EUI WORKING PAPERS IN ECONOMICS

EUI Working Paper ECO No. 92/98

Theory and Estimation of Individual and Social Welfare Measures: A Critical Survey

Marco Becht

European University Institute, Florence

Please note
As from January 1990 the EUI Working Paper Series is divided into six sub-series, each sub-series is numbered individually (e.g. EUI Working Paper **LAW** No. 90/1).

EUROPEAN UNIVERSITY INSTITUTE, FLORENCE

ECONOMICS DEPARTMENT

EUI Working Paper ECO No. 92/98

Theory and Estimation of Individual and Social Welfare Measures: A Critical Survey

MARCO BECHT

BADIA FIESOLANA, SAN DOMENICO (FI)

Printed in Italy in January 1993
European University Institute
Badia Fiesolana
I – 50016 San Domenico (FI)
Italy

Theory and Estimation of Individual and Social Welfare Measures: A Critical Survey

Marco Becht *
European University Institute
Badia Fiesolana
I–50016 San Domenico di Fiesole (FI)
Internet: Becht@bf.iue.it

Abstract

The most widespread measure of *individual welfare* is consumer surplus (CS). If consumer surplus is to represent underlying preferences, very restrictive assumptions must be imposed and, worse, the resulting measures completely ignore distributional issues. Applied economists often argue that consumer surplus is a good approximation to the theoretically correct measures and the only feasible choice in practice. This is no longer true; recent advances in estimation techniques have made it possible to determine the approximate values of the correct measures quite satisfactorily. The theory and estimation of *social welfare* measures automatically involves ethical and distributional judgements. Often, these are difficult to incorporate in intuitive summary indicators that are easy to estimate. A popular shortcut, summing up consumer surpluses or equivalent variations, is ethically unacceptable; such measures treat Ecus as equals, not people. A range of money metric measures is presented that provide a more desirable, albeit still problematic alternative. Subject to severe data limitations, the theoretically correct welfare measures can be estimated for a wide range of modelling situations using parametric and nonparametric techniques.

*Originally prepared for a reading course in Public Economics under the guidance of Professor Peter Hammond and a *June Paper*, both part of the Ph.D. program in the Economics Department at the European University Institute, Badia Fiesolana, I–50016 San Domenico di Fiesole (FI). Many indispensable discussions with Peter Hammond and Robert Waldmann, LaTeX help from Götz Rohwer and useful comments from Steve Martin, Alexander Schrader and Chaim Braude are gratefully acknowledged. Thanks to Barbara Bonke for having administered the publication of this paper and letting me blow the margin limit by two full 0.15 cm; all other errors and omissions remain my own.

1 Introduction

Economists have been thinking about welfare measures since the earliest days of their subject. There are at least two parts to the problem: How should one measure individual welfare? How should one measure social welfare? That both are important questions is beyond doubt. Almost every paper in applied economics has a section on "welfare implications", usually leading the authors to make policy recommendations. Very often these are of limited quality, based on the wrong theoretical welfare measure, mixing *ordinal* and *cardinal* preference orderings, or reporting individual welfare measures that have been, wrongly, applied to aggregate data.

At least theoretically there seems to be, after 120 years or so of thinking, some consensus on what the appropriate measures should be — a form of variation, (Hicks' equivalent variation is one example), based on a money metric[1]. Practically, there are still some who argue that the equivalent variation is difficult (or impossible) to estimate and that consumer surplus is a good approximation to a theoretically correct measure of individual welfare.

Section 1 contains definitions, discusses individual measures of welfare and contrasts the Marshallian consumer surplus literature with other, better measures of welfare. Section 2 looks at three recent attempts to define a single measure of social welfare. Section 3 links the theoretical considerations to parametric and nonparametric models and shows how the correct measure can be computed for a range of modelling situations.

2 Individual Welfare Measures

2.1 What do Welfare Measures Measure?

Morey (1984) has forcefully argued that a considerable part of the confusion that persists in the welfare measurement literature arises because "people are not explicit about whether they believe consumers have cardinal or ordinal preference orderings" [Morey (1984), p. 164][2]. This paper is concerned with welfare measures, denominated in Ecus, that correspond to ordinal preference orderings of the consumer. Such

[1] This assessment might be too optimistic. The controversy over Marshallian Surplus versus Hicksian Measures has seen articles with titles like, "The Plain Truth about Consumer Surplus" [Mishan (1978)], "The Ugly Truth about Consumer Surplus" [Foster and Neuburger (1978)], "The Truth Plain or Ugly, but the Truth: A Rejoinder" [Mishan (1978)]. Even if the war is over, the "Confuser Surplus" [Morey (1984)] is still with us. For a "provocative" assessment of the public economics literature as a whole compare Hammond (1990).

[2] More recently this view has been emphasised by Gravelle and Wriglesworth (1987); Mishan (1977) used similar arguments.

measures contain information about the ranking of different projects by individual consumers and how many Ecus each individual is better or worse off. They contain *no* information about the intensity of preference for one project over another. For example, if project A, for some individual, yields Ecu1000 and project B yields Ecu2000 this does *not* imply that, to the individual, project A is worth twice as much as project B[3].

2.2 Consumer Surplus

2.2.1 Historical Development

To understand why consumer surplus[4] is such an influential and widely used concept in economics, it is important to take a brief look at the history of economic thought (confusion) in this area. Say (1826)[5] stated that "price is the value of things and their value the measure of the utility imputed to them". According to Say, to measure total utility, one has to multiply the price times the quantity of commodities purchased.

Jules Dupuit[6] refined Say's approach. He argued that the observed price does not measure the utility of each unit, but only the utility of the last unit purchased. According to Dupuit the consumer would be willing to pay p_i for $i = 1 \ldots n$ units, where $p_i > p_j \; \forall \; i > j$, for each unit of the commodity. Provided consumption is perfectly divisible total utility, according to Dupuit, is defined as the sum of the individual prices. The difference between Dupuit's and Say's measure is *consumer surplus* (CS).

[3] Advocates of "welfare measures" that measure cardinal utility, providing a mapping from Ecus to utils, sometimes argue that policymakers want to know whether project A is worth twice as much as project B to the particular consumer. What cardinalists are looking for is a function that transforms utils into money, a function of the form $M = a + bU$, where M is money, U utility, a is a constant and b is the inverse of the marginal utility of money, λ. For this transformation to work, one has to assume constancy of λ with respect to prices and income. Samuelson (1942) showed that λ can not stay constant with respect to both prices and income. A line–integral proof on this point has been provided by Silberberg (1972). He concludes, "It would be nice, if there were always a unique one–to–one correspondence between utility changes and money changes ... However, it is simply not so" [p. 951].

[4] Consumer Surplus can have different meanings. For example the entry by Takayama (1987) in *The New Palgrave: A Dictionary of Economics*, entitiled "consumer surplus", covers Marshallian Consumer Surplus, Takayama calls it Marshall–Dupuit or M–D measure, and Hicksian compensating and equivalent variation, called H–measures. Mishan (1978) too adopts this terminology. In this paper consumer surplus stands for Marshallian Consumer Surplus.

[5] Jean–Baptiste Say lived from 1767 to 1832. The quote is taken from the 1880 edition of the *Traité d'économie politique*, published in English in 1970 by August Kelley Editions in New York. In 1826, the French original was already in its fifth edition.

[6] Arséne–Jules–Emile Juvenal Dupuit lived from 1804 to 1866. For a detailed summary of his work see Ekelund (1987) and the references therein.

In "Principles or Economics" Marshall (1930) provides the following definition of consumer surplus: "We have already seen that the price which a person pays for a thing can never exceed, and seldom comes up to that which he would be willing to pay rather than go without it: so that the satisfaction which he gets from its purchase generally exceeds that which he gives up in paying away its price; and he thus derives from the purchase a surplus of satisfaction. The excess of the price which he would be willing to pay rather than go without the thing, over that which he actually does pay, is the economic measure of this surplus satisfaction. It may be called *consumer's surplus*." [Marshall (1930), page 124, italics in original]. In the subsequent paragraph, (§2) Marshall gives the example of a man who makes tea purchases for domestic consumption. He gives a ficticious price–demand relationship and computes consumer surplus for a number of price levels for the domestically consumed, single good. In the next section (§3), Marshall extends the analysis for tea to a large market. He chooses "to neglect that the same sum of money represents different amounts of pleasure to different people" [Marshall (1930), page 128]. In a footnote, Marshall draws the diagram that has become a standard way of illustrating consumer's surplus. Price is measured along the vertical axis, quantitiy along the horizontal axis.

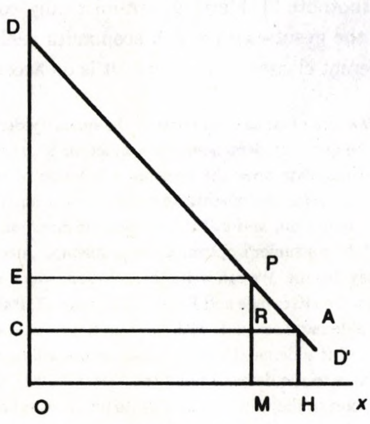

Fig. 1.

The straight line DD' is the demand curve for tea in a large market. At the price AH the consumers purchase amount OH. Changing the price to MP, the consumers purchase OM. The area DCA is the conumers' surplus when the price is AH.

Note VI of the Mathematical Appendix gives a formal definition of consumer's surplus for a single good and one consumer. In terms of the (inverse) demand function $y =$

$f(x)$, where y is the price and x the quantity demanded[7], consumer's surplus is given by an integral

$$CS = \int_b^a f(x)dx. \quad (1)$$

The upper bound a is the *quantity* demanded. The lower bound b is some kind of (quantity) subsistence level, below which "$f(x)$ will be infinite[8], or at least indefinitely great for values of x less than b."

Marshall himself pointed out some of the limitations and shortcomings of his own conept, namely the move from consumer's surplus to consumers' surplus, the case where more than one good are consumed and income effects. On the first issue Marshall notes that "the real worth of a thing might be discussed with reference not to a single person but to people in general; .. . This involves the consideration that a pound's worth of satisfaction to an ordinary poor man is a much greater thing than a pound's worth of satisfaction to an ordinary rich man: .." [Marshall (1930), page 130] and "but it would be assumed that such differences between individuals might be neglected, since we were considering in either case the average of large numbers of people; .." [*ibidem*, footnote 2]. Marshall optimistically concludes that "... by far the greater number of the events with which economics deals, affect in about equal proportions all the different classes of society; ... it is on account of this fact that the

[7]Marshall wrote and drew the price as a function of the quantity demanded. In the definition of contemporary economics, the quantity demandend is a function of prices and income. It is because of Marshall that modern economists *draw* the price as a function of the quantity demanded and call it the demand *curve*, but *write* the quantity demanded as a function of the price, the way a mathematician or physicist would do, and call it the demand *function*. For example, Gravelle and Rees (1981) stipulate that "the consumer's optimization problem, .. , depends on his preferences, the prices he faces and his money income. We can write this solution, which we call his *demand for goods* as a function of prices and income [Gravelle and Rees (1981), page 77, italics in original]. However, on page 105, the authors draw a demand schedule with price on the vertical axis and quantity demanded on the horizontal axis and call it a demand curve. Noboy seems willing to break with tradition and draw a graph that corresponds to the demand function; Varian (1984), Cowell (1986), Kreps (1990) all draw graphs that correspond to the way Marshall wrote his (inverse) demand functions and not to the way they themselves do. Drawing the demand function the Marshall way is not a problem as far as the visual property of "downward sloping" is concerned. However, when illustrating consumer's surplus integrals based on today's definition of the demand function, one might get confused – either one can integrate under today's inverse demand function and draw consumer's surplus underneath Marshall's demand curve, or one can integrate today's demand function proper and draw CS to the left of Marshall's demand function. Obtaining the correct sign is yet another complication. It might be altogether easier to break with tradition and start drawing diagrams with the quantity demanded on the vertical axis.

