VERY ROUGH DRAFT!

Title idea 1: **The Uselessness of Cost-Benefit/Kaldor-Hicks Evaluations in a General Framework**

Title idea 2:

Separating Efficiency from Distribution: A Pyrrhic Victory

Title Idea 3:

The Potential Pareto Criterion Endorses Pareto-Worsening Moves

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Abstract. We use non-monetary definitions of the Kaldor and Hicks Tests due to Hayashi (2017), which very attractively capture the essence of the Potential Pareto principle, to define Kaldor-efficient and Hicks-efficient points. We show that in a pure-exchange economy, there are no Hicks-efficient points, and the set of Kaldor-efficient points is the set of Pareto-efficient points. In an economy with production, a move to a larger Edgeworth Box passes the Kaldor Test even if it makes everyone worse off, and a move to a smaller Edgeworth Box fails the Hicks Test even if it makes everyone better off.

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The Kaldor Potential Pareto Criterion ("PPC") for social decision-making says, at its most basic level, that a policy should be adopted if, upon adoption, a further change could be made that would leave everyone better off (weakly, with strict for one person) than they were in the beginning. Complementary to this, the Hicks Potential Pareto Criterion says that a policy should not be adopted if, upon failure to adopt it, a further change could be made that would leave everyone better off (weakly, with strict for one person) than if the policy had been adopted.

Ever since the publication of Kaldor (1939) and Hicks (e.g., 1943), economists have been divided into two camps: the first, unimpressed by the arguments of Kaldor and Hicks ("K-H"), maintain Pareto Efficiency as the only valid criterion for making social decisions outside of using social welfare functions which explicitly incorporate value judgments; and the second, accepting K-H's arguments, and thus using Cost-Benefit Analysis ("CBA") (environmental economics), its alter-ego "the Kaldor-Hicks Criterion" (law and economics), or using "surplus maximization," which gets legitimacy from Willig's argument that it approximates the K-H approach. One complaint which the second camp has about the Pareto Criterion is obviously true: Pareto cannot rank all policies. The K-H approach is much superior to Pareto in this respect: Kaldor can rank any pair of policies whose aggregate "compensating variation" (defined below) is nonzero, and Hicks can rank any pair of policies whose aggregate equivalent variation (defined below) is nonzero. The second complaint the second camp only makes by implication: the second camp wishes to separate efficiency from distribution, and using Pareto Efficiency makes this impossible.

The facts concerning the first complaint are by now well understood. Scitovsky (1941) pointed out a long time ago that the Kaldor and Hicks Tests can contradict each other. Many authors since then have insisted this invalidates the K-H approach, but this clearly has not dissuaded large numbers of economists from applying that approach to important questions of public policy.

The facts concerning the second complaint are wrapped in confusion, and the purpose of this paper is to sort them out. Proponents of Potential Pareto ("PP," which is what we will call K-H/CBA for the rest of this paper), starting with Kaldor (1939 p. 550) and becoming more explicit in Musgrave (cited by Tirole 1988 p. 32) and Harberger (1971), claim that efficiency can be separated from distribution, and that doing so distinguishes objective, "scientific" analysis, which concerns efficiency, from subjective, unscientific, ethical or moral considerations, which concern distribution and which economists "have no expertise in discussing." Typical of the way *opponents* of the K-H approach address the efficiency-vs.-distribution controversy is Blackorby and Donaldson (1990 p. 490): "a notion of efficiency that is independent of the distribution of income—an idea that makes no sense in real-world economies."

After decades of conflict no progress has been made in resolving this controversy because these groups have been talking at cross-purposes. Opponents of PP are saying, correctly, that one cannot separate *Pareto* efficiency from distribution. Proponents of PP implicitly reply that they are not using Pareto Efficiency, so the opponents' proposition is true but completely irrelevant. The Proponents are using Potential Pareto Efficiency, and, the implication goes, *that* can be separated from distribution. Regrettably, the proponents of the PP Criterions have never been explicit on this point. Once stated, the point immediately raises the question: can one *prove* that efficiency and distribution are separate when efficiency is understood in the PP sense? Proponents of PP have not attempted such a proof. Constructing it would require characterizing the set of PP-efficient points and showing that it is independent of distribution. However, the literature lacks a characterization of PP points. The PP Criterion has been applied on a one-by-one basis only, asking whether one particular policy does or does not pass either the Kaldor Test or the Hicks Test. This is inadequate to supply a characterization of *all* the points which would pass the Kaldor Test, or the Hicks Test.

