential customers use propane for heating, 43% for cooking, 33% to fuel a hot water heater, 6% to run a clothes dryer, 18% to operate a fireplace and 10% to heat a swimming pool. Further (p. 11), 12% spend \$200 or less per year on propane, 10% between \$201 and \$300, 12% between \$301 and \$500, 21% between \$501 and \$1,000, 27% between \$1,001 and \$2,000, and 7% spend \$2,000 or more on propane per year. (10% of respondents did not answer this question.) Average annual expenditure was \$977 and the median annual expenditure was \$800. The average age of Superior customers was 52 years and 32% of customers were retired. Regarding annual household income, 15% of Superior customers earned less than \$25,000 per year, 11% earned between \$25,000 and \$35,000 annually, 12% between \$35,000 and \$45,000, 11% between \$55,000 and \$75,000, and 9% earned more that \$75,000 annually. (32% of those surveyed did not state their annual income.)

In brief, Superior's commercial customers, at least to the east of Manitoba, tend to be small businesses in rural areas. Its residential customers tend to be low-income, older-than-average and located in rural areas.

6.c End Uses of Propane

As discussed in Section 3.a.iii, the more a good is considered a necessity, the more price-inelastic demand for it will be. The more price-inelastic is demand, the smaller will be

the deadweight loss associated with the exploitation of market power created by a merger (and thus the greater the likelihood that the merger will satisfy the Total Surplus Standard). I noted that, in addition to usual concerns about anti-competitive impacts, there will be significant equity concerns in the case of a necessity. This is because a relatively poor household spends proportionately more of its income on necessities than a relatively wealthy household does (as illustrated in Table 1).

It is clear that propane is not a necessity in all uses. For example, propane used to fuel a gas barbecue may be closer to being a luxury than a necessity.

On the other hand, a person living in rural Canada who dries crops or heats his or her home with propane is a different matter. The CMR study (Section 6.b) reveals that many residential consumers live in rural areas, their incomes are low, and they tend to be older (at least according to CMR). These people may regard propane to heat their homes as a necessity (or nearly so), and thus this type of consumer would be quite vulnerable to price increases.

If propane is deemed a necessity, at least in some uses and locations, its demand will be price inelastic, and thus a price-increasing merger will lead to little deadweight loss. However, it is precisely in this case that equity concerns are greatest.

Of course, residential consumption of propane is only one component of total demand for propane. In some applications, such as agriculture, it is an input into production processes. Should the price of propane increase, it is likely that production costs will increase. Cost increases will be reflected in the prices of other consumer goods. However, without a full general equilibrium model, it is not known to what extent these other goods would be considered necessities. CMR's survey of Superior's commercial customers revealed that many were rural, small businesses, but the information provided is insufficient to

determine the precise nature of the goods and services these firms produce.

6.d Information from the United States

The Energy Administration (June, 1997) prepared "An Analysis of U.S. Propane Markets: Winter 1996-97." The main purpose of the study was to examine the causes and consequences of significant increases in the price of propane in the fall of 1996.

They note (p. 52): "Demand is ... relatively inflexible. Residential/commercial and agricultural demands are largely determined by the weather, and little fuel-switching capability exists." This would accord with the view that propane is quite price-inelastic.

With respect to the income characteristics of households — many of them rural — who heat their homes with propane, they note the following (p. 11): "Many propane-using households fall into low income levels, and find it difficult to absorb price increases such as those seen in 1996." They support this by observing that 25% of single-family households were eligible for federal fuel assistance at the time.

If American and Canadian households who heat their homes with propane are similar, this report suggests that demand is price-inelastic. Further, it suggests that low-income households are especially vulnerable to price increases.

6.e Summary

To examine the distributional impacts of an increase in the price of propane one would like to have a full set of data concerning household consumption according to use and income level. In addition, one would want information concerning other uses of propane

(e.g., agricultural) in order to assess how a price increase in any of these sectors may affect prices of other final goods and services.

CMR's survey of Superior's customers reveals that commercial users tend to be rural and small, and that many residential customers are rural, low-income and somewhat older. Also, there is some evidence that expenditure on propane as a percentage of total expenditure is proportionately more important for low-income families than high-income ones. An American study notes the impact of propane price increases on rural, low-income families.

It is expected that the price elasticity of demand is quite low. This notion is supported by the same American study. Again, when the reason for price inelasticity is that the good is a necessity or near-necessity, one may expect small deadweight losses and substantial distributional impacts.

