Journal of Benefit-Cost Analysis

Volume 3, *Issue* 2 2012 *Article* 3

Scitovsky Reversals and Practical Benefit-Cost Analysis

Richard E. Just, *University of Maryland*
Andrew Schmitz, *University of Florida*
Richard O. Zerbe, *University of Washington, Seattle*

Recommended Citation:

Just, Richard E.; Schmitz, Andrew; and Zerbe, Richard O. (2012) "Scitovsky Reversals and Practical Benefit-Cost Analysis," *Journal of Benefit-Cost Analysis*: Vol. 3: Iss. 2, Article 3.
DOI: 10.1515/2152-2812.1109

Scitovsky Reversals and Practical Benefit-Cost Analysis

Richard E. Just, Andrew Schmitz, and Richard O. Zerbe

Abstract

The possibility of preference reversals according to the Kaldor-Hicks (KH) criterion in benefit-cost analysis has concerned economists since Scitovsky (1941) first published his results. Lawyers and philosophers have argued that the potential of reversals calls the use of benefit-cost analysis into question, implying elimination of its use. We demonstrate that reversals occur only with inferior goods in the case of static production possibilities and that reversals occur under changing production possibilities only when production possibilities frontiers cross, which is a myopic characterization that ignores practical cases of global production possibilities.

KEYWORDS: Scitovsky, inferior goods, crossing production possibility frontiers, benefit-cost analysis

Author Notes: Richard E. Just is Distinguished University Professor at the University of Maryland, Andrew Schmitz is Eminent Scholar and Ben Hill Griffin Jr. Endowed Chair at the University of Florida and Richard O. Zerbe is the Daniel J. Evans Distinguished Professor at the Evans School, University of Washington. We would like to thank Tyler Scott for research assistance. Professor Zerbe would like to thank the John D. and Catherine T. MacArthur Foundation and the Center for Benefit-Cost Analysis for support while working on this article.

Introduction

The possibility of preference reversals in benefit-cost analysis has concerned economists since Scitovsky (1941) first published his results. Scitovsky preference reversals refer to situations in which, using the Kaldor-Hicks potential compensation test (PCT), one would choose to move from state A to state B but, using the same test, would choose to move back from B to A.[1] Lawyers and philosophers have fastened onto the reversal possibility to attempt to call the use of benefit-cost analysis into question (e.g., Coleman, 1980; Markovits, 1993). In a recent book, Markovits (2008: 53) writes:

> This Scitovsky Paradox invalidates the Kaldor-Hicks test because it implies that, if the test were accurate and a Scitovsky paradox arose, both the policy and its reversal would be economically efficient and, hence, the policy would simultaneously be economically efficient and economically inefficient.

Even in an article advocating benefit-cost usage, Adler and Posner (1999: 186) write "even if the reversal will not occur, its possibility haunts the entire project of CBA."[2]

The purpose of this paper is to show that, although important concerns have been raised about the PCT,[3] the reversal paradox is not one of them. Recently, Schmitz and Zerbe (2008) have shown several cases where reversals are unlikely in most practical applications of benefit-cost analysis. For example,

[1]Technically, there are two compensation criteria (Coate, 2000). Kaldor (1939) evaluates a policy change by comparing the *status quo* with a set of allocations that can be reached through lump sum redistribution from the post-change situation. Hicks (1940) evaluates a policy change by comparing the post-change utility allocation with the set of allocations attainable through lump sum redistribution from the *status quo*. A policy change is desirable if there does not exist a utility allocation in the latter set, which is Pareto superior to the post-change situation. In other words, the Hicks criterion applies in the reverse direction compared to that of Kaldor.

[2]Note, however, that Adler and Posner (1999: 216) go on to state that despite "the dominant focus, in the critical literature, on the features of CBA that no respectable moral criterion would (allegedly) possess [such as] Scitovsky reversals… it is a mistake to leap from the existence of these features to the conclusion that it is wrong for CBA to be institutionalized as the method by which agencies choose between projects."