Using Hayashi's (2017) generalization of the Kaldor and Hicks Tests, this paper supplies a characterization of the points which would pass the Kaldor Test, or would pass the Hicks Test. Given this characterization, we show that the proponents of PP are correct: PP efficiency is, unlike Pareto Efficiency, separate from distribution. However, we also show that in exchange economies, PP efficiency amounts to little more than an exhortation to go to anywhere on the contract curve; and in production economics, it endorses any increase in production in any commodity if unaccompanied by decrease in production of any other commodity, regardless of whatever changes in distribution may have been required to obtain that production increase. The ethical demerits of these implications mean that overall, the PP Criterion looks worse at the end of this paper than it did at the beginning, despite this paper's vindication of its claim that (its version of) efficiency is separate from distribution.

The ethical shortcomings of the PPC were first pointed out long ago and are not this paper's initial concern, but they should be kept in mind. The PPC endorses all acts of theft so long as the thief is sufficiently wealthy that, had they been forced to pay the victim's value ("willingness to accept", *WTA*) for the stolen object, both thief and victim would be better off than before the theft. The legal implication of the PPC is that if a rational seller would be willing to accept compensation *WTA* in return for giving up object "X," and if a rational buyer would willingly and credibly pay *WTA* for that object, then theft of X by the potential buyer should go unpunished by the country's court system, absent incentive effects. However the same theft, if committed by a thief so poor as to be unable to willingly and credibly pay *WTA* for the object, should, according to PPC, be punished. Since the PPC endorses involuntary transfers from the poor to the rich but not vice versa, it unsurprisingly has enjoyed great popularity among some policy makers, judges, and economists during the era of rising income inequality post-1980, as perusal of the literature on Cost-Benefit Analysis, Law and Economics, or antitrust analysis would demonstrate. Kaldor pointed out that the PPC justified repeal of the Corn Laws and the subsequent impoverishment of landlords, who by 1846 evidently had lost most of their political and economic power. In the same way, the PPC justified free trade arguments in the late twentieth century and the subsequent impoverishment of industrial workers in developed countries, who had by the late 1980's lost most of their political and economic power. While the "Takings Clause" of the US constitution's Fifth Amendment protects people from losing their property due to government action without compensation, workers have never had enough political power to accomplish enactment of a similar provision protecting people from losing their jobs due to government action without compensation. For that matter, industrialists are also unprotected from government action rendering their industry unprofitable. Only holders of real property, who held most political power in the eighteenth century, are protected by the Takings Clause.

1. Using Compensating and Equivalent Variation to Operationalize the Potential Pareto Criterion

Traditionally, the Kaldor criterion has been operationalized by checking whether the "willingness [and ability] to pay" (traditionally *WTP*, here *WATP*) of the "winners" from the policy exceeds the *WTA* of the "losers" of the policy. The Hicks criterion has been operationalized by checking whether the *WTA* of the "winners" from the policy, if the policy is abandoned, exceeds the *WATP* of the "losers" of that policy. However, the Potential Pareto criterion, as expressed above, actually does not require there to exist any policy "winners."

Operationalizing the Potential Pareto criterion in the traditional way can also be expressed using compensating variation, CV, and equivalent variation, EV. If they are measured in terms of money, as is typical, the using v to denote the indirect utility function, $\mathbf{p}$ to denote the price vector, i to denote income, zero subscripts to denote the initial situation, and primes to denote the new situation, the definition of CV and EV for a price and income change are

$$v(\mathbf{p}', i' - CV) = v(\mathbf{p}_0, i_0) = u_0$$

and

$$v(\mathbf{p}_0, i_0 + EV) = v(\mathbf{p}', i') = u' \,.$$

The sign of CV and EV will be positive if $u' > u_0$ and negative if $u' < u_0$. If $u' > u_0$ then $CV = WATP$ and if $u' < u_0$ then $CV = WTA$. If $u' > u_0$ then $EV = WTA$ and if $u' < u_0$ then $EV = WATP$.