[8]It is interesting to note that Marshall thought that the utility of life, at least to oneself, is infinite.

exact measurement of the consumers' surplus in a market has already much theoretical interest, and may become of high practical importance." [opus cit., page 131]. Marshall was more pessimistic about the aggregation of goods. In Mathematical Note VII he writes, "if we could find a plan for grouping together in one common demand curve all those things which satify the same wants and are rivals; and also for every group of this of which the services are complementary [total utility of income could be represented by $\Sigma \int_b^a f(x)dx$]. But we cannot do this: and therefore the formula remains a mere general expression, having no practical application."[9]. On the issue of income effects, Marshall was more optimistic again. Towards the end of Mathematical Note VI (page 842) he concludes that "if it be desirable to take account of the influence which his expenditure [the consumer's] on tea exerts on the value of money to him, it is only necessary to multiply [the quantity demanded] by the amount which he has already spent on tea which represents the marginal utility of money when his stock of it has been diminished by that amount." Overall it appears that Marshall saw consumers' surplus as an intelligent theoretical vehicle and as useful in practice; many applications of the concept in later chapters of his "Principles" may serve as evidence[10].

There are additional weaknesses; one, CS is defined in terms of the inverse demand function (see footnote). Two, Marshall assumed that his inverse demand functions were strictly independent of each other. Although this satisfies the integrability conditions, it is an overly restrictive assumption.

The current definition of CS is for a single consumer, a single price change and commodities x_i, $i = 1, 2, .., n$, with nominal prices $P = (p_1, p_2 \ldots p_n)$. The demand function for the ith good is given by $x_i = x_i(P, Y)$ where Y is the consumer's nominal income. Instead of Marshall's quantities a and b consider the initial situation $Q^0 = (P^0, Y^0)$ and the subsequent situation $Q^1 = (P^1, Y^1)$. According to Takayama (1987) in *The New Palgrave: A Dictionary of Economics* "Marshall (1920) argued that the welfare impact on the consumer can be measured by the trapezoid to the left of the demand curve $x_1(P_1, P_2^0, ..., P_n^0, Y^0)$ formed by the given price change. The is the famous concept of *consumer surplus* by Marshall." It should be evident that this is not what Marshall originally had in mind[11]; once again the confusion arises

[9] Applied economists who estimate demand systems perform this kind of grouping already at the pre-estimation stage. Hence, it is hardly surprising that most of them do not consider Marshall's original objection when they get to the stage of computing consumer's surplus.

[10] Marshall also used consumer surplus arguments when he analysed the British postal monopoly. Indeed, he estimated the loss in consumers' surplus from the monopoly, as opposed to having a competitive, private postal service, at L4.5m for the mid-1880's; compare Albon (1989) for a critical evaluation of Marshall's work.

[11] In Chapter XIII of his Principles, Marshall (1930) discusses the effects of taxation and bounties on consumers' surplus. In his analysis, price changes lead to *changes* in consumers' surplus [opus cit., page 467].

from Marshall's use of the inverse demand function. Returning to integrals, today's definition integrates the area to the left of demand curve (drawn the Marshall way), bounded by the price vectors P^0 and P^1. For a single price change, the integral is given by

$$CS = -\int_{P_1^0}^{P_1^1} \sum_{i=1}^{n} x_1 \left(P, Y^0\right) dP_i \qquad (2)$$

where $P_1^0 < P_1^1$, the original price is smaller than the final price for the first good and the prices of all other goods and income are held constant. In terms of Figure 1, this would correspond to a price change from CA to EP and (a change in) consumer's surplus of CEPA. An extension to multiple price changes, can be found in Silberberg (1972).

2.2.2 Consumer Surplus: A Measure of Individual Welfare ?

As was argued before, and accepting the important value judgement, that "what the consumer prefers is better"[12], a "good economic" welfare indicator must be judged by whether or not it accurately reflects consumers' preferences.

Chipman and Moore (1976,80) have laid down such conditions for consumer surplus. In technical terms, they ask "what properties must be satisfied by a vector valued $((n+1)$ – component) function $f(p, I)$ of variable prices $p = (p_1 ... p_n)$ and income I in order that the line integral of this function over the space of price income pairs (p, I) connecting an initial point (p_0, I_0) and a terminal point (p_1, I_1) correctly measures the change in a consumer's utility as between these two situations?"

They show, first, that when the first n components of $f(p, I)$ are restricted to be functions of prices alone, consumer surplus cannot represent the underlying preferences unless these are homothetic[13]. Second, they demonstrate that when the last $(n-1)+1$ components of $f(p, I)$ are restricted to be functions of prices alone, preferences must be parallel[14]. Parallel preferences have the peculiar property that, for any fixed vector of prices p, increases in income are entirely spent on the first commodity.

[12]This assumption is generally referred to as "consumer sovereignty". Although a drug addict might prefer more drugs, they do not necessarily increase his/her welfare. Indeed, it might be welfare improving for society paternalistically to discourage their use — as is indeed the case in most countries.

[13]Recall that a preference relation R is homothetic if $x^1 R x^2$ iff $\lambda x^1 R \lambda x^2$ for $\lambda > 0$. Changing both quantities x_1 and x_2 by a factor λ does not change the consumer's preference for x_1 over x_2.

[14]Utility functions that correspond to parallel preferences generate income-expansion paths that are straight lines parallel to the axis of the first commodity. For a formal definition and a diagram compare Chipman and Moore (1976), equation (2.70) or Chipman and Moore (1980), [p. 937]. A textbook discussion can be found in Mansfield (1975) or Silberberg (1990)].

The results of Chipman and Moore confirm and complete those of Samuelson (1942) and show that for the case of homothetic preferences, marginal utility must be independent of prices and, in the case of parallel preferences, independent of income and of all prices other than that of commodity 1. Clearly, these requirements are very restrictive. Indeed they are so restrictive that they rule out consumer surplus as a credible indicator of individual economic welfare.

2.2.3 Consumer Surplus: A Good Approximation?

Willig (1976) admits that CS is not the correct theoretical welfare measure, but argues that it is so "close" to the correct measures that the approximation errors are negligible when compared to the standard errors from estimating demand functions. To illustrate this point, he reports the results of simulations for a range of parameter values on the income elasticity and the ratio of consumer surplus relative to base income, something he defines as "a measure of the proportional change in real income due to a price change."

Hausman (1981) convincingly demolishes Willig's case[15]. He shows that,

- For a single price change no approximation is necessary because exact measures can be calculated straightforwardly[16].
- If the loss of income resulting from the price change is large, relative to the original level of income, the approximation error becomes very large[17].
- The theoretically correct measures of deadweight loss are badly distorted, even when Willig's results hold[18].

Why approximate the correct measures using Consumer Surplus. If approximations have to be made, they can be made directly; such techniques have been provided by McKenzie and Pearce (1976), McKenzie (1982) and Hammond (1988).

[15]Hausman's work is very similar to Markandya (1978), who cites Willig but does not criticise him directly. McKenzie (1979) had already tried to demolish Willig's case; for a reply see Willig (1979).

[16]As will be argued later, and in Section 3, this is also possible for more than one price change.

[17]Baldry (1988) has shown that with a CES utility function that allows for the withdrawal of one good (zero quantity), even the errors as measured by Willig can become large; he considers a special case that illustrates the dangers of confining oneself to the analysis of single price changes. (Yet) another paper that compares differences between CS and compensating variations is Johnson (1985).

[18]Hausman made a mistake in his numerical example of female labour supply that was meant to illustrate this point. This was corrected by Haveman, Garley and Andreoni (1987). There is also a printing mistake in equation (21). Instead of $P_1^1 + \alpha$ the equation should read $P_1^{1+\alpha}$, as in equation (22).

2.3 Theoretically Exact Measures

Unlike consumer surplus, the measures that will be presented in this section are constructed from consumers' preferences. Hence, the question is not whether they accurately represent those preferences, as in the case of the CS, but whether they can be calculated from a set of ordinary demand functions.

McKenzie (1983), (chapter 2) shows how to construct theoretically correct measures based on consumer preferences. First he expresses ***a particular class*** of utility functions in terms of a cost of utility (expenditure function), which he then uses to derive a money metric, or equivalence function, and a related compensation function. The money metric is very intuitive, because it maps money values to a preference ordering. McKenzie uses the money metric to define two measures of individual welfare, Hicksian equivalent variation (EV) and compensating variation (CV)[19]. As it turns out, only the equivalent variation is an ordinal money metric measure of individual welfare. As Chipman and Moore (1980) show, compensating variation is an ordinal money metric only under the assumption that preferences are homothetic[20].

McKenzie also discusses the move from consumer preferences to ordinary demand functions and *vice versa*. Whilst the former is standard textbook material, the latter involves solving differential equations by means of an integrating factor. However, having *derived* the demand functions from specific parametric classes of utility functions, as McKenzie does, it must be true that an integrating factor exists that solves the differential equation.

Although interesting, McKenzie's methodology is not of great practical interest. When the equivalence class of ordinal utility functions is known, as he implicitly assumes, the task of deriving an exact measure of economic welfare become a mere mathematical exercise. The whole discussion about integrating factors might suggest that McKenzie follows a "revealed preference" approach, while, in fact, he is not.

---

[19]The equivalent and compensating variations are due to Hicks (1946) and Hicks (1956). For excellent textbook treatments of CV and EV see Varian (1984), [page 264], Cowell (1986), [pp. 81] and Gravelle and Rees (1981), [pp. 103]. As a reminder, let m^0, p^0, u^0 denote income, price and utility before and m^1, p^1, u^1 after the change; then, in terms of the expenditure function, $EV = E(p^0, u^1) - m^0$ and $CV = m^1 - E(p^1, u^0)$.

[20]A clear summary of these issues, as well as cardinal versus ordinal preferences was provided by Gravelle and Wriglesworth (1987). They also show that CV always satisfies the weaker requirement of *completeness*; the measure must be able to indicate the sign of the change, no more. Intuitively, the compensating variation is not a representation of a consumer's ordinal preference ordering, because final prices vary as the final allocation varies. Kay (1980) and King (1983) were aware of this point when trying to measure the welfare effects of tax reform; "But measures based on compensating variation employ a different reference price vector for each reform. Hence the money value of the gain from reform A cannot be compared with the money value of the gain from reform B because these values are computed at different price levels" [King (1983), p. 193].

Hausman (1981), Vartia (1983) and Hammond (1990) have shown that, in principle, theoretically correct measures of individual welfare can be defined and calculated, even when the ordinal class of utility function is not known. In a way, they turn the problem upside down. Instead of specifying a particular family of utility functions, like McKenzie, and estimating the resulting demand system, they first consider the market demand function and then go back to recover the corresponding welfare measures. They never need to specify a utility function; all they need to show is that the estimated demand function does indeed correspond to a preference ordering for the consumer.

Markandya (1978) and Hausman (1981) focus on the integrability of demand functions by looking at the case of a single price change. Both consider some quite general specifications of single demand relations that can be integrated analytically. However, their treatment is incomplete. Even for a single price change, analysing single demand equations is only legitimate when the underlying utility functions are separable between the good whose price changes and the other goods. Additionally, the existence of a solution to the differential equations is a sufficient, but not a necessary condition for the demand functions to correspond to a preference ordering for the consumer. Furthermore, Hausman defines his exact welfare measures in terms of the expenditure function. As Hammond (1990) points out, this is not always correct, because the expenditure function might not have an inverse, — but only a boundary problem.

Vartia (1983) extends Markandya's and Hausman's results. He deals with more than one price change and addresses the integrability problem in a rigorous manner. Also, he gives some programmable algorithms to solve the more complicated differential equations. In particular, Vartia shows that when a set of ordinary demand functions satisfies the "Direct Utility Hypothesis", the compensated demand functions can be recovered by solving a first order nonlinear differential equation. The compensated demand functions are used to construct price indices of the Paasche type and quantity indices of the Laspeyres type. Although his paper is more general than Markanya's and Hausman's, Vartia's main interest are price indices and not welfare measures.