[3] Some of these involve the possibility that rankings can be altered by compensation or its form, and that some states including first-best states cannot be ranked by the PCT. However, the latter two are not so serious upon realizing that no objective criterion can rank income distributions, and the former two only become relevant in such matters. Blackorby and Donaldson (1990) have also raised a concern about the use of compensating and equivalent variations, which are typically used to apply the PCT.

https://doi.org/10.1515/2152-2812.1109 Published online by Cambridge University Press

reversals do not occur if one of the policies generates a first-best bundle of goods, or if compensation is actually paid. Left open, however, are other cases of normal goods and typical cases of weakly positive technological progress. These conditions are considered here. The results are that reversals do not arise in comparing two states if the goods of interest are normal rather than inferior goods and production possibility frontiers (PPFs) in the two states do not cross. These conditions are likely to hold for practical benefit-cost analysis because policies of political interest typically focus on normal goods, and new technologies and public infrastructure investments typically lead to new PPFs that weakly dominate old frontiers.

Background

The legal philosopher Coleman (1980: 519f) uses an example of reversibility to argue that the Kaldor-Hicks PCT is not a useful criterion for decision-making. Table 1 outlines Coleman's hypothetical example, demonstrating the before-project and after-project states of the world. Both Mr. 1 and Ms. 2 are assumed to prefer having one unit each of good X and good Y to having two units of either good. The situations before and after the project are shown in Table 1. Note that the project PPF transforms one unit of X into one unit of Y.

Table 1. Coleman's preference reversal example.

	Status quo (State A)		Proposed project (State B) (without compensation)	
	Good X	Good Y	Good X	Good Y
Mr. 1	2	0	1	0
Ms. 2	0	1	0	2

The proposed project passes the PCT as, in the new state of the world, Ms. 2 could give one unit of Y to Mr. 1, leaving him better off with one unit of X and one unit of Y, and Ms. 2 no worse off, having one unit of Y as in the original state. However, in the *status quo* situation Mr. 1 could give one unit of X to Ms. 2, leaving her better off than she would be after the proposed project and Mr. 1 no worse off than he would be following the proposed project. Thus, a Scitovsky reversal occurs. On this basis, Coleman argues strongly that benefit-cost analysis is not a useful basis for decision-making.

Four properties of this example are noteworthy: (1) compensation is implicitly assumed to be costless; (2) both situations are second best; (3) compensation is not actually paid so either Mr. 1 or Ms. 2 loses in moving between states A and B; and (4) goods X and Y are inferior goods to at least one party. This example does not consider what we characterize as the typical case of

https://doi.org/10.1515/2152-2812.1109 Published online by Cambridge University Press

potential reversals because Coleman's PPF shifts such that the new frontier does not weakly dominate the old one. The assumption of costless compensation is consistent with the standard PCT approach, but it loses salience in the real world. Without costless compensation a reversal may not occur (e.g., if having one unit of each good in the example is not preferred over two units of one good by more than the cost of compensation). Nor will a reversal occur if compensation actually takes place.

Second-best situations

With reference to Coleman's example, the logic of second best implies that there is a state of the world that is Pareto superior to it that should be considered. The obvious question is: why not move to a first-best situation?[4] The full array of possibilities is shown in Table 2.

Table 2. Absence of reversals when comparing to first-best states.

	A *Status quo*		B Uncompensated state after the proposed project		A′ Pareto superior state compared to *status quo*		B′ Pareto superior state compared to state after the proposed project	
	Wheat	Cotton	Wheat	Cotton	Wheat	Cotton	Wheat	Cotton
Mr. 1	2	0	1	0	1	1	1	0
Ms. 2	0	1	0	2	0	1	1	1

To make the example concrete, suppose the two goods X and Y represent wheat and cotton, and that one acre of land produces one unit of either wheat or cotton. Welfare optimization does not lead to either states A or B because a state A′ is possible that is Pareto superior to state A and a state B′ is possible that is Pareto superior to state B (recall that the PPF can transform one unit of one good into one unit of the other good). Because states A′ and B′ are first-best states, they are Pareto non-comparable. Neither the move from A′ to B′ nor the move from B′ to A′ passes the PCT. Thus, a reversal cannot occur.[5] Trade in either land or

[4] We acknowledge that some economists regard first-best states as unattainable because of transactions costs (Coate, 2000). To simplify our discussion, we prefer alternatively to regard unavoidable transactions costs as defining production possibility frontiers that characterize feasible first-best states. See Zerbe and MuCurdy (1999).