7. Conclusion

A value judgement regarding income-distributional issues cannot be avoided in the applied welfare analysis of mergers. To apply the Total Surplus Standard is to make the judgement that a dollar is a dollar is a dollar to whomever it accrues. To apply a Price Standard is to judge the losses of consumers to be of infinite importance and the potential gains of firms to be of no importance. Both standards are unsatisfactory in this regard.

Another source of dissatisfaction is that application of a Total Surplus Standard would allow some welfare-diminishing mergers, whereas application of a Price Standard would rule out some potentially welfare-enhancing mergers.

Mishan, Harberger and Williamson — major authors in the fields of cost-benefit analysis, the measurement of welfare change and merger analysis, respectively — all note the

importance of both efficiency and equity in policy analysis. There is an equity-efficiency tradeoff to be assessed.

In the case of mergers, as in all applied welfare economics, how this tradeoff is to be assessed is problematic. The relevant legislation may provide direction. Ultimately and unavoidably, however, a value judgement must be made.

In the case of this specific merger, there are indications that the negative impacts of a price increase would fall disproportionately on relatively low-income families and small, rural businesses. Moreover, it would appear that in some uses propane is regarded somewhat as a necessity. In this circumstance one expects a minor deadweight loss and a major distributional concern to coincide.

APPENDIX A: A MATHEMATICAL TREATMENT

Suppose one believes (not unreasonably) that aggregate economic welfare (W) of a country depends on the well-being or utility (U) of its citizens, and that the utility of an individual depends on his or her income (y). A general social welfare function that represents these beliefs is given by equation 1:

$$W = W[U_1(y_1), U_2(y_2), U_3(y_3), \dots U_i(y_i), \dots U_n(y_n)] \quad [1]$$

Here y_i denotes the income of person i and U_i denotes his or her utility (which is a function of his or her income). The number of individuals or households in this society is given by n .

Now suppose that some event like a merger makes some people better off, some worse off, and some no better or worse off. Here, dy_i , person i 's change in income, is measured by his or her compensating variation (or consumer or producer surplus in the context of the Total Surplus Standard). That is, dy_1 might be positive (Person 1 gains by the merger), dy_{12} might be negative (Person 12 loses by the merger) and so forth.

Equation 2 gives the change in aggregate welfare (dW):

$$\begin{aligned} dW = & (\partial W/\partial U_1) \cdot (\partial U_1/\partial y_1) \cdot dy_1 + (\partial W/\partial U_2) \cdot (\partial U_2/\partial y_2) \cdot dy_2 + \\ & (\partial W/\partial U_3) \cdot (\partial U_3/\partial y_3) \cdot dy_3 + \dots + (\partial W/\partial U_i) \cdot (\partial U_i/\partial y_i) \cdot dy_i + \dots + \\ & (\partial W/\partial U_n) \cdot (\partial U_n/\partial y_n) \cdot dy_n . \end{aligned} \quad [2]$$

First, if person j is not affected by the merger, then $dy_j = 0$ and all 'j' values drop out of the equation. For example, the merger might be between two tour operators specializing in group sailing trips across Hudson Bay, and Person j hates sailing, water and

groups. So even if the merger of the two operators would cause the price of a trip to increase, Person j does not care ($CV_j = dy_j = 0$).

Second, $\partial W/\partial U_i$ terms appear in each of the terms on the right-hand side of equation 2. This measures by how much social welfare changes when Person i 's utility changes. If one believes that one person's well-being is as important as the next person's, $\partial W/\partial U_i$ should be identical to $\partial W/\partial U_1$, $\partial W/\partial U_2$ and to all other like terms. Thus, they may be omitted.

Therefore, the expression for the change in social welfare reduces to a much simpler expression:

$$dW = (\partial U_1/\partial y_1) \cdot dy_1 + (\partial U_2/\partial y_2) \cdot dy_2 + (\partial U_3/\partial y_3) \cdot dy_3 + \dots + (\partial U_i/\partial y_i) \cdot dy_i + \dots + (\partial U_n/\partial y_n) \cdot dy_n . \quad [3]$$

In equation 3, $\partial U/\partial y_i$ is Person i 's marginal utility of income. The Total Surplus Standard treats this as if it is the same for all individuals. So, given this value judgement, these are treated as all being identically equal to one (and thus are dropped from the equation). The resulting expression for the change in aggregate welfare (dW_{TS} in this special case) thus reduces to

$$dW_{TS} = dy_1 + dy_2 + dy_3 + \dots + dy_i + \dots + dy_n , \quad [4]$$

where all the positive dy_i terms are grouped as aggregate producer gains (gains from the increase in price caused by the merger plus 'efficiency' gains) and all of the negative dy_j terms are grouped together as the loss of aggregate consumer surplus due to the price-increasing impact of a merger.