Hammond (1990) generalises the previous results. Although the paper starts with a discussion of preferences and ends with demand functions, it takes exactly the "revealed preference" (as opposed to the "known preferences"?) approach. There are a number of important features that distinguish it from previous attempts. First, two kinds of good are considered, traded goods x, that correspond to the usual definitions and untraded goods z, that include public goods. This is important, because it allows one to properly define the set of exogenous variables. Thus the change considered goes from initial values (p_0, m_0, z_0) to final value (p_1, m_1, z_1), where p are the prices of the traded goods and m money. Second, there is a clear definition of the ***money metric direct utility function*** and ***money metric indirect utility function***. Third, it is the money metric indirect utility function that is used to define general variation in money metric utility. This rules out the case where the indirect utility function is not invertible, the expenditure function does not represent consumers' preferences, and welfare measures based on the expenditure function fail. Fourth, there is a clear derivation of Hicks' compensating and equivalent variation as special cases of the general variation. It becomes evident how and why they differ and why equivalent variation is the preferred measure. Fifth, there is a distinction between small changes and large changes in the money metric measure of individual welfare. While the case of small changes is (relatively) straightforward, large changes require the construction of an *income compensation function*, the very construct the consumer surplus approach is lacking. Assuming a continuously differentiable path $(p(t), z(t))$ $(0 \leq t \leq 1)$, the money metric measure of the change from (p_0, m_0, z_0) to (p_1, m_1, z_1) with respect to an arbitrary reference point (p_R, z_R) can be found by solving an ordinary differential equation in $m(t)$. This is an important result, since there exist a large number of efficient algorithms for solving ordinary differential equations. Sixth, exact conditions are laid down for the demand and willingness to pay functions (consumers' marginal willingness to pay for a change in z) to correspond to a preference ordering[21]. This part is crucial for the "upside down" approach adopted for the welfare measurement problem. Finding a solution to the ordinary differential equation in $m(t)$ is not enough for the individual welfare measures to correspond to a consumer's preference ordering.

As a separate point, Hammond also discusses the case, appropriately baptised a "personal catastrophe", where the welfare measures are not defined. The change from (p_0, m_0, z_0) to (p_1, m_1, z_1) is so dramatic for the consumer that one could never hope to compensate with a finite amount of money[22].

2.4 What Measure?

This section has defined welfare measures as constructs that can rank all possible price and income combinations before and after a change according to an individual's preferences. This includes the secondary, but important assumption that what the consumer wants is better ("consumer sovereignty"). In the terminology of Gravelle and Wriglesworth (1987) these welfare measures have the *ordinality* property[23]. A narrow definition of the term "welfare measure" helps to avoid a large part of the

[21] Another reference here is Hurwicz and Uzawa (1971).

[22] Actually, a "personal miracle" is also possible. The consumer is so well off that one could never hope to bring him/her back to earth with a finite withdrawl of money; compare Fortune magazine for examples.

[23] Some surplus measure S has the ordinality property "for all possible proposed pairs of price and income combinations (p^1, y^1), (p^2, y^2), and for any intitial combination (p^0, y^0): $S(0,2) \geq (\leq) S(0,1)$ if and only if $v(p^2, y^2) \geq (\leq)\, v(p^1, y^1)$" [Gravelle and Wriglesworth (1987), p. 233], where v(p,y) is the indirect utility function. For another, clear summary of an axiomatic approach to the definition

controversy over Marshallian Consumer surplus arising from a general confusion between the concepts of ordinal and cardinal utility. Also, it defines theoretically exact welfare measures — as measures that rank alternatives according to the consumers' preferences. The table below[24] summarizes the main findings.

Condition for Validity	EV	CV	Marshallian Surplus
Ordinality	No restrictions	Homothetic Preferences	Homothetic or Parallel Preferences (with add. restrictions)
	Hause (1975)	Chipman & Moore (1980)	Chipman & Moore (1976)

(Mis)uses of consumer surplus and compensating variation for measuring welfare come in various degrees. A large group of applied work simply ignores all theoretical considerations, estimates demand equations and conducts "welfare analysis", unashamedly, in terms of consumer surplus[25]. A particularly striking example are Smith and Kaoru (1990) who use "Meta–Analysis"[26] applied to a sample of 200 published and unpublished studies of recreational demand over the period 1970 to 1986. They find that 77 of the 200 used consumer surplus estimates or sufficient information to derive them, — as they do[27]. A second group of empirical studies follow Willig (1976) and report compensating variations approximated by estimates of consumer surplus. A typical example is a study of the distributional impact of gasoline conservation policies by Archibald and Gillingham (1982) who use a short panel data set to estimate an individual specific translog demand system. For two tax reforms (a fifty percent increase in gasoline taxation and the introduction of a coupon scheme) they compute Willig's consumer surplus approximation to the compensating variation for each household.

---

of welfare measures see Ebert (1984). Ebert calls *ordinality* the *correct ranking* property; his article also covers welfare indices.

[24]Adapted from a table in Gravelle and Wriglesworth (1987), p. 247.

[25]A CD–ROM search of abstracts appearing in the *Journal of Economic Literature* revealed that the *American Journal of Agricultural Economics* (19 articles), the *American Economic Review* (16), the *Journal of Political Economy* (7), *Land Economics* (7), the *Southern Economic Journal* (6), the *International Economic Review* (6) and some others are full of applied and theoretical work on and using consumer surplus as a form of "welfare measure". The search command was "CONSUM* AND SURPLUS". This yields 199 references. Excluding books, this leaves 185 journal articles, including comments and replies. Of course, the search also includes articles that explicitly reject consumer surplus. However, since these are few, I preferred to report the "raw" counts.

[26]"Meta–Analysis", crudely defined, are techniques that derive statistical results from more than one data set or statistically similar studies that are based on different data sets (and samples); for a rigorous introduction see Rosenthal (1991).

[27]In industrial economics, the influential work of Schmalensee (1981) on the welfare effects of price discrimination has lead to a string of empirical work that uses consumer surplus estimates to "measure" the impact of changes in price discrimination on welfare.

The approach and conclusions of Willig (1976) seem to be the consensus in industrial economics. In one of the standard textbooks on industrial economics, Tirole (1988) postulates that "The goods and industries considered in this book *generally* represent only a small share of consumer expenditure. Price changes are therefore likely to generate small income effects, and it may be appropriate to assume that demand is downward sloping and that the consumer surplus is a good approximation of welfare." [Tirole (1988), p.11, italics not in original].

A third strand of the literature has followed Hausman (1981)[28] in estimating a single demand equation and deriving the expenditure function via Roy's identity[29]. These applications also tend to follow Hausman's example in deriving compensating variation rather than equivalent variation, the correct welfare measure[30]. Very few empirical studies have implemented the theoretically correct measures. Morey (1985) has estimated ranges of individual equivalent (and compensating) variation from the demand for a Colorado ski area, but does not seem to worry much about the differences between EV and CV. King (1983) comes closest to the requirements of economic theory. He analyses the welfare implications of tax reform by estimating ranges of individual equivalent variations and reports his results with standard errors[31].

In practice, a number of important problems remain. It is not clear how one can define goods that include the public environment, and, more problematically, get data for estimating willingness to pay functions. What is the most appropriate statistical technique and what demand systems can one hope to estimate in practice? How can one ensure that the integrability conditions hold and solve the system of differential equations? Is it possible to solve differential equations that have discontinuous or multivalued right hand sides, as in discrete choice situations? Applied economists have worked on most of these questions. The results appear incomplete and often

[28]Markandya (1978) is usually not cited.

[29]The authors usually use the functional forms and solutions provided in Hausman (1981).

[30]Hausman mentions EV in a footnote of his survey article on labour supply in the *Handbook of Public Economics*. He writes: "The alternative measure [to CV] of the equivalent variation uses post-tax utility U' as the basis for measuring welfare loss. For labor supply in the two-good set-up, the equivalent variation typically gives a higher measure of welfare loss than does the compensating variation." When considering his measure of deadweight loss, based on CV, he goes on to argue: "Here we follow Diamond and McFadden (1974) and use taxes raised at the compensated point. Kay (1980) has recently argued in favor of using the uncompensated point. As with CV and EV measures the problem is essentially one of which is the better index number basis." [Hausman (1985), footnotes 44, 45, p. 244]. Regarding the second remarks, even if one ignores all theoretical considerations, Pauwels (1986) has shown that all deadweight loss measures based on compensating variations are unreliable.

[31]King (1983) actually derives equivalent gains; equivalent gain and equivalent variation are essentially the same measure. Table 2 (p. 205) reports the distribution of equivalent gains by decile of original equivalent income, including the standard errors of mean equivalent gain; an extensive literature search indicates that Table 2 is, to date, unique.

scattered through various literatures. Section 3 provides an outline of some of the econometric issues involved.

To conclude, Marshallian consumer surplus is not a good measure of individual economic welfare. It reflects very special, unrealistic types of consumer preferences and completely ignores the income effects of a price change. It very rarely provides a good approximation to the correct theoretical measures, although these can be calculated without great difficulty.

3 Social Welfare Measures

As could be seen the measurement of individual welfare is difficult — the measurement of welfare for society as a whole is even more difficult. Actually, it is not immediately obvious why one wishes to calculate a single social welfare measure at all. After all, when considering a policy change the crucial question is: Who gains, who loses? How significant are the gains, how significant are the losses? Why not simply report the distribution of the individual welfare measures and leave it at that? Given the information on the individual gains and losses, everybody can calculate his or her own social welfare measure [compare Hammond (1990)]. However, things are not that simple. There is some advantage in having a single measure when comparing two rival policies, at least as long as the assumptions underlying the construction of the social welfare function are spelt out clearly.

King (1983) considers both cases. For a hypothetical tax reform in the U.K., he calculates and reports a variety of statistics on the distribution of gains and losses in his sample population. In particular, he compares the distribution of "equivalent gain", his individual welfare measure, with "cash gains", a measure the Chancellor of the Exchequer likes to use in his budget speech. On the other hand, he is keen on calculating the "social value" of the reform, an overall measure based on a social welfare function. In the following, five different approaches to calculating the "social value" in terms of a money metric will be considered.

As before, it must be stressed that all the money metric measures presented assume "consumer sovereignty". However, unlike in the case of individual welfare measures, here it is assumed that "what the consumer prefers" is not only better for her or him, but for society as a whole.

3.1 Additive Money Metric Utility

Harberger (1971) in his "open letter to the profession" pronounces "Three Basic Postulates for Applied Welfare Economics".

(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;

(c) when evaluating the net benefits of 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.*

[Harberger (1971), page 785, italics not in original]

Harberger recommends adding up individual consumer surplus measures. Why the consumer surplus is not the correct measure of individual welfare was discussed in the previous section. The question here is a different one: is it legitimate to sum up individual welfare measures?

Hammond (1990, page 16) clarifies Harberger's implicit assumptions. In particular, if Harberger's assertions are to have any meaning at all, the price vector must be the same for all members of society. Furthermore, in the reference situation the additive money metric measure Harberger suggests is equal to the total level of unearned income. Both are strong assumptions. More seriously, Harberger's measure completely ignores any concern for distributional justice. In effect, what he proposes is a social welfare function with all weights equal to one.

Kaldor and Hicks proposed a measure like Harberger's as a compensation test of potential welfare improvements[32]. Proponents of compensation tests might argue that summing individual equivalent or compensating variations (EV_i, CV_i) gives a rough summary indicator and when the sum of the individual variations is larger than zero ($\sum EV_i > 0$ or $\sum CV_i > 0$) a project might be *potentially* Pareto improving. Boadway (1974), [pp. 932-4] has shown that summing CVs provides necessary but not sufficient conditions for accepting or rejecting the Kaldor–Hicks tests. Ng (1979), [pp. 97] calls this the *Boadway paradox*[33]. However, as Hammond (1979,87) shows, the lump sum redistributions required for this kind of test to serve as a signal of a potential true

[32]The *Kaldor test* redistributes from those who gain to those who lose from a change, after it has taken place. If the gainers can fully compensate the losers and still remain better off, the change passes the Kaldor test. The *Hicks test* asks if the potential losers could (or should) compensate the potential gainers, prevent the change and remain better off than if the change had actually taken place. If the losers could (or should), the potential change passes the Hicks test; compare Boadway and Bruce (1984), pp. 263.