[5] The Coleman example will, of course, not work without considering potential compensation. The PCT requires that a given distribution of the initial bundle is compared with all possible

https://doi.org/10.1515/2152-2812.1109 Published online by Cambridge University Press

goods can produce such a first-best situation. These results follow generally from the standard finding that the reversal problem arises only in comparisons between two second-best bundles (Just et al., 2004). Thus, the second-best example is relevant for practical purposes only where a first-best situation cannot be reached, for example, in the case of market failure that cannot be corrected by government intervention.

If compensation is actually paid, then the reversals of Coleman's example do not occur. In moving from A to B, Mr. 1 loses, and in moving from B to A Ms. 2 loses. However, if compensation is actually paid in each case, then the resulting states are Pareto superior from which no reversal occurs. These possibilities are also illustrated in Table 2. In moving from A to B, the compensation suggested by the Coleman example (payment of one unit of cotton as compensation by Ms. 2 to Mr. 1) achieves the same distribution represented by state A′ in Table 2 if paid. Similarly, the compensation suggested for the move from B to A (payment of one unit of wheat as compensation by Mr. 1 to Ms. 2) achieves the same distribution represented by state B′ in Table 2 if paid. Thus, no reversals are possible because Pareto superior states are attained.

Inferior goods and reversibility

A simple proof shows that a good must be inferior in order for a reversal to occur.[6] A good is inferior (normal) when increasing income causes an individual's demand for the good to decrease (increase). In the pure consumer model, inferiority of a good causes WTP > WTA. Suppose Mr. 1 receives (x_1^A, y_1^A) of respective goods *X* and *Y*in state A and (x_1^B, y_1^B) in state B, and Ms. 2 receives (x_2^A, y_2^A) in state A and (x_2^B, y_2^B). in state B. Then, for both Mr. 1 and Ms. 2, willingness to pay (WTP) for the change from state A to state B in terms of good *Y* is defined by:

$$u_i(x_i^A, y_i^A) = u_i(x_i^B, y_i^B - \mathrm{WTP}_i^{AB}),\ i = 1, 2. \tag{1}$$

and willingness to accept (WTA) to forego the change from A to B is defined by:

distributions of the second bundle. In comparing only states A and B without potential compensation considerations, they are non-comparable.

[6] In the example of Table 2, cotton has less value to Mr. 1 in state A′ than in state A. The value of cotton has fallen in the higher income state so that cotton is an inferior good to Mr. 1. Similarly, wheat is an inferior good for Ms. 2.

https://doi.org/10.1515/2152-2812.1109 Published online by Cambridge University Press

$$u_i(x_i^A, y_i^A + \mathrm{WPA}_i^{AB}) = u_i(x_i^B, y_i^B),\ i = 1,2. \tag{2}$$

Similarly, for the change from state B to state A, WTP and WTA are defined by reversing the roles of A and B in Equations (1) and (2). As is well known, $\mathrm{WTA}_i^{AB} > \mathrm{WTP}_i^{AB}$ holds if good X is a normal good with respect to income (as represented by good Y); also, by definition, $\mathrm{WTP}_i^{BA} = -\mathrm{WTA}_i^{AB}, i = 1,2$ (Just et al., 2004; Zerbe and Bellas, 2006). The PCT criterion requires

$$\mathrm{WTP}_1^{AB} + \mathrm{WTP}_2^{AB} > 0 \tag{3}$$

to make the change from A to B, which is the familiar condition that requires a positive sum of compensating variations over all individuals to satisfy the PCT criterion. A reversal occurs if and only if, in addition to (3), $\mathrm{WTP}_1^{BA} + \mathrm{WTP}_2^{BA} > 0$, or equivalently,

$$-\mathrm{WTA}_1^{AB} - \mathrm{WTA}_2^{AB} > 0, \tag{4}$$

which is the familiar condition whereby a reversal does not occur if the sum of equivalent variations over all individuals is also positive. Adding Equations (3) and (4) obtains