The Kaldor Test traditionally was interpreted to say a policy should be adopted if and only if the sum of the CV's is positive. Using this operationalization, no policy could pass the Kaldor Test unless there was at least one "winner."

One objection to the EV/CV/WATP/WTA operationalization or interpretation of Potential Pareto is the one given above: it allows no policy which lacks a "winner" to pass the Kaldor Test, while the basic insight of Potential Pareto requires no winner to exist. There is a more striking objection, however, the Boadway Paradox: "a move from one Walrasian equilibrium to another Walrasian equilibrium typically yields a positive sum of compensating variations (the *Boadway Paradox*) even though no 'efficiency gain' has occurred (there is no Potential Pareto Improvement)" (Blackorby and Donaldson 1990 p. 472).

In the theory of non-monetary valuation, there is a somewhat similar paradox, this time concerning equivalent variation. Given two commodities a and b, CV for a change from a to a' is defined by

$$U(a', b_0 - CV) = U(a_0, b_0) \tag{1}$$

and EV is defined by

$$U(a_0, b_0 + EV) = U(a', b_0) \,. \tag{2}$$

As before, the sign of CV and EV will be positive if $a' > a_0$ and negative if $a' < a_0$. If $a' > a_0$ then $CV = WATP$ and if $a' < a_0$ then $CV = WTA$. If $a' > a_0$ then $EV = WTA$ and if $a' < a_0$ then $EV = WATP$. In the Edgeworth Box of Figure 1, moving from o to n passes the Hicks test regardless of

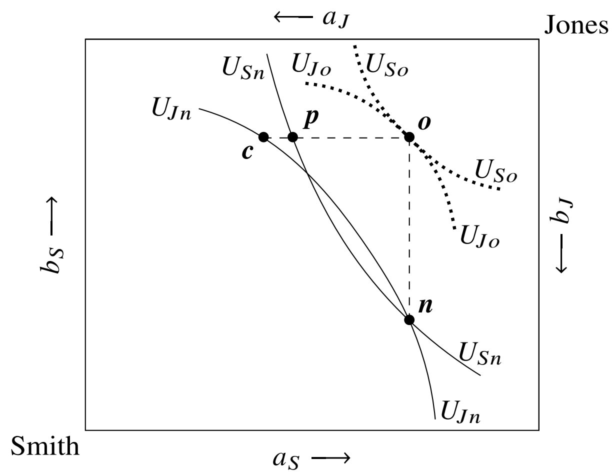


Figure 1. Moving from o to n passes the Hicks test regardless of the orientation of the dotted indifference curves, but given the orientation shown, o is Pareto Optimal and n is not.

the orientation of the dotted indifference curves, but if those curves are orientated as shown in the figure, o is Pareto Optimal and n is not.

These paradoxes raise doubts about whether the EV/CV/WATP/WTA operationalization or interpretation of Potential Pareto is correct.

2. Hayashi's Definitions

Hayashi has proposed alternative definitions of the Kaldor and Hicks Tests. These do not require existence of a winner in order for a policy to pass, and so are more consistent with the original intent of Potential Pareto. Moreover, they are not subject to the Boadway Paradox. Also, they make it possible to characterize the set of all Kaldor-efficient points and the set of all Hicks-efficient points. Therefore, we propose to adopt Hayashi's definitions as reflecting the true spirit of the Kaldor and Hicks Tests (as opposed to the EV/CV/WATP/WTA interpretation).

We will say that two allocations **a** and **b** "belong to the same Edgeworth Box," and we will write "$\mathbf{a} \overset{E}{=} \mathbf{b}$," if $\sum_i a_i = \sum_i b_i$, that is, if the amount of each commodity in **a** and **b** are equal. Furthermore, we will write "**a** is a Pareto improvement over **b**" as "$\mathbf{a} >_P \mathbf{b}$," "**a** is a Hicks improvement over **b**" as "$\mathbf{a} >_H \mathbf{b}$," and "**a** is a Kaldor improvement over **b**" as "$\mathbf{a} >_K \mathbf{b}$." The acronym P.E. will stand for "Pareto Efficient."