[33]In contrast, Dierker and Lenninghaus (1986) have shown that, if the consumption possibility set is convex, $\sum EV_i > 0$ can indicate a Pareto improvement.

improvement are not incentive compatible. Therefore, since the Kaldor–Hicks tests are theoretically flawed in the first place, one need not be too concerned about the paradox (or the absence of the paradox)[34].

Judge Posner (1981), a former Professor in the Chicago Law School, now a U.S. Federal Judge and one of the founders of the "law and economics" movement in the U.S., has reiterated Harberger's suggestion. However, while Harberger's justification for adding up consumer surplus measures was for, what he felt, important practical reasons [Harberger (1971), II], Posner justifies his claim on ethical grounds. What he effectively argues is that money should be treated equally, not people.

3.2 Money Metric Measures of "Social Value"

3.2.1 Additive Money Metric Utility with Distributional Weights

Harberger (1978) to some extent retracted from his original (1971) stance and suggested multiplying individual welfare measures by distributional weights that vary inversely with income[35].

However in section VI. he is careful to point out that "when distributional weights are used ... the result is to open the door to projects and programs whose degree of inefficiency by more traditional (unweighted) cost–benefit measures would (I feel confident) be unacceptable to the vast majority of economists and the informed public." [Harberger (1978), p. 113]. As an illustration, Harberger sends ice–cream from a rich oasis to a poorer one, through the desert, on the back of a camel. In two different calibrations that both pass the distributionally weighted test, he finds that $\frac{3}{4}$th and $\frac{63}{64}$th of the ice–cream would melt on the way. His remarks seem to suggest that he would prefer to let the poor oasis go without ice–cream (or bread?).

Unfortunately, Harberger overlooks an important aspect of weighting in the social welfare function. Apart from very small projects, the policy change will change the income distribution. Hence, Harberger's distributional weights are not the same before and after the change. Indeed, a desirable policy is very likely to move, or should move, a substantial part of the households at the lower end of the distribution to a higher quantile.

[34] This point was forcefully argued in Hammond (1990), [p. 17].

[35] "There can be no doubt that distributional weights (particularly weights which vary inversely with income) have a strong appeal to those nurtured in the grand tradition of economics." [Harberger (1978), pp.110].

3.2.2 Money Metric Measures based on a "Social Expenditure Function"

Pollak (1981) constructed a "social cost of living index" by defining an indirect social welfare function, a kind of indirect utility function for society, and a corresponding social expenditure function. The social expenditure function has been used by Jorgenson, Lau and Stoker (1981), Jorgenson and Slesnick (1983,84,90) and Jorgenson (1990) to construct specific indices of social welfare, which they employ empirically to investigate issues of inequality and efficiency in the U.S. after the Second World War.

Pollak starts by considering an investigator's preference relation R and a corresponding social welfare function $W(\chi)$, "where $\chi = (X_1, X_2, ...X_S)$ is the n x S dimensional 'social consumption vector' showing each household's consumption of every good." [Pollak (1981), page 314] By assuming "consumer sovereignty" this social welfare function can be written as $W(\chi) = \Omega[U_1(X_1), ..., U_S(X_S)]$, where U_i is the ith household's utility function.

The crucial idea behind Pollak's approach is to define the indirect social welfare function $\Lambda(P, \mu_1, ..., \mu_s) = \Omega[\Psi_1(P, \mu_1), ..., \Psi_s(P, \mu_s)]$. The maximum value of the indirect social welfare function "is the maximum 'social utility' attainable in the price situation P when the distribution of expenditure among households is given by $(\mu_1, ..., \mu_s)$. The social expenditure function is defined as the minimum expenditure required to attain each indifference curve of the social welfare function at prices P." [Pollak (1981), pp. 314–315]. The indirect social welfare function and the social expenditure function are equivalent to a single consumer's indirect utility and expenditure function.

Jorgenson and Slesnick extend Pollak's work by considering a particular functional form for $W(\chi)$, the Samuelson–Bergson social welfare function, which they go on to estimate. It is the social expenditure function that allows them to express the social welfare function in monetary values. Jorgenson and Slesnick make a number of assumptions regarding their consumers' preferences and the social orderings they build into $W(\chi)$. To facilitate comparisions, they use the axiomatic framework for social choice found, for example, in Roberts (1980). For the consumer, they take a trans–log indirect utility function to represent preferences, impose Lau's (1982) exact aggregation conditions, and take the household as the basic consuming unit. Furthermore, they put commodities into five more or less arbitrary groups and attribute five demographic characteristics to each household.

Technically, they express their social welfare function as the sum of a term that measures the average of individual welfare levels over all consuming units and a second term, that represents the individual diversions from the average. Their function is homogeneous of degree one in individual welfare [cf. Roberts (1980)]. A number of parameters allow them to shape the function, so as to incorporate quantitative value judgements. An example is the function $\rho(x) \leq -1$, the *degree of aversion to inequality*; x is a matrix describing the social state.

Jorgenson and Slesnick define four indices, which Jorgenson (1990) uses to assess the impact of changes in the price system and the distribution of total expenditure $\{M_k\}$[36] on the standard of living, equity and efficiency for the U.S. economy.

A standard of living index, $Q_A(p_0, W_0, W_1)$, compares two levels of aggregate expenditure per capita, it is a quantity index of social welfare. It is found by evaluating Pollak's social expenditure function for: (i) a base price system p_0 and a base level of social welfare W_0; (ii) the base price system p_0 and the current level of social welfare W_1. The base level of social welfare W_0 is found by evaluating the social welfare function at p_0 and the base period distribution of total expenditure $\{M_k{}^0\}$ and W_1 is found by evaluating the social welfare function for the current price system p_1 and the current distribution of expenditure $\{M_k{}^1\}$. Using the social expenditure function they obtain from the trans-log indirect utility function, ln Q_A becomes the *translog social standard of living index*. It posses convenient dimensions; when actual social welfare has increased it is larger than zero, when actual welfare has decreased it is smaller than zero.

The *quantity index of efficiency*, $Q_p(p^0, W^2, W^3)$ is the ratio of Pollak's expenditure function evaluated at prices p_0 and the maximum level of welfare W^3, divided by the social expenditure required to attain the potential level of social welfare W^2 at base prices p^0. The maximum level of welfare W^3 is the maximum level of welfare that can be attained through lump-sum transfers of aggregate total expenditure. The maximum level of welfare W^3 is an important concept in the methodology of Jorgenson and Slesnick, since they take it as a measure of efficiency. Again, using the translog indirect utility function; ln $Q_p(p^0, W^2, W^3)$ is the *translog efficiency index*. A value larger than zero indicates that "potential social welfare" has increased.

The *quantity index of equity*, Q_E is defined as the ratio of the quantity index of social welfare and the quantity index of efficiency.

$$Q_E(p^0, W^0, W^1, W^2, W^3) = \frac{Q_A(p^0, W^0, W^1)}{Q_P(p^0, W^2, W^3)} \tag{3}$$

Again, using the trans-log utility function, ln Q_E becomes the *translog equity index*. When the index is larger than zero, equity, supposedly, has increased.

The *social cost of living index*, P is defined as the social expenditure function evaluated at current prices p^0 and maximum level of welfare W^3 divided by the social expenditure function evaluated at base prices p^0 and, again, the maximum level of welfare W^3. Hence, it is the ratio of the level of expenditure required to attain W^3

[36] $\{M_k\}$ in Jorgenson and Slesnick's notation is μ_s in Pollak's.

at current prices and the level of expenditure required to attain the same level of welfare at base prices.

$$P = \frac{M(p^1, W^3)}{M(p^0, W^3)} \tag{4}$$

The log of P is defined as the *translog social cost of living index* which is the translog version of Pollak's index. As Jorgenson points out, since the index only depends on the maximum level of welfare W^3, it does not vary with the degree of aversion to inequality r. When lnP is greater than zero and aggregate expenditure is constant, social welfare is *decreased* by moving from p^0 to p^1.

Jorgenson and Slesnick compare these to indices that are defined in terms of real expenditure per person. For example, they compare the rate of growth in the *translog social cost of living index* to the Consumer Price Index defined by the U.S. Bureau of Labor Statistics and obtain a measure of bias in the C.P.I.

There are a number of objections to the Jorgenson and Slesnick approach. As Hammond (1990) points out, their social welfare measure lnP requires non–local information, even for small changes. This is due to the definition of P in terms of W^3. It seems very hard to move from the actual income distribution to their optimal distribution, even for small changes. In addition, the effort to define W^3 includes optimal redistribution via lump–sum transfers and thus poses serious incentive compatibility problems [Hammond (1979), Hammond (1987)]. Furthermore, the welfare measures they obtain are hard to interpret since they are defined in terms of an optimal income distribution. However, they do make clear the value judgements, by incorporating them properly in the Samuelson–Bergson welfare function. Also, to be fair, Jorgenson and Slesnick were not concerned with evaluating projects, but with analyzing inequality and measuring national income.

Regarding the empirical aspect, the translog demand system they estimate suffers from the shortcomings discussed for individual welfare measures. It is not really satisfactory to impose a particular type of utility function, and corresponding demand function, on the data. Jorgenson and Slesnick recover individual demands from aggregate data by appealing to the aggregation properties of their system. One should test exact aggregation, not assume it.

3.2.3 "Individualised" Weighted Social Welfare Functions

Sen (1982) has tried to compare the level of real national income for different countries[37]. Obviously this means comparing different groups. To Sen it was important

[37]The approach described here was first suggested in Sen (1976) and Sen (1979); it is briefly discussed in Hammond (1990). Additional theoretical work can be found in Ebert (1987).

to make welfare comparisons. To do this, he started from the idea of "personalized commodities" – the same commodities in the possession of two different people are two different goods. This allowed him to define individualised welfare weighted prices, which form the basis of his welfare comparisons. In effect, he makes society one big consumer, making it possible to apply individual welfare measures. Sen avoids the problem implicit in Harberger's weighting. As the projects considered change the income distribution, the weights change. Hence, someone who has been moved up the scale by the project subsequently has a lower welfare weight attached.

Sen's approach is not very intuitive. In particular the value of the measures he obtains is hard to interpret; they are in terms of "welfare weighted money". Hammond (1988), appendix) considers how to calculate these measures. However, his methods only provide approximations, although is is possible to devise "welfare weighted" versions of Vartias' methods.

3.3 Uniform Money Metric of Social Welfare

Uniform Money Metric Measures are closely related to the "uniformly distributed dollars" (UDD) used in Feldstein (1974) and Rosen (1976)[38]. Hammond (1990) has suggested a social welfare measure which shares many of the advantages of the individual measures he proposed. It is based on the idea of a uniform poll subsidy (or tax) that would produce the same effect on social welfare as the project considered.

In Section 3.2 of that paper, a direct social welfare function of Paretian form and a corresponding indirect social welfare function are introduced. The variables x, traded goods, z, untraded goods and m, money income, are redefined over a finite set of individuals I. Section 3.3 recasts Jorgenson and Slesnick in terms of money metric functions; the *total money metric direct utility function* and the *total money metric indirect utility function*. The limitations of their measure become very clear[39].

Section 3.4 introduces the indirect *uniform money metric social welfare function* $\mu(p, \mathbf{m}; \mathbf{z})$ which is central to the paper. To define the money metric, several reference vectors must be kept fixed; here these are a reference price vector p^R, some reference exogenous interpersonal profile of quantity vector $\mathbf{z}^R$ and a reference income distribution, $\mathbf{m}^R$ of unearned incomes. Hammond's measure considers "the level of uniform

[38] Rosen asked: "If, for example, we find that the ratio of W [the social welfare function] under regime A to that in tax regime B is 1.01, how much better is A than B? In order to interpret such a change in the welfare index, it is useful to translate it into an equivalent change in family incomes. Perhaps the most natural way to accomplish this is to determine how many uniformly distributed dollars (UDD) are necessary to raise welfare in B by one percent."