$$\mathrm{WTP}_1^{AB} - \mathrm{WTA}_1^{AB} + \mathrm{WTP}_2^{AB} - \mathrm{WTA}_2^{AB} > 0, \tag{5}$$

which cannot hold if X is a normal good for both individuals (i.e., if $\mathrm{WTA}_i^{AB} > \mathrm{WTP}_i^{AB}, i = 1,2$). Thus, a reversal can occur only if X is an inferior good for one of the parties (and that inferiority dominates the relationship of sums of compensating and equivalent variations), even in comparing second-best states. Although inferiority is a condition synonymous with WTP > WTA in the pure consumer model of this section, we show below that WTP > WTA can occur more generally for normal goods in a model including production.

Reversibility with crossing production possibility frontiers

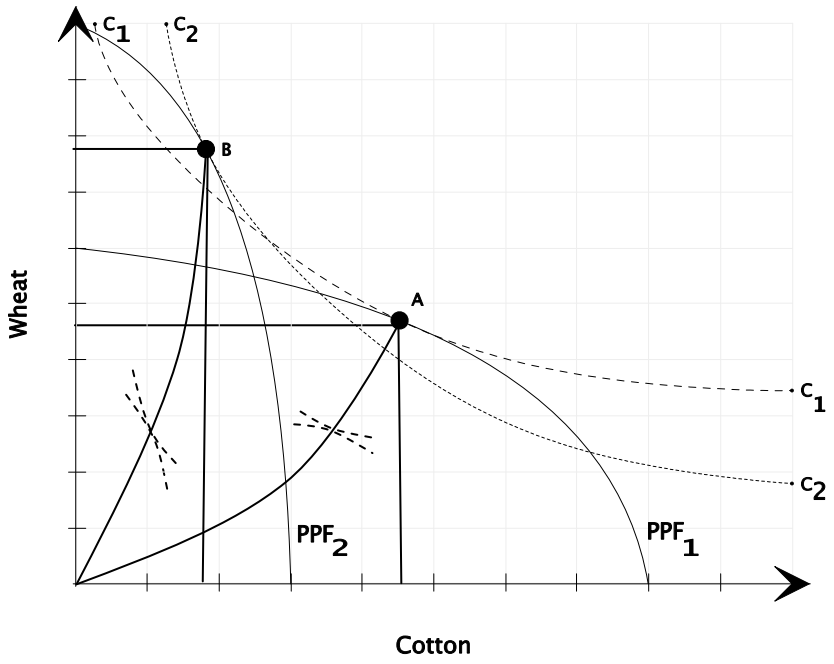
The standard demonstration of the Scitovsky reversal paradox is with a fixed PPF and a temporal choice (Blackorby and Donaldson, 1990). Thus, the standard assumption is that projects that shift the PPF are not considered. Although the above results show that Scitovsky reversals will not occur under this standard

https://doi.org/10.1515/2152-2812.1109 Published online by Cambridge University Press

assumption when all goods are normal goods, reversals can occur in more general comparisons that evaluate changes in technology that produce crossing PPFs.[7]

Figure 1 illustrates the case of crossing PPF's and Scitovsky indifference curves (SICs) associated with alternative allocations. An SIC represents the locus of indifference points for persons 1 and 2 for given allocations within the Edgeworth-Bowley boxes associated with production points A and B (see Just et al., 2004). In Figure 1, consider a move from A to B associated with a shift from an original PPF_1 to a new PPF_2 where PPF_2 lies partly above and partly below PPF_1. In this case, an SIC such as C_1 can be tangent to PPF_1 at point A, and yet lie below PPF_2 at point B. By contrast, an SIC such as C_2 can be tangent to PPF_2 at point B, and yet lie below PPF_1 at point A. In this case, reversals can occur even though no goods are inferior.

Figure 1. Scitovsky reversals with a non-normal PPF shift.