Hayashi (p. 22) defines a Hicks Improvement as:

$$\mathbf{y} >_H \mathbf{x} \quad \text{if} \quad \left[\nexists\, \mathbf{x}' \stackrel{E}{=} \mathbf{x} \quad \text{such that} \quad \mathbf{x}' >_P \mathbf{y}\right]. \tag{3}$$

He (pp. 18–19) defines a Kaldor Improvement as

$$\mathbf{y} >_K \mathbf{x} \quad \text{if} \quad \left[\exists\, \mathbf{y}' \stackrel{E}{=} \mathbf{y} \quad \text{such that} \quad \mathbf{y}' >_P \mathbf{x}\right]. \tag{4}$$

Under Hayashi's definition of the Kaldor Test, the motion from o to n in Figure 1 fails the Kaldor Test. Therefore, Hayashi's definition of the Test is an improvement, more genuinely capturing their "PP" sense than the Kaldor and Hicks Test do themselves.

3. Main Results

Proposition 1. *With respect to all allocations within one Edgeworth Box,*

$$\mathbf{y} \text{ is P.E.} \iff \mathbf{y} >_H \mathbf{x}.$$

Proof. Since (3) is meant to be a *definition* of a "Hicks Improvement," we can interpret it as

$$\mathbf{y} >_H \mathbf{x} \quad \text{iff} \quad \left[\nexists\, \mathbf{x}' \stackrel{E}{=} \mathbf{x} \quad \text{such that} \quad \mathbf{x}' >_P \mathbf{y}\right]. \tag{5}$$

This is the same as Definition 4 of Keenan and Snow (1999), except that they have weak Pareto superiority at the end, instead of strong Pareto superiority.[1]

[1] Keenan and Snow want to move away from solely pairwise comparisons. Their pages 217–8: "The key lies in recognizing that Kaldor's test is not a comparison of two allocations but a comparison of one allocation $\bar{x}$ to a set consisting of all possible allocations of a new aggregate bundle X." Later on: "Thus, while Boadway's paradox shows that one allocation x having $\sum_h CV^h(\bar{x}^h, x^h)$ positive does not imply that $X = \sum_h x^h$ is Kaldor superior to $\bar{x}$, we establish that all efficient allocations of X having $\sum_h cv^h(\bar{x}^h, x^h)$ positive does ensure Kaldor superiority." (So Keenan and Snow's focus is on CV and EV, which is not the focus of this paper.) They continue: "Our results indicate that using the aggregate Hicksian measures to implement compensation tests would be a formidable task.... There can be sufficient criteria that require less information, for example, **a larger aggregate bundle X implies Kaldor superiority**; and there can be necessary criteria that require less information, for example, X Kaldor superior to $\bar{x}$ requires that the old cost of X, $p(\bar{x}) \cdot X$, exceeds the old cost of the old aggregate, $p(\bar{x}) \cdot \sum_h \bar{x}^h$, but there cannot be a necessary and sufficient condition requiring less information."

See also "Hicks Inverse Potential-Pareto-Preference" on p. 4 of Aldo Montesano (2007) "The Compensation Principle and the National Income Test," The B.E. Journal of Theoretical Economics: Vol. 7: Iss.
1 (Advances), Article 44.

Assume henceforth that $\mathbf{x} \stackrel{E}{=} \mathbf{x}' \stackrel{E}{=} \mathbf{y}$. Then (5) is equivalent to

$$\mathbf{y} >_H \mathbf{x} \quad \text{iff} \quad \left[\nexists\, \mathbf{x}' >_P \mathbf{y}\right] . \tag{6}$$

However, $\mathbf{x}' \stackrel{E}{=} \mathbf{y}$ implies that

$$\nexists\, \mathbf{x}' >_P \mathbf{y} \iff \mathbf{y} \text{ is P.E.} \tag{7}$$

Therefore, (6) is equivalent to

$$\mathbf{y} >_H \mathbf{x} \quad \text{iff} \quad [\, \mathbf{y} \text{ is P.E.}] . \tag{8}$$