[39] Jorgenson and Slesnick's index $\ln P$ has the same level of social welfare, W^3, in the numerator and denominator because they only want to construct price indices and not welfare measures.

poll subsidy which, if given to all individuals in the reference situation $(p^R, \mathbf{m}^R, \mathbf{z}^R)$, would yield the same level of social welfare."

Formally, $\mu(p, \mathbf{m}; \mathbf{z})$ is the (unique) solution to the equation

$$V(p^R, \mathbf{m}^R + \mu(p, \mathbf{m}; \mathbf{z})1; \mathbf{z}^R) = V(p, \mathbf{m}; \mathbf{z}) \tag{5}$$

where 1 represents a vector of ones and $V(p, \mathbf{m}; \mathbf{z})$ is the indirect social welfare function. Starting from a reference vector where only $(p, \mathbf{z})$ are at their reference values $(p^R, \mathbf{z}^R)$, but the income distribution takes the value $\mathbf{m}^R + \sigma 1$, where σ is the before mentioned uniform net poll subsidy, then $\mu(p^R, \mathbf{m}; \mathbf{z}^R) = \sigma$.

Section 3.5 defines a corresponding measures of welfare change. For a change in the exogenous variables from initial values $(p^0, \mathbf{m}^0, \mathbf{z}^0)$ to final values $(p^1, \mathbf{m}^1, \mathbf{z}^1)$, a measure of welfare change is the uniform variation in money metric social welfare.

$$(p^1, \mathbf{m}^1; z^1) - \mu(p^0, \mathbf{m}^0; z^0) \tag{6}$$

Like in the individual case, this allows one to define the *uniform equivalent variation* (UEV) and *uniform compensating variation* (UCV).

The rest of the paper follows the discussion on individual welfare measures. Is it possible to recover the uniform money metric social welfare function from a set of ordinary demand equations without spelling out an exact functional form for the social welfare function? Which conditions must be imposed on the demand system to correspond to a preference ordering for all the consumers in the society? Again, the solution lies in solving a differential equation, albeit the integrability conditions are somewhat different then in the case of the individual consumer[40].

Hammond's measure has all the advantages of his individual measures and, also, it does not suffer from the redistribution problems of Jorgenson and Slesnick. It can be calculated from the current income distribution in the reference vector and therefore does not suffer from "first best illusion". At worst, it is not the most intuitive measure one could hope for, but maybe this is due to the use of the money metric, rather than to the idea of poll subsidies in particular. Indeed, some alternatives are suggested in the conclusion of Hammond (1990).

[40]The integrability conditions differ from the familiar ones in, for example in Varian (1984), because they distinguish between traded and untraded goods.

4 Estimation

4.1 Parametric Estimation of Exact Welfare Measures

The estimation of welfare measures is a cornerstone in the evaluation of large projects, for example tax reform. The parametric approach to evaluating tax reform was pioneered by Rosen (1976) and King (1983). Despite a whole range of practical and theoretical problems, partly addressed in King (1987), the parametric estimation of demand systems and welfare measures is one of the tools applied to designing reforms in Eastern European Countries; see Pudney (1991) for Hungary.

4.1.1 Classification of Approaches

Traditionally, applied economists have (mis)used parametric estimation of demand systems as the basis for welfare calculations, even when the correct welfare measures are considered. Good summaries of parametric approaches to demand analysis can be found in Deaton (1986), Blundell (1988) and an excellent book by Thomas (1987). Thomas distinguishes between two schools of thought.

1. Those who initially specify a family of (direct or indirect) utility functions for the consumer, then derive and estimate the parameters of the utility function by estimating corresponding demand functions. It is guaranteed that the obtained functional forms satisfy all restrictions imposed by consumer theory. Klein and Rubin (1947) were probably among the first to pioneer this approach. Later examples are the linear expenditure system (LES) used by Stone (1954) and the indirect addilog model of Houthakker (1960).

2. Those who start from a general set of demand functions, not necessarily derived from a parametric family of direct or even indirect utility functions, then test for consistency with utility maximisation, impose the necessary restrictions, reestimate and recover the expenditure and indirect utility functions. Initially one has to estimate the full $n(n+1)$ price and total expenditure responses. In practice, n, the number of commodity groups, has to be kept rather small. Examples are the Rotterdam model by Theil (1965) and Barten (1969)[41] and the double logarithmic system, applied by Byron (1970a,70b).

A third approach is a combination of the former two. It starts from "flexible functional forms" that approximate locally a general expenditure function or the corresponding

[41] There are good reasons to believe that the Rotterdam model never satisfies the general restrictions imposed by consumer theory; see Deaton and Muellbauer (1980, page 73).

indirect utility function. They also generate demand equations which do not necessarily satisfy the general restrictions of theory. This approach was inspired by Diewert (1971). Examples are the direct and the indirect translog model, Christensen, Jorgenson and Lau (1975) and the Almost Ideal Demand System (AIDS) of Deaton and Muellbauer (1980).

King (1983) has presented a computer program, the Tax Reform Analysis Package (TRAP), that estimates welfare measures using any of the examples for approach one and flexible functional forms.

Hausman (1981) argues the case for the second parametric approach. "My approach differs from much recent work in that I begin with the observed market demand curve and then derive the unobserved indirect utility function and expenditure function. The more common approach is to start from a specification of the utility function, for example, Stone–Geary or translog, and then estimate the unknown parameters from the derived market demand functions. The method used here seems preferable on two grounds. First, the only observable data are the market demand data so good econometric practice would indicate finding a function that fits the data well. Thus different specifications of the demand function, not the utility function, would be fit with the best-fitting demand equation chosen to base the applied welfare analysis on. Second, specifications such as the translog functions force all the demand curves to have the same functional form which are often difficult to fit econometrically. ..." [Hausman (1981), page 664].

4.1.2 Presentation of estimation results

Estimates of social welfare measures usually give a single number and do not leave the applied economist with many presentational choices. Individual welfare measures are more subtle. King (1983) was the first to report individual welfare changes over the range of the income distribution and the associated confidence regions. Since then, general mathematical and statistical packages, like *Mathematica™* and *SAS™*, have come to feature graphical possibilities that open new avenues to applied public economists. One possibility is to report individual measures of equivalent variation over the income range and a range of price changes.

To illustrate this possibility, consider the second example in Hausman (1981). Hausman reports a hypothetical long run demand function for petrol of the form[42],

$$x_1 = \alpha p_1 + \delta y + z\gamma \quad . \tag{7}$$

[42] He takes the values $\alpha = -14.22$, $\delta = 0.082$, and $\gamma = 4.95$.

The corresponding expenditure function is Hausman's equation (17),

$$e(p_1, \bar{u}) = e^{\delta p_1}\bar{u} - \frac{1}{\delta}\left(\alpha p_1 + \frac{\alpha}{\delta} + z\gamma\right) \tag{8}$$

Using this information Hausman calculates the compensating variation for the "mean" person[43], who would lie somewhere in the middle of the surface in Figure 2.

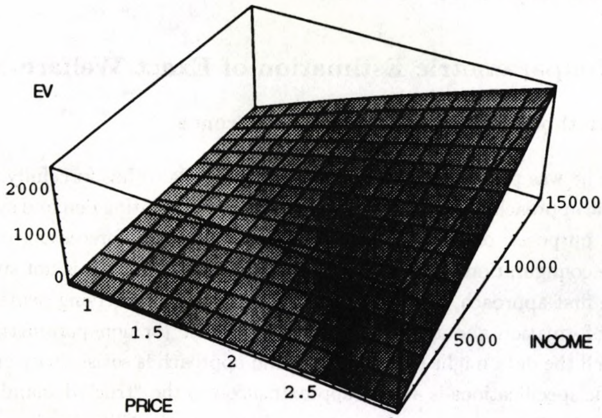

Figure 2.: Own Calculation of Equivalent Variation for for Hausman (1981) equation (37). Incomes from $500 to $15.000 per month. Initial price $0.75, new prices between $0.80 and $3.00 per gallon.

What Figure 2 tries to illustrate is the importance of reporting *distributions* of equivalent variation, not single numbers based on averaging over years and individuals. For the "mean" individual with an income of $720, the equivalent variation for a price change from $0.75 to $1.00 is $34.95[44]. For the same household and a price

[43] As was argued before, this "mean" person might be wholly unrepresentative of the total population. Ignoring the theoretical problems associated with compensating variations, reporting such a number in applied work is not only uninformative: it is misleading.

[44] Hausman computed a compensating variation of $37.17. A Marshallian approximation, favoured by Willig (1976), gives $35.99 per month. The equivalent variation computed here implies a 6.2% difference between EV and CV and a 3% difference between EV and CS. As Willig noted, in terms of these numbers it does not make a big difference which of the measures one uses. However, the differences in this simple example are misleading. For more realistic demand functions and more than one price change the gaps can become substantial.

change from $0.75 to $2.50 the equivalent variation is $67.13. For a household with $8000 a month the equivalent variation for the $0.75–$1.50 price change is $469.18, for $0.75–$2.50 it is $1040.32. These numbers represent 4.9%, 9.0%, 5.9% and 13% of monthly reference income respectively[45].

For single price changes King (1983) remains the 'state of the art'. He gives confidence intervals for each estimate of the equivalent variation locus. Although it implies a great deal of extra work, unless one uses a package like TRAP, it is desirable that all applied work adopts this good practice[46].

4.2 Nonparametric Estimation of Exact Welfare Measures

4.2.1 Methods based on Revealed Preference

Although he was probably not the first, Varian (1982a,b) has forcefully attacked the parametric approach to demand analysis[47]. To him, estimating demand systems serves two main purposes: one, making welfare judgements; two, forecasting demand given new price configurations. He argues that parametric estimation is not suitable for either. The first approach, specifying a utility function and deriving demand functions uses no information about other possible parametric (or non-parametric) specifications which the data might reveal. The second approach is satisfactory only when the parametric specifications is a good approximation to the "true" demand functions. If not, the tests that are meant to ensure consistency with utility maximisation are not valid, since the test statistics contain *misspecification bias.* Flexible functional forms, a combination of approaches one and two, suffer from the same shortcomings.

Varian deals with this *integrability problem* by applying the theory of revealed preference. He asks how raw data itself , not a parametric form of demand function, can be

[45] Again, the percentages would differ rather more if the example was non linear and considered more than one price change.

[46] In recent work, Kling and Sexton (1990) have used bootstrapping to estimate the statistical properties of two common, parametric specifications of a single demand curve (parametric approach two). Using the methods suggested in Freedman and Peters (1984), they resample from the error distribution of their estimated equations (for a textbook introduction to bootstrapping see, for example, Härdle (1990).). For linear and semilog demand functions, they find that their estimator can be very imprecise. They also find that precision primarily depends on the size and quality of the underlying data. Hence they conclude that "there may be higher returns to collecting more and better data than from worrying about theoretical discrepancies between various measures" [Kling and Sexton (1990), page 418]. While this conclusion is debatable, there is no doubt that bootstrapping might be a serious alternative to asymtotics for constructing standard errors, or confidence intervals for the empirical welfare measures. It also has the added advantage of making no assumptions about the error distributions.

[47] Varian's work is closely related to Afriat (1967) and Afriat (1977). Unfortunately, these tend to be almost inaccessible to anybody but the very specialised reader.

tested for consistency with preference maximisation, how the underlying preferences can be recovered from a cloud of observations, and whether it is still possible to model consumers' responses to price changes. Varian approaches the problem by defining when a budget (prices and expenditures) is revealed preferred or revealed worse. This gives the conditions under which the actual choices observed can be tested for consistency. Furthermore, he defines upper and lower bounds for the "money metric" utility function of Samuelson (1979), two constructs he calls under– and overcompensation functions. The question here is to determine, not whether, but by how much a bundle is preferred to another. The analysis is extended to the indirect income compensation function[48], bounded by the *indirect overcompensation function* and *indirect undercompensation function*.