[7]In addition, no ambiguity arises when there is a distribution rule (a rule that chooses one income distribution over another) that can be used to prefer one of two otherwise indifferent choices (Mishan, 1981).

https://doi.org/10.1515/2152-2812.1109 Published online by Cambridge University Press

When two SICs are tangent to the same PPF, the respective first best allocations are Pareto non-comparable because they cannot cross inside the feasible output set, assuming the PPF has a typical concave shape and the indifference curves have the typical convex shape. Thus, no changes are possible that pass the PCT. However, as Figure 1 illustrates, if the SICs associated with A and B are tangent to different PPFs, and cross between the points of tangency at A and B, then a reversal is possible.

However, even these reversals cannot occur with normal technological change whereby the PPF under the new technology weakly dominates the PPF under the old technology. In this case, any SIC tangent to the new PPF will be above all feasible points under the old technology. Reversals can occur with non-normal shifts in the PPF when the PCT is applied to crossing Scitovsky indifference curves because the PCT requires that a given distribution of the initial bundle is compared with all possible distributions of the second bundle.

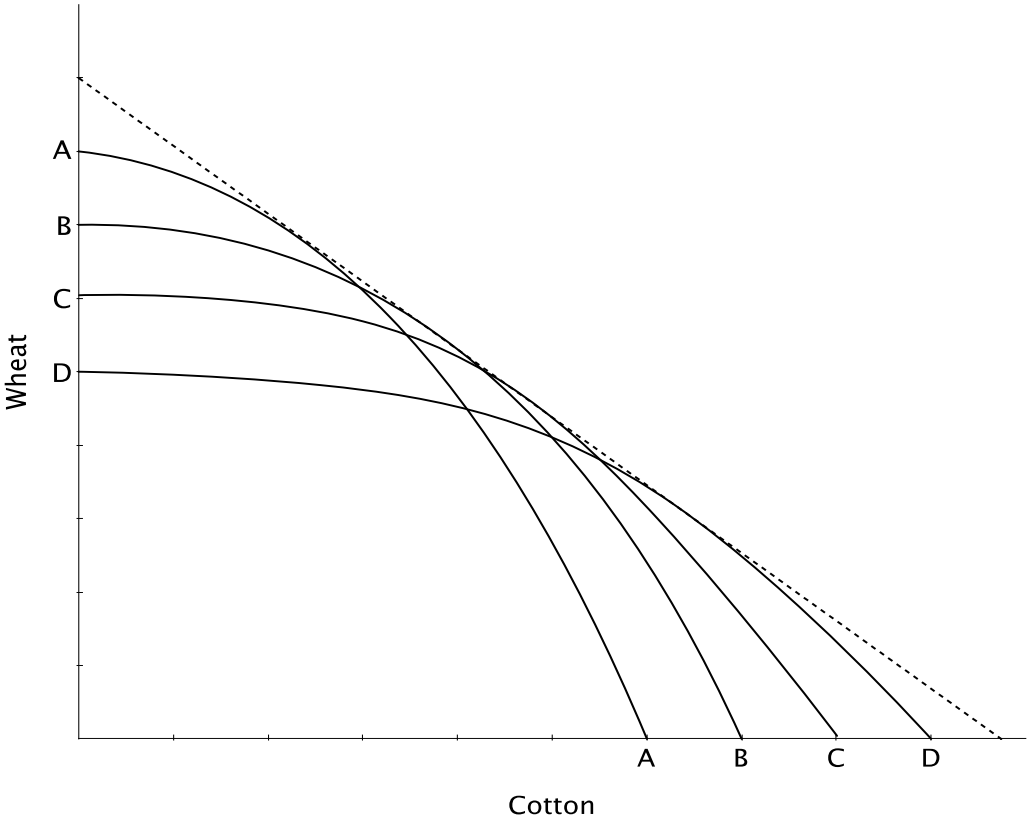
Inapplicability of reversals with global welfare maximization

From a broader perspective, the potential for reversals disappears when a more global view is taken of welfare optimization. This is true for static production possibilities even with inferior goods if compensation is actually paid in cases where willingness to pay exceeds willingness to accept in aggregate. In the case of changing production possibilities, practical cases of incremental technological progress and the ability to scale up or down many projects and policies means that the alternatives are rarely represented by two distinctly different PPFs. That is, the move from one PPF to another tends to take place in marginal steps over time by adjusting policy parameters or project scales. Thus, the move between alternative PPFs can be characterized by a choice among many PPFs, as illustrated in Figure 2. With many feasible PPFs, the grand PPF can be defined as the envelope of feasible PPFs, as illustrated by the dotted curve in Figure 2. From this global perspective, economic efficiency calls for operating on the grand PPF, which dominates any parts of individual PPFs that are not on the frontier of the grand PPF.