For example, and for simplicity, assume there are 3 firm owners and 3 consumers for whom $dy_1 = 100$, $dy_2 = 50$, $dy_3 = 25$, $dy_4 = -20$, $dy_5 = -40$, and $dy_6 = -90$. In this case, with all the assumptions involved and employing equation [4], the change in total surplus = $dW_{TS} = 25$. Therefore, the merger would pass the Total Surplus Standard.

However, what if $\partial U_1/\partial y_1 \neq \partial U_2/\partial y_2 \neq \partial U_3/\partial y_3 \neq \dots \neq \partial U_i/\partial y_i \neq \dots \neq \partial U_n/\partial y_n$? That is, what if marginal utilities of income are not equal? Indeed, suppose individuals 1 through 6 are ranked from wealthiest to poorest. If one believes that marginal utility of income decreases as income increases, then $\partial U_1/\partial y_1$ through $\partial U_6/\partial y_6$ might exhibit a pattern such as 0.25, 0.50, 0.75, 1.25, 1.50 and 1.75.

If one now calculates the change in social welfare using these weights according to equation [3],

$$\begin{aligned} dW &= 0.25(100) + 0.50(50) + 0.75(25) + 1.25(-20) + 1.50(-40) + 1.75(-90) \\ &= -173.75. \end{aligned}$$

Therefore, albeit in a constructed example, the total surplus method would indicate an aggregate welfare gain whereas, in fact, the merger would reduce welfare.

APPENDIX B: PRICE ELASTICITY AND THE TOTAL SURPLUS STANDARD

Williamson (1968: 22) derives (mathematically) cost savings minus deadweight loss (Area A - area C in Figure 1). Although it would be an exact formulation if the demand function in question were linear, Williamson allows that the following is his approximation for non-linear demand functions.

The Total Surplus Standard is satisfied if

$$\frac{\Delta AC}{AC} - \frac{k}{2} \eta \left(\frac{\Delta P}{P} \right)^2 > 0$$

- Here
- $\Delta AC = (AC_1 - AC_2)$;
 - AC denotes the average of AC_1 and AC_2 ;
 - k is an "index of pre-merger market power" and is greater than or equal to one;
 - $\Delta P = (P_2 - P_1)$;
 - P denotes the average of P_1 and P_2 ; and,
 - η is the price elasticity of demand, here defined to be a non-negative number. If η is less than one, the good is price-inelastic, and if η is greater than one, the good is price-elastic.

Note that if demand for the good in question is perfectly price inelastic (the case of an absolute necessity), $\eta = 0$, and any cost saving would cause the Total Surplus Standard to be satisfied. For less extreme elasticities, there is interplay among η , P and ΔP . That is, the lower the elasticity, the greater may be the price increase due to monopoly power, but this would raise the average price.

APPENDIX C: A NUMERICAL EXAMPLE

Please refer to Figure 1. Assume that $A = \$9$ -billion, $B = \$8$ -billion and $C = \$7$ -billion, where A is a measure of 'efficiency' gains, B measures the impact of the price increase on producers and consumers, and C denotes the deadweight loss due to monopoly.

- The total surplus method is simply $(A - C) = \$2$ -billion. The merger satisfies the Total Surplus Standard.
- This merger does not satisfy the Price Standard because price rises.
- The loss of consumer surplus is given by $B + C$ (\$15-billion), whereas the 'efficiency' gain is given by A (\$9-billion). As $(B + C) > A$, the merger fails to satisfy the Consumer Surplus Standard.

To calculate the set of weights that just balances gains and losses, one can assign a weight of 1 to producers' gains and a weight of w to consumers' losses. Here, the value of w is the one that just causes the weighted change in total surplus to be equal to zero. This is the solution to

$$TS = 0 = (1) \cdot (\$9-b) + (1) \cdot (\$8-b) - (w) \cdot (\$8-b) - (w) \cdot (\$7-b).$$

The solution to this equation is $w = 1.13333$.

Then, given the circumstances of a particular merger, if decision-makers think that the appropriate (common) welfare weight to be attributed to consumers is greater than that accorded to owners of merging firms by more than a factor of 1.13333 (13.33 $\frac{1}{3}$ %), the merger would be rejected.

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