In section 7 of the paper Varian applies some of the algorithms for calculating over– and undercompensation functions to actual data. For aggregate data, he reports consistency with the General Axiom of Revealed Preference (GARP), contradicting studies that have used parametric methods. He gives a very convincing explanation for this result. Post war aggregate data for the U.S. is characterised by small changes in relative prices and, up to three years before Varian's writing, large increases in mean income. Hence, each year was revealed preferred to the previous year. The "representative consumer" was able to buy the bundles of each of the previous years. Or, thinking about it the other way round, the "representative consumer" in the previous years was unable to buy any of the bundles in later years. Therefore, observed aggregate behaviour must satisfy GARP. *Varian concludes that parametric methods have not rejected utility maximisation, but the chosen parametric form has.* It seems that this, first of all, casts doubt on the usefulness of analysing aggregate data in applied demand analysis, but also, it gives additional ammunition to alternative and, strangely enough, still unorthodox approaches to estimating individual and social welfare.

Varian also computes approximations to his "true" over– and under–compensation functions and thus calculates a "true cost of living index". Although methodologically interesting, the computed measures do not appear to be very reliable. The price variation in the data is simply too small and possibly overshadowed by the approximation errors. In general, Varian's bounds are not sufficiently close to the "true" measures. Nonparametric estimation promises to obtain these directly, while retaining the spirit of Varian's analysis.

[48] Varian calls the money metric *direct income compensation function*.

4.2.2 Nonparametric Estimation: General background.

Nonparametric methods in the econometric context are not the distribution free methods which one refers to, under the same name, in statistics, although they have a lot in common. Nonparametric methods in economics try to estimate a relationship between variables without imposing a prespecified functional form. Parametric methods do use such functional forms, which are imposed on the data, giving rise to the familiar misspecification problem.

Both methods have advantages and disadvantages. Nonparametric methods are able to capture unexpected features in the data, and to *explore* an unknown relationship between variables; the specification is not anchored in theory. On the other hand, provided one chooses the correct functional form, parametric methods are suitable for testing parameterisations derived from economic theory. Blossfeld, Hamerle and Mayer (1989) draw attention to this important methodological issue in the context of estimating hazard functions. Using the semiparametric Cox proportional hazards model, an investigator can obtain the influence of covariates without having to make further assumptions about the form of the hazard–rate path. However, when interested in testing specific hypotheses, for example a human capital explanation of returns to schooling, regarding the hazard path itself, the use of parametric methods is required.

In the context of estimating welfare measures, are nonparametric methods the suitable choice of technique? What question does one try to answer ? If the question was "do consumers in country X possess a utility function Y, maximise utility subject to a budget constraint and exhibit a demand function of functional form Z ?" parametric and not nonparametric methods should be implemented. In the context of estimating welfare measures, the question is a different one. The applied public economist does not know the preference ordering of the consumers in the country of interest, indeed, consumers might exhibit different preference orderings, utility and demand functions. What one can hope to do is to fit a parameter free functional form, as best as one can, to observed demands for each consumer or cohort. Non parametric estimation of demand systems corresponds to parametric approach two. Hence, nonparametric estimation is the preferred technique for welfare analysis, if (parametric) approach two is more suitable than one and nonparametric is superior to parametric estimation. The most severe limitation of the nonparametric approach lies in the lack of available micro–data sets with many and frequent observations over time for large cross sections and many goods.

4.2.3 Nonparametric Estimation in Practice

In very recent and yet unpublished work, Jerry Hausman and Whitney Newey at MIT have obtained nonparametric (and parametric) estimates of gasoline demand for the United States, using micro-data collected at the household level. They use their estimates to derive exact welfare measures, following the procedure previously suggested in Hausman (1981). The paper by Hausman and Newey is the potential bench-mark for future work in this area.

Hausman and Newey have monthly data for the years 1979, 1980, 1981, 1983, 1985 and 1988 and a total of 18,113 observations. Although the first three surveys are split into eight, the latter into nine regions, they do not report how much regional price variation was in the data. Hausman and Newey had 72 data points to describe an intra household price variation from \$1.34–\$1.46, on average, for 1979–81 to \$0.83 in 1988, all at 1983 prices.

Hausman and Newey use kernel estimators and they experiment with different bandwidths. The smoothing parameter selection problem is addressed by an analytical method due to Silverman (1985), for density estimation under normality, and the cross-validation method discussed in Härdle (1990).

They fit a single nonparametric equation (with dummy shifts) of the form

$$\log q_i = g(\log p_i, \log y_i) + Z_i\gamma + e_i \quad (i = 1, ..., n) \tag{9}$$

$$E[e\,|p, y] = 0 \tag{10}$$

where q_i is household petrol demand, p_i petrol price, y_i household income and Z_i a matrix of 20 indicator variables for different region and survey year effects. Here g is the nonparametric function to be estimated.

Recovering the exact welfare measures is based on Roy's identity, which establishes a link between the demand functions and the indirect utility function.

$$x_1(p,y)\frac{\partial v(p,y)}{\partial y} + \frac{\partial v(p,y)}{\partial p_1} = 0 \tag{11}$$

Roy's identity is a partial differential equation. Hausman (1981) shows how this partial differential equation (PDE) can be transformed into an ordinary differential equation (ODE), not an unimportant detail when trying to apply numerical methods to find a solution. The ordinary differential equation that is used to recover the welfare measures is

$$\frac{dy(p_1)}{dp_1} = x_1(p,y) \tag{12}$$

For the nonparametric case, Hausman and Newey make a 'guess' at the form of the solution and define

$$S(p, y^0) = y^0 - e(p, u^1) \tag{13}$$

By differentiating with respect to p and remembering Shepard's lemma, it can be checked that this has the right form.

$$\frac{\partial e(p, u^1)}{\partial p_i} = h_i(p, u^1) = x_i(p, e(p, u^1)) \qquad \text{Shepard's lemma} \tag{14}$$

Hence, and since $e(p, u^1) = S(p, y_0) - y_0 = S(p, y) - y$,

$$\frac{\partial S(p, y)}{\partial p} = -x\left(p, e(p, u^1)\right) = -x\left(p, y - S(p, y)\right) \quad with \quad S(p^1, y) = 0 \tag{15}$$

which checks with the ODE defined above.

Furthermore, since

$$\begin{aligned} x(p, y) &= \exp\left(\hat{g}(\log p, \log y)\right) \\ x\left(p, y - S(p, y)\right) &= \exp\left(\hat{g}\left(\log p, \log(y - S(p, y)\right)\right)\right) \end{aligned} \tag{16}$$

the desired ODE becomes

$$\frac{\partial S(p, y)}{\partial p} = -\exp\left[\hat{g}(\log p, \log(y - S(p, y)))\right] \tag{17}$$

Hausman and Newey solve this equation by the fourth order Runge–Kutta algorithm, a standard method for solving systems of ordinary differential equations that is sometimes not very efficient but is stable in most cases.

A comparison of parametric and nonparametric average demand reveals that the non–parametrically estimated demand curve contains a lot more local information, as was to be expected. The derivation of a sampling distribution for the nonparametric estimator of welfare change draws on Newey (1988). Hausman and Newey find that the rate of convergence for the estimated equivalent variation is considerably faster than the rate of convergence for the nonparametric estimates themselves. Although one must await publication of the draft paper, it seems that this result is related to considering the *average equivalent variation* in the whole population. If this is the case, there is a tradeoff between getting an estimate of an unrepresentative and, in a way, unethical "welfare measure" with a well behaved asymptotic distribution and a more informative range of welfare measures, but with a weaker or unknown sampling distribution.

Extending the Hausman and Newey specification to two goods and more than one price change gives,

$$\log q_{1i} = g_1(\log p_{1i}, \log p_{2i}, \log y_i) + Z_i\gamma_1 + e_{1i} \tag{18}$$

$$\begin{aligned} \log q_{2i} &= g_2(\log p_{1i}, \log p_{2i}, \log y_i) + Z_i\gamma_2 + e_{2i} \qquad (i = 1, ..., n) \\ & E[e_{1i} \mid p_{1i}, p_{2i}, y_i] = 0 \\ & E[e_{2i} \mid p_{1i}, p_{2i}, y_i] = 0 \\ & E[e_{1i}, e_{2i}] = 0 \end{aligned} \tag{19}$$

where g_1 and g_2 are the functions to be estimated nonparametrically. Ignoring Slutsky symmetry for the moment, both equations can be estimated separately, since they are reduced forms. The usual issues of identification and cross equation restrictions do not arise for the unresricted estimates. However, the issue of Slutsky symmetry still arises (discussed in a later section).

In effect, system estimation adds another dimension to the smoothing problems. Härdle (1990) has a chapter on "smoothing in higher dimensions", Silverman (1985) considers "the kernel method for multivariate data". The challenge and limitation to smoothing in higher dimensions, to use Härdle's expression, is the data required to approximate surfaces in spaces of higher order. Silverman (page 94) reports the following relationship between dimensionality and required sample size.

Dimensionality	Sample Size
1	4
2	19
3	223
4	768
6	2790
7	10700
8	43700
9	187000
10	842000

For applications in economics, even with very large micro data sets, 8 is the largest dimension one can ever hope to model[49].

4.2.4 Price Variation

A common problem in demand analysis stems from the difficulty of obtaining enough data that contains a sufficient degree of price variation; a problem that is exacerbated when trying to use nonparametric techniques. There are two sources of price variation in household survey data, variation over time, intra-household variation, and variation over a cross-section, inter-household variation. Household specific real prices can be calculated by dividing the reported expenditure by quantity purchased and deflating by the general price index. Usually, one finds a considerable degree of variation in a single cross-section. However, such variation is inevitably misleading and more reflects varieties or qualities purchased than differences in true prices. Pudney (1991) recommends that inter-household price information is used only when it can be identified with household location. Ideally, these are, again, grouped into cells that have the same income and social class composition. One can also argue for including demographic criteria. Unless one has a very large cross-section for a big country, like the U.S., which is more likely to have regional price variation for some products, very few additional data points result.

Hence, the main source of price variation is intra-household price variation. To have enough, one must hope to have data for several years and preferably on a monthly basis. Monthly data captures the substantial seasonal price variation, which can be often larger than real price variation over a longer period. Quarterly data too is promising.

---

[49]Maybe this is too pessimistic and the use of, for example, squashing functions will provide a way around this "curse of dimensionality" problem.

In general, estimating responses to price variation nonparametrically poses a serious data problem. There are no ready answers and very few studies to draw on. One possible way around the data problem is the semi-parametric estimation of a demand system, estimating parametrically over prices (time) and nonparametrically over income (cross-section and time). Such a specification, retaining the previous notation, is given by

$$\log q_{1i} = g_1(\log y_i) + \beta_{11}\log p_{1i} + \beta_{12}\log p_{2i} + Z_i\gamma_1 + e_{1i}$$
$$\log q_{2i} = g_2(\log y_i) + \beta_{21}\log p_{1i} + \beta_{22}\log p_{2i} + Z_i\gamma_2 + e_{2i} \qquad (i = 1, ..., n)$$
$$E[e_{1i}\,|p_{1i}, p_{2i}, y_i] = 0$$
$$E[e_{2i}\,|p_{1i}, p_{2i}, y_i] = 0$$
$$E\,[e_{1i}, e_{2i}] = 0$$

Although this approach takes away most of the spirit, and advantages of the nonparametric approach, it is, short of collecting richer data sets, the only feasible alternative for systems estimation. Note, the identification issue and cross equation restrictions do arise with this specification.

4.3 Integrability Conditions

The estimated functions g_1 and g_2 are continuously differentiable, obtaining the Hessian poses, in principle, no difficulties. However, can one impose symmetry and negative semi-definiteness without losing the advantages of nonparametric estimation? The obvious solution to imposing the negative semi-definite constraint is the choice of the smoothing parameter, a strategy that equally applies to smoothing in higher dimensions.