▮

Call the set of all P.E. allocations "the contract curve." Then:

Corollary 1. *A move passes the Hicks Test if and only if it is a move to the contract curve.*

Let an allocation be called "Hicks efficient" if there are no other allocations within the same Edgeworth Box which are Hicks-improvements over it. Then:

Corollary 2. *There are no Hicks-efficient points.*

Proof. Every point can be Hicks-improved-upon by any point on the contract curve. ▮

Note that if $\mathbf{a}$ is P.E. then $\mathbf{a} >_H \mathbf{a}$. Also, if both $\mathbf{a}$ and $\mathbf{b}$ are P.E. then $\mathbf{a} >_H \mathbf{b}$ and $\mathbf{b} >_H \mathbf{a}$. In a policy-making context, this sets up a never-ending cycle between $\mathbf{a}$ and $\mathbf{b}$.

Proposition 2. *With respect to all allocations within one Edgeworth Box,*

$$\mathbf{x} \textit{ is not P.E.} \iff \mathbf{y} >_K \mathbf{x} .$$

Proof. Since (4) is meant to be a definition of a "Kaldor Improvement," we can interpret it as

$$\mathbf{y} >_K \mathbf{x} \quad \text{iff} \quad \left[\exists\, \mathbf{y}' \stackrel{E}{=} \mathbf{y} \quad \text{such that} \quad \mathbf{y}' >_P \mathbf{x}\right] . \tag{9}$$

This is equivalent to Definition 2 of Keenan and Snow (1999). See the "Kaldor Direct Potential-Pareto-Preference" on p. 4 of Aldo Montesano (2007).

Assume as before that $\mathbf{x} \stackrel{E}{=} \mathbf{x}' \stackrel{E}{=} \mathbf{y}$. Then (9) is equivalent to

$$\mathbf{y} >_K \mathbf{x} \quad \text{iff} \quad [\exists\, \mathbf{y}' >_P \mathbf{x}]\ . \tag{10}$$

However, $\mathbf{y}' \stackrel{E}{=} \mathbf{x}$ implies that

$$\exists\, \mathbf{y}' >_P \mathbf{x} \iff \mathbf{x} \text{ is not P.E.} \tag{11}$$

Therefore, (10) is equivalent to

$$\mathbf{y} >_K \mathbf{x} \quad \text{iff} \quad [\,\mathbf{x} \text{ is not P.E.}]\ . \tag{12}$$

∎

Corollary 1. *Any move away from an allocation which is not on the contract curve passes the Kaldor Test. Any move away from an allocation which is on the contract curve fails the Kaldor Test.*

Let an allocation be called "Kaldor efficient" if there are no other allocations within the same Edgeworth Box which are Kaldor-improvements over it. Then:

Corollary 2. *The set of Kaldor-efficient points is equal to the set of Pareto-efficient points (which is the contract curve).*

Note that if $\mathbf{a}$ is not P.E. then $\mathbf{a} >_K \mathbf{a}$. Also, if neither $\mathbf{a}$ nor $\mathbf{b}$ are P.E. then $\mathbf{a} >_K \mathbf{b}$ and $\mathbf{b} >_K \mathbf{a}$. In a policy-making context, this could set up a never-ending cycle between $\mathbf{a}$ and $\mathbf{b}$.

In order to say something about economies with production, it is useful to establish this basic relationship:

Proposition 3. *In general (that is, not necessarily with respect to allocations within one Edgeworth Box),*

$$\mathbf{y} >_H \mathbf{x} \iff \mathbf{x} \not>_K \mathbf{y}\,.$$

Proof. Rewriting (9),

$$\mathbf{x} >_K \mathbf{y} \quad \text{iff} \quad \left[\exists\, \mathbf{x}' \stackrel{E}{=} \mathbf{x} \quad \text{such that} \quad \mathbf{x}' >_P \mathbf{y}\right]. \tag{13}$$

Form the contrapositive (of both implications):

$$\mathbf{x} \not>_K \mathbf{y} \quad \text{iff} \quad \left[\nexists\, \mathbf{x}' \stackrel{E}{=} \mathbf{x} \quad \text{such that} \quad \mathbf{x}' >_P \mathbf{y}\right]. \tag{14}$$