In this context, first-best situations are defined with respect to the envelope curve or grand PPF. Assuming the grand PPF is concave, as is highly plausible, the problem of reversals among crossing PPFs disappears. That is, no reversals would occur in the context of the grand PPF under the same conditions as reviewed in the first part of this paper for the fixed PPF case.

https://doi.org/10.1515/2152-2812.1109 Published online by Cambridge University Press

Figure 2. The envelope of many crossing production possibility frontiers.



Conclusions

Scitovsky reversals have raised questions about the use of the compensation principle in benefit-cost analysis and have been used to argue that benefit-cost analysis should be abandoned. On the contrary, this paper shows that reversals cannot occur in the broad classes of cases that characterize practical problems of benefit-cost analysis. Absence of inferior goods is shown to eliminate the possibility of reversals in the context of a fixed PPF. Even with inferior goods, reversals do not occur if a first-best bundle is considered or compensation is paid. We further show that reversals with changing PPFs are possible only with crossing frontiers, which occur only in the myopic case of ignoring the grand PPF defined as the envelope of all possible PPFs (under practical assumptions about shape).Thus, the debate over whether or not the reversal possibility furnishes a reason to abandon or question the use of benefit-cost analysis is resolved in favor of the use of benefit-cost analysis for practical purposes.

https://doi.org/10.1515/2152-2812.1109 Published online by Cambridge University Press

References

Adler, M.D., and E.A. Posner. 1999. Rethinking cost-benefit analysis. *Yale Law Journal* 109 (2): 165–247.

Blackorby, C., and D. Donaldson. 1990. A review article: The case against the use of the sum of compensating variations in cost-benefit analysis. *The Canadian Journal of Economics. Revue Canadienne D'économique* 23 (3): 471.

Coate, S. 2000.An efficiency approach to the evaluation of policy changes. *Economic Journal* 110 (463): 437–455.

Coleman, J. 1980. Efficiency, utility and wealth maximization. *Hofstra Law Revie*w 8 (3): 509–551.

Hicks, J. 1940.The valuation of social income. *Economica* 7 (26): 105–124.

Just, R.E., D.L. Hueth, and A. Schmitz. 2004. *The Welfare Economics of Public Policy: A Practical Approach to Project and Policy Evaluation*. Cheltenham, UK: Edward Elgar.

Kaldor, N. 1939.Welfare propositions and interpersonal comparisons of utility. *Economic Journal* 49 (145): 549–552.

Markovits, R.S. 1993. A constructive critique of the traditional definition and use of the concept of the effect of choice on allocative (economic) efficiency: Why the Kaldor Hicks Test, the Coase theorem, and virtually all law and economics welfare arguments are wrong. *University of Illinois Law Review* 485: 512–515.

Markovits, R.S. 2008. *Truth or Economics: On the Definition, Prediction, and Relevance of Economic Efficiency*. New Haven CT: Yale University Press.

Mishan, E. 1981. *Introduction to Normative Economics*. New York: Oxford University Press.

Schmitz, A., and R.O. Zerbe, Jr. 2008. Scitovsky reversals and efficiency criteria in policy analysis. *Journal of Agricultural & Food Industrial Organization* 6 (2): Article 3.

Scitovsky, T. 1941. A note on welfare propositions in economics. *Review of Economic Studies* 9: 77–88.

Zerbe, R., and A. Bellas. 2006. *A Primer for Benefit-Cost Analysis*. Cheltenham, UK: Edward Elgar.

Zerbe, R.O., and H.E. MuCurdy. 1999. The failure of market failure. *Journal of Policy Analysis and Management* 18 (4): 558–578.

https://doi.org/10.1515/2152-2812.1109 Published online by Cambridge University Press