The issue of symmetry does not arise for single equations, but is essential for demand systems. Unless symmetry is imposed, there are no numerical solutions to the system of differential equations, the expenditure functions can not be retrieved and exact welfare analysis is no longer possible. Like negative semi-definiteness, symmetry should be imposed in the smoothing process itself. Indeed, imposing such restrictions might reduce the dimensionality problem significantly and render the estimation of larger demand systems possible. However, it is not clear how symmetry can be imposed in practice. Unless it is done properly, one would lose too many of the desirable properties of the nonparametric approach.

If the nonparametric approach to estimating welfare measures is to have any practical relevance, one must estimate a demand system, check the integrability conditions and recover the expenditure functions by solving the resulting system of differential equations numerically. These issues pose challenging problems to statisticians and applied micro economists.

4.4 Conclusion

In his survey article on 'Demand Analysis' for the *Handbook of Econometrics*, Angus Deaton stated that "there is no valid theoretical or practical reason for ever integrating under a *Marshallian* demand curve. The very considerable literature discussing the practical difficulties of doing so (the path independence of the integral, for example) provides a remarkable example of the elaboration of secondary nonsense which can occur once a large primary category error has been accepted; the emperor with no clothes, although quite aware of his total nakedness, is continuously distressed by his inability to tie his shoelaces." [Deaton (1986), p. 1826]. Six years after publication the emperor, in many parts, is still without clothes. Applied work in industrial organisation, agricultural and environmental economics (and elsewhere) still computes Marshallian consumer surplus measures, or CS approximations to CV, to measure the welfare of the individual and sums surpluses to measure the welfare of society. In the traditional area of parametric estimation, there is, until now, one well known application that explicitly computes ranges of equivalent variations; King (1983).

The theory of individual welfare measures is well defined and does not pose great conceptual difficulties. Nevertheless, valid applications of the theory for policy analysis remain scarce. The theory and estimation of social welfare measures are difficult. Many of the existing measures are hard to interpret, especially since it is not clear what value judgements have been used in their construction. However, simply summing up individual welfare measures, although it is very clear what value judgements have been used, is not a solution. Although Hammond's measure is easier to interpret than the others, maybe an alternative to the money metric, for example the income tax measure proposed in Section 4.2 of Hammond (1990) is more intuitive.

For estimation, it has been shown that the traditional, parametric methods of demand analysis lend themselves to welfare estimation, as suggested by theory. Extended versions of packages like TRAP, which include the step from the estimated demand function to the cost function, can remove the temptation to resort to consumer surplus based welfare measures in policy analysis[50].

For nonparametric estimation, two main technical challenges have been identified; one, deriving sampling distributions for the estimated welfare measures; two, impos-

[50]Mathematica 2.0 already includes a function that symbolically solves basic differential equations. The numerical algorithms provided by Vartia (1983) can be applied even when there is no explicit solution for the chosen functional form.

ing symmetry on the Slutsky matrix of second order derivatives of the expenditure function. Conceptually, both problems seem to have a solution. Data limitations appear severe, but if the nonparametric approach proves easier, more accurate and more powerful than the traditional parametric methods, one expects governments to commission new surveys and employ research teams to conduct the kind of analysis presented, but on a much larger scale; one should hope so anyway.

On the whole, given the importance and history of the subject, the literature appears surprisingly patchy and provides great opportunities for theoretical and policy oriented future research.

Appendix: JEL Abstract-Search

Journal	Count	Percent
Acta Oeconomica	1	0.54
American Economic Review	16	8.65
American Journal of Agricultural Economics	19	10.3
Annals of Regional Science	2	1.08
Applied Economics	2	1.08
Atlantic Economic Journal	3	1.62
Australian Journal of Agricultural Economics	5	2.70
Boulder and Oxford: Westview Press	1	0.54
Bulletin of Economic Research	3	1.62
Canadian Journal of Agricultural Economics	3	1.62
Canadian Journal of Economics	2	1.08
Consommation	1	0.54
Contemporary Policy Issues	1	0.54
Econometrica	5	2.70
Economia Politica	1	0.54
Economic Geography	4	2.16
Economic Inquiry	1	0.54
Economic Journal	3	1.62
Economic Record	1	0.54
Economica	2	1.08
Energy Economics	1	0.54
Engineering Economist	1	0.54
European Economic Review	1	0.54
History of Political Economy	2	1.08
Indian Economic Journal	1	0.54
Information Economics and Policy	1	0.54
International Economic Review	6	3.24
International Journal of Industrial Organization	3	1.62
Journal of Agricultural Economics	2	1.08
Journal of Consumer Affairs	1	0.54
Journal of Economic Issues	1	0.54
Journal of Economic Literature	1	0.54
Journal of Economic Studies	1	0.54

Note: Table continued on next page.

Appendix: JEL Abstract-Search (continued)

Journal	Count	Percent
Journal of Economic Theory	4	2.16
Journal of Economics (Zeitschrift fur Nationalokonomie)	1	0.54
Journal of Environmental Economics and Management	4	2.16
Journal of Industrial Economics	4	2.16
Journal of International Economics	1	0.54
Journal of Money, Credit, and Banking	1	0.54
Journal of Political Economy	7	3.78
Journal of Public Economics	5	2.70
Journal of Regulatory Economics	1	0.54
Journal of Risk and Uncertainty	1	0.54
Kyklos	1	0.54
Land Economics	7	3.78
Manchester School of Economics and Social Studies	2	1.08
Marine Resource Economics	1	0.54
Osaka Economic Papers	1	0.54
Oxford Economic Papers, N. S.	1	0.54
Public Finance	4	2.16
Quarterly Journal of Economics	4	2.16
Rand Journal of Economics	5	2.70
Regional Science Perspectives	1	0.54
Regional Studies	2	1.08
Review of Economic Studies	5	2.70
Review of Economics and Statistics	1	0.54
Rivista Internazionale di Scienze Economiche e Commerciali	1	0.54
Schweizerische Zeitschrift fur Volkswirtschaft und Statistik	1	0.54
Scottish Journal of Political Economy	3	1.62
Social Choice and Welfare	1	0.54
Southern Economic Journal	6	3.24
Southern Journal of Agricultural Economics	1	0.54
Swedish Journal of Economics	2	1.08
Urban Studies	1	0.54
Water Resources Research	1	0.54
Weltwirtschaftliches Archiv	1	0.54
Western Journal of Agricultural Economics	1	0.54
Zeitschrift fur Nationalokonomie	3	1.62
Zeitschrift fur die gesamte Staatswissenschaft	1	0.54
Total	185	

Note: The search command was "CONSUM* and SURPLUS".

References

ALBON, R.P. (1989), "Alfred Marshall and the Consumers' Loss from the British Post Office Monopoly". *History of Political Economy*. **21**(4): pp. 679-88.

AFRIAT, S.N. (1967), "The Construction of a Utility Function from Expenditure data". *International Economic Review*. **8**: pp. 67–77.

AFRIAT, S.N. (1977), *The Price Index*. Cambridge: Cambridge University Press.

ARCHIBALD, R. AND R. GILLINGHAM (1982), "The distributional impact of alternative gasoline conservation policies". *The Bell Journal of Economics*. **12**: pp. 426–444.

BALDRY, J.C. (1988), "Wealth Effects and the Valuation of Common Access Facilities: Some Calculations". *Economic Record*. **64**(185): pp. 128–32.

BARTEN, A.P. (1969), "Maximum liklihood estimation of a complete system of demand equations". *European Economic Review*. **1**: pp. 7–73.

BLOSSFELD, H.P., A. HAMERLE, AND K.U. MAYER (1989), *Event History Analysis. Statistical Theory and Application in the Social Sciences*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

BLUNDELL, R. (1988), "Consumer Behaviour: Theory and empirical evidence – a survey". *The Economic Journal*. **98**: pp. 16–65.

BOADWAY, R.W. (1974), "The welfare foundations of cost-benefit analysis". *Economic Journal*. (84): pp. 926-39.

BOADWAY, R.W. AND N. BRUCE (1984), *Welfare Economics*. Oxford: Basil Blackwell.

BYRON, R.P. (1970a), "The restricted Aitken estimation of sets of demand relations". *Econometrica*. **38**: pp. 816–30.

BYRON, R.P. (1970b), "A simple method for estimating demand systems under seperable utility assumptions". *Review of Economic Studies*. **37**: pp. 261–74.

CHIPMAN, J.S. AND J.C. MOORE (1976), "The Scope of Consumer's Surplus Arguments", in *Evolution, Welfare and Time in Economics: Essays in Honor of Nicholas Georgescu – Roegen*, A.M. Tang, F. Westfield, andJ. Worley, (eds). D. C. Heath: Lexington, Mass.

CHIPMAN, J.S. AND J.C. MOORE (1980), "Compensating Variation, Consumer's Surplus and Welfare". *American Economic Review*. **70**: pp. 933–949.

CHRISTENSEN, L.R., D.W. JORGENSON, AND L.J. LAU (1975), "Transcendental logarithmic utility functions". *American Economic Review*. : pp. 367–83.

COWELL, F. (1986), *Microeconomic Principles*. Oxford: Philip Allan Publishers Limited.

DEATON, A. (1986), "Demand Analysis", in *Handbook of Econometrics*, Z. Griliches and M. Inriligator, (eds). North Holland:

DEATON, A. AND J. MUELLBAUER (1980), *Economics and consumer behaviour*. Cambridge: Cambridge University Press.

DIAMOND, P.A. AND D.L. MCFADDEN (1974), "Some Uses of the Expenditure Function in Public Finance". *Journal of Public Economics*. **3**: pp. 3–21.

DIERKER, E. AND J. LENNINGHAUS (1986), "Surplus Maximisation and Pareto Optimality", in *Contributions in Mathematical Economics*, W. Hildenbrand and A. Mas-Colell, (eds). North–Holland: Amsterdam.

DIEWERT, W.E. (1971), "An Application of the Shepard Duality Theorem: A Generalized Leontief Production Function". *Journal of Polictical Economy*. **79**: pp. 481–507.

EBERT, U. (1984), "Exact Welfare Measures and Economic Index Numbers". *Zeitschrift für Nationalökonomie*. 1: pp. 27–38.

EBERT, U. (1987), "Hicksian measures of welfare change". *Journal of Public Economics*. **33**: pp. 115–124.

EKELUND, R.B.J. (1987), "Dupuit, Arsène–Jules–Emile Juvenal", in *The New Palgrave: A Dictionary of Economics*, J. Eatwell, N. Milgate, andP. Newman, (eds). Macmillan: London. pp. 943–944.

FELDSTEIN, M. (1974), "Distributional preferences in public expenditure analysis", in *Redistribution through public choice*, H. Hochman and G. Peterson, (eds). Columbia University Press: New York.

FOSTER, C. AND H. NEUBURGER (1978), "The Ugly Truth about Consumer's Surplus". *Zeitschrift für Nationalökonomie*. **38**(3–4): pp. 379–388.

FREEDMAN, D.A. AND S.C. PETERS (1984), "Bootstrapping a Regression Equation: Some Empirical Results". *Journal American Statistical Association*. **79**: pp. 97-106.

GRAVELLE, H. AND R. REES (1981), *Microeconomics*. New York: Longman.

GRAVELLE, H.S.E. AND J.L. WRIGLESWORTH (1987), "The Three Consumer Surpluses as Individual Welfare Measures". *Scottish Journal of Polictical Economy*. **34**(3): pp. 230–48.

HAMMOND, P. (1990), "Theoretical Progress in Public Economics: A Provocative Assessment". *Oxford Economic Papers*. **42**: pp. 6-33.

HAMMOND, P.J. (1979), "Straightforward Individual Incentive Compatibility in Large Economies". *Review of Economic Studies*. : pp. 263–282.

HAMMOND, P. (1982), "The Economics of Justice and the Criterion of Wealth Maximization". *Yale Law Journal*. **91**: pp. 1493–1507.

HAMMOND, P.J. (1987), "Markets as Constraints: Multilateral Incentive Compatibility in Continuum Economies". *Review of Economic Studies*. : pp. 399–412.