The second part of (14) is, from (5), equivalent to $\mathbf{y} >_H \mathbf{x}$. ∎

Corollary.

$$\mathbf{x} >_K \mathbf{y} \iff \mathbf{y} \not>_H \mathbf{x}\,.$$

Proof. Take the contrapositive of Proposition 3. ▮

Then for an economy with production:

Proposition 4. *Any move from an allocation* $\mathbf{x}$ *in one Edgeworth Box to an allocation* $\mathbf{y}$ *in a larger Edgeworth Box passes the Kaldor Test.*

Proof. Let $\mathbf{y}'$ be an allocation in the new Edgeworth Box which, compared to $\mathbf{x}$, gives less of no commodity to anyone and gives more of at least one commodity to at least one person. This is feasible because $\mathbf{y}'$ is in the larger Edgeworth Box. Then $\mathbf{y}' >_P \mathbf{x}$. Since by assumption $\mathbf{y}' \overset{E}{=} \mathbf{y}$, (9) implies that $\mathbf{y} >_K \mathbf{x}$. ▮

Corollary. *A move from an allocation* $\mathbf{x}$ *in one Edgeworth Box to an allocation* $\mathbf{y}$ *in a larger Edgeworth Box passes the Kaldor Test even if* $\mathbf{x} >_P \mathbf{y}$*.*

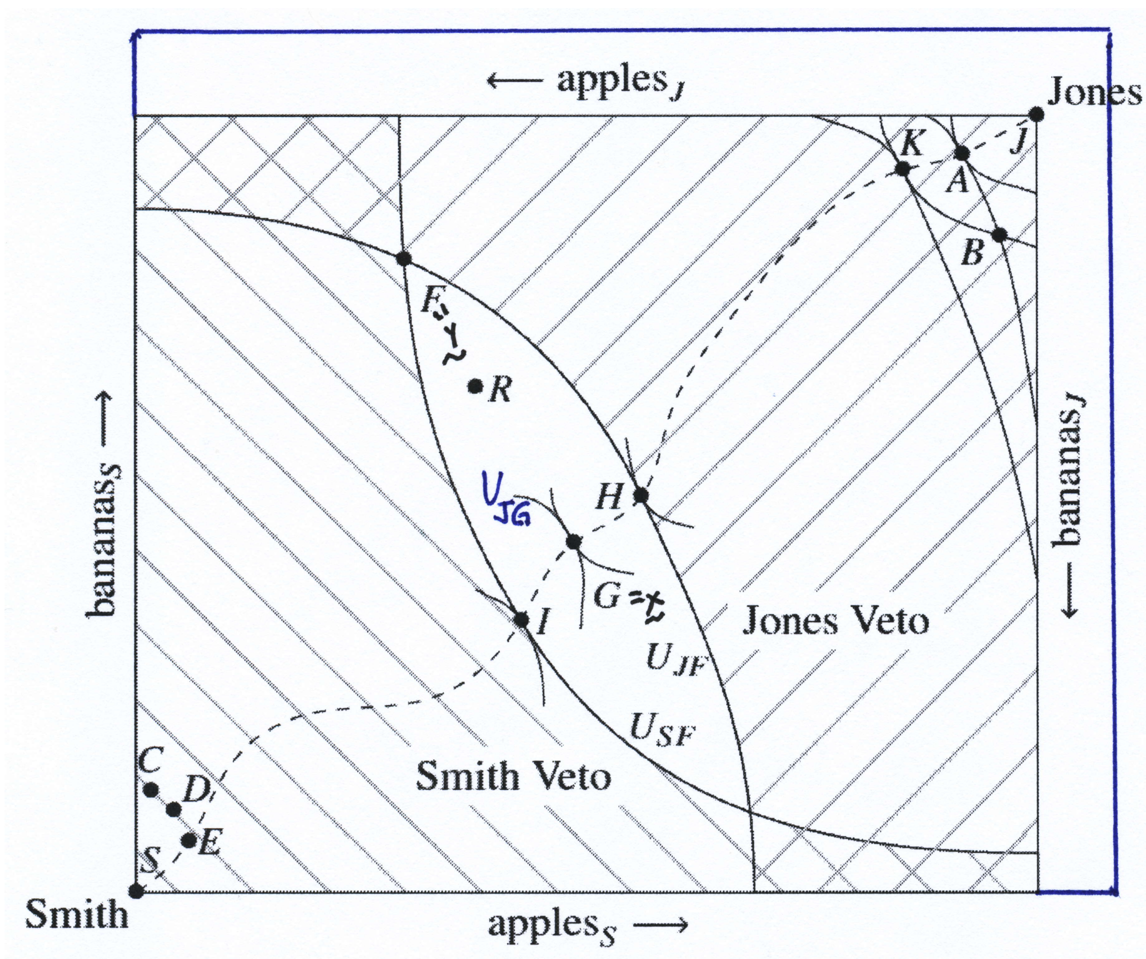
Proof. To see that it is possible to construct a $\mathbf{y}$ satisfying $\mathbf{x} >_P \mathbf{y}$, consider Figure 2. The original Edgeworth Box has black axes; the new, larger Edgeworth Box has Jones's axes drawn in blue. Let $\mathbf{x}$ be point G in the smaller Edgeworth Box. Let $\mathbf{y}$ be point F in the larger Edgeworth Box.

Smith's indifference curves in the two Boxes are identical, so Smith prefers $\mathbf{x}$ to $\mathbf{y}$. Jones's indifference curves shift from one Box to the other because Jones's origin shifts. However, if the Boxes differ only slightly in size, Jones's indifference curves will shift only slightly. (Jones's preferences do not shift from one Box to another, only the position of his indifference curves shift.) So even though U_{JF} and U_{JG} shift, the actual indifference curves of Jones which will pass through F and G will not look much different than U_{JF} and U_{JG} [is some continuity assumption required on Jones's utility for this?], so it will still be true in the new Box that Jones prefers G to F, that is, he prefers $\mathbf{x}$ to $\mathbf{y}$. We conclude that both Smith and Jones prefer $\mathbf{x}$ to $\mathbf{y}$. ▮

Note: it should be possible to prove here that the Potential Pareto criterion could endorse a move to a "Pareto-minimal" (see Crettez 2020) point.

Note: without putting numbers on *EV* or *CV*, Chapman (2020 p. 9) writes,

> . . . given these individual preference orderings over the four states of affairs, the three Kaldor-Hicks efficient contracts can



← apples$_J$
Jones
K
A
J
B
F
R
H
U_{JG}
G
I
Jones Veto
U_{JF}
U_{SF}
Smith Veto
C
D
E
S
Smith
apples$_S$ →
bananas$_S$ →
← bananas$_J$

Figure 2

take these individuals from z to y, from y to x, and from x to w, and generate a Pareto inferior outcome, or an outcome (w) in which every individual is worse off than when he or she started (in outcome z).

Chapman's K-H moves are also individually-rational choices of strategies in a game, so his result is the Pareto-inferiority of the outcome of a Prisoner's Dilemma. But his example is narrower than ours because it depends on having more than two agents, and on their preferences not being single-peaked (his p. 11). (Chapman's fn. 12 refers back to pp. 69–71 of Chapman (1994).)

Proposition 5. *Any move from an allocation* $\mathbf{y}$ *in one Edgeworth Box to an allocation* $\mathbf{x}$ *in a smaller Edgeworth Box fails the Hicks Test.*

Proof. Apply Proposition 3 to Proposition 4. ▮

Corollary. *A move from an allocation* $\mathbf{y}$ *in one Edgeworth Box to an allocation* $\mathbf{x}$ *in a smaller Edgeworth Box fails the Hicks Test even if* $\mathbf{x} >_P \mathbf{y}$.

Proof. Proposition 5 and the fact that in the proof of the Corollary to Proposition 4 we proved that it was possible to have $\mathbf{x} >_P \mathbf{y}$. ▮

Given the results of Kaplow and Shavell (2001), perhaps it is not surprising that PP, being non-welfarist, violates the Pareto Principle.

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