HAMMOND, P.J. (1988), "Principles for Evaluating Public Sector Projects", in *Surveys in Public Sector Economics*, P. Hare, (eds). Basil Blackwell: Oxford. pp. 15–44.

HAMMOND, P.J. (1990), "Money Metric Measures of Individual and Social Welfare Allowing for Environmental Externalities". Florence. European University Institute. Working Paper No. ECO 90/12

HARBERGER, A.C. (1971), "Three Basic Postulates for Applied Welfare Economics: An Interpretive Essay". *Journal of Economic Literature*. **9**: pp. 785–797.

HARBERGER, A.C. (1978), "On the Use of Distributional Weights in Social Cost–Benefit Analysis". *Journal of Politcal Economy*. **86**(2): pp. S87–S120.

HAUSE, J.C. (1975), "The Theory of Welfare Cost Measurement". *Journal of Political Economy*. **83**: pp. 1145–1182.

HAUSMAN, J. (1985), "Taxes and Labor Supply", in *Handbook of Public Economics*, A.J. Auerbach and M. Feldstein, (eds). North–Holland: Amsterdam. pp. 213–261.

HAUSMAN, J.A. (1981), "Exact Consumer's Surplus and Deadweight Loss". *American Economic Review*. **71**: pp. 662–676.

HAUSMAN, J.A. AND W.K. NEWEY (1990), "Nonparametric Estimation of Exact Consumers Surplus and Deadweight Loss". MIT, Cambridge, Mass., xerox.

HAVEMAN, R.H., M. GARLEY, AND J. ANDREONI (1987), "Exact Consumer's Surplus and Deadweight Loss: A Correction". *American Economic Review*. **77**: pp. 494–495.

HICKS, J.R. (1946), "The generalized theory of consumer surplus". *Review of Economic Studies*. : pp. 68-74.

HICKS, J.R. (1956), *A Revision of Demand Theory*. Oxford: Clarendon Press.

HOUTHAKKER, H. (1960), "Additive Preferences". *Econometrica*. **28**: pp. 244–57.

HURWICZ, L. AND H. UZAWA (1971), "On the Integrability of Demand Functions", in *Preference, Utility and Demand*, J.S. Chipman, et al., (eds). Harcourt, Brace, Javanowich: New York. pp. 114–148.

HÄRDLE, W. (1990), *Applied nonparametric regression*. Econometric Society Monograph, Vol. 19. Cambridge: Cambridge University Press.

JOHNSON, F. (1985), "The Imprecision of Traditional Welfare Measures in Empirical Applications". *Applied Economics*. **17**(5): pp. 923–32.

JORGENSON, D.W., L.J. LAU, AND T.M. STOKER (1981), "Aggregate Consumer Behaviour and Individual Welfare", in *Macroeconomic Analysis: Essyas in Marcoeconomics and Econometrics*, D. Currie, A.R. Novay, andD. Peel, (eds). Croom Helm: London.

JORGENSON, D.W. AND D.T. SLESNICK (1983), "Individual and social cost–of living indexes", in *Price level measurement*, W.E. Diewert and C. Montmarquette, (eds). Statistics Canada: Ottawa. pp. 241–336.

JORGENSON, D.W. AND D.T. SLESNICK (1984), "Aggregate Consumer Behaviour and Measurement of Inequality". *Review of Economic Studies*. **51**: pp. 369–392.

JORGENSON, W. (1990), "Aggregate Consumer Behaviour and the Measurement of Social Welfare". *Review of Economic Studies*. : pp. 369–392.

JORGENSON, W. AND D.T. SLESNICK (1990), "Inequality and the Standard of Living". *Journal of Econometrics*. **43**: pp. 103–120.

Kay, J.A. (1980), "The deadweight loss from a tax system". *Journal of Public Economics*. **13**: pp. 111–119.

King, M.A. (1983), "Welfare Analysis of Tax Reforms using Household Data". *Journal of Public Economics*. **21**: pp. 183-214.

King, M.A. (1987), *Empirical analysis of tax reforms*. Advances in Econometrics - Fifth Annual Congress Volume II, ed. T.F. Bewley. Cambridge: Cambridge University Press. 61-90 pages.

Klein, L.R. and H. Rubin (1947), "A Constant Utility Index of the Cost of Living". *Review of Economic Studies*. **15**(84–87):

Kling, C.L. and R.J. Sexton (1990), "Bootstrapping in Applied Welfare Analysis". *American Journal of Agricultural Economics*. **72**(2): pp. 406-18.

Kreps, D.M. (1990), *A Course in Microeconomic Theory*. Cambridge: Cambridge University Press.

Mansfield, E. (1975), *Microeconomics*. 2 ed. New York: W. W. Norton & Company Inc.

Markandya, A. (1978), "The Quality of Current Approximations to the Measurement of Compensation Costs". *Oxford Economic Papers*. **30**: pp. 423–433.

Marshall, A. (1930), *Principles of Economics*. 8 ed. London: Macmillan & Co.

McKenzie, G. (1979), "Consumer's Surplus Without Apology: Comment". *American Economic Review*. **69**: pp. 465-68.

McKenzie, G.W. (1982), "Welfare Measurement – A Synthesis". *American Economic Review*. **72**: pp. 669–682.

McKenzie, G.W. (1983), *Measuring Economic Welfare: New Methods*. Cambridge: Cambridge University Press.

McKenzie, G.W. and I.F. Pearce (1976), "A New Operational Procedure for Evaluating Economic Policies". *Review of Economic Studies*. **43**: pp. 465–468.

Mishan, E.J. (1977), "The Plain Truth About Consumer Surplus". *Zeitschrift für Nationalökonomie*. **37**(1–2): pp. 1–24.

Mishan, E.J. (1978), "The Truth Plain or Ugly, but the Truth: A Rejoinder". *Zeitschrift für Nationalökonomie*. **38**(3–4): pp. 389–396.

Morey, E. (1984), "Confuser Surplus". *American Economic Review*. **74**: pp. 163–173.

Morey, E.R. (1985), "Characteristics, Consumer Surplus, and New Activities". *Journal of Public Economics*. **26**: pp. 221–236.

Newey, W. (1988), "Nonparametric Inference". Cambridge, Mass. MIT. mimeo No.

Ng, Y.-K. (1979), *Welfare Economics. Introduction and Development of Basic Concepts*. London: Macmillan. 332 pages.

Pauwels, W. (1986), "Correct and Incorrect Measures of Deadweight Loss of Taxation". *Public–Finance*. **41**(2): pp. 267–76.

POLLAK, R.A. (1981), "The Social Cost of Living Index". *Journal of Public Economics*. **15**(1981): pp. 311–336.

POSNER, R.A. (1981), *The Economics of Justice*. Cambridge, Mass.: Harvard University Press.

PUDNEY, S. . "Tax Reform in Hungary: Analysis of Household Survey Data". in *Economic Transformation in Eastern Europe*. 1991.

ROBERTS, K. (1980), "Possibility Theorems with Interpersonally Comparable Welfare Levels". *Review of Economic Studies*. **47**: pp. 409–420.

ROSEN, H.S. (1976), "A Methodology for Evaluating Tax Reform Proposals". *Journal of Public Economics*. **6**: pp. 105-121.

ROSENTHAL, R. (1991), *Meta-Analytic Procedures for Social Research*. Applied Social Research Methods Series, Vol. 6. Newbury Park: Sage Publications.

SAMUELSON, P. (1979), "Compementarity". *Journal of Political Economy*. **7**: pp. 1255–1289.

SAMUELSON, P.A. (1942), "Constancy of the Marginal Utility of Income", in *Studies in Mathematical Economics and Econometrics: In Memory of Henry Schultz*, O. Lange, (eds). University of Chicago Press: Chicago. pp. 75–91.

SCHMALENSEE, R. (1981), "Output and Welfare Implications of Monopolistic Third–Degree Price Discrimination". *American Economic Review*. **71**: pp. 242–247.

SEN (1982), *Choice, Welfare and Measurement*. Cambridge, Mass.: Harvard University Press.

SEN, A.K. (1976), "Real National Income". *Review of Economic Studies*. **43**: pp. 19–39.

SEN, A.K. (1979), "The Welfare Basis of Real Income Comparisions: A Survey". *Journal of Economic Literature*. **17**: pp. 1–45.

SILBERBERG, E. (1972), "Duality and the Many Consumer's Surpluses". *American Economic Review*. **62**: pp. 942–952.

SILBERBERG, E. (1990), *The Structure of Economics. A Mathematical Analysis*. 2 ed. New York: McGraw–Hill Publishing Company.

SILVERMAN, B.W. (1985), *Density estimation for statistics and data analysis*. London: Chapman Hall.

SMITH, K.V. AND Y. KAORU (1990), "Signals or Noise? Explaining the Variation in Recreation Benefit Estimates". *American Journal of Agricultural Economics*. **72**(2): pp. 419–33.

STONE, J.R.N. (1954), "Linear expenditure systems and demand analysis – an application to the pattern of British demand". *Economic Journal*. **64**: pp. 511–27.

TAKAYAMA, A. (1987), "Consumer Surplus", in *The New Palgrave: A Dictionary of Economics*, J. Eatwell, N. Milgate, andP. Newman, (eds). Macmillan: London. pp. 607–613.

THEIL, H. (1965), "The information approach to demand analysis". *Econometrica*. **33**: pp. 67–87.

THOMAS, R.L. (1987), *Applied Demand Analysis*. London and New York: Longman.

TIROLE, J. (1988), *The Theory of Industrial Organization*. Cambridge, Massachusetts: The MIT Press.

VARIAN, H. (1982a), "The Nonparametric Approach to Demand Analysis". *Econometrica*. **50**: pp. 945–973.

VARIAN, H. (1982b), "Nonparametric Tests of Models of Consumer Behaviour". *Review of Economic Studies*. **50**: pp. 99–100.

VARIAN, H. (1984), *Mircoeconomic Analysis*. New York, London: W. W. Norton & Company.

VARTIA, Y.O. (1983), "Efficient Methods of Measuring Welfare Change and Compensated Income in Terms of Demand Functions". *Econometrica*. **51**: pp. 79–98.

WILLIG, R.D. (1976), "Consumer's Surplus without Apology". *American Economic Review*. **66**: pp. 589–597.

WILLIG, R.D. (1979), "Consumer's Surplus Without Apology: Reply". *American Economic Review*. :

EUI WORKING PAPERS

EUI Working Papers are published and distributed by the
European University Institute, Florence

Copies can be obtained free of charge
– depending on the availability of stocks – from:

The Publications Officer
European University Institute
Badia Fiesolana
I-50016 San Domenico di Fiesole (FI)
Italy

Please use order form overleaf

Publications of the European University Institute

To The Publications Officer
European University Institute
Badia Fiesolana
I-50016 San Domenico di Fiesole (FI)
Italy

From Name . . . .
Address. . . . .
. . . .
. . . .
. . . .
. . . .

❒ Please send me a complete list of EUI Working Papers
❒ Please send me a complete list of EUI book publications
❒ Please send me the EUI brochure Academic Year 1993/94
❒ Please send me the EUI Research Report

Please send me the following EUI Working Paper(s):

No, Author . . . .
Title: . . . .
No, Author . . . .
Title: . . . .
No, Author . . . .
Title: . . . .
No, Author . . . .
Title: . . . .

Date . . . .

Signature . . . .

Working Papers of the Department of Economics Published since 1990

ECO No. 90/1
Tamer BASAR and Mark SALMON
Credibility and the Value of Information Transmission in a Model of Monetary Policy and Inflation

ECO No. 90/2
Horst UNGERER
The EMS – The First Ten Years
Policies – Developments – Evolution

ECO No. 90/3
Peter J. HAMMOND
Interpersonal Comparisons of Utility: Why and how they are and should be made

ECO No. 90/4
Peter J. HAMMOND
A Revelation Principle for (Boundedly) Bayesian Rationalizable Strategies

ECO No. 90/5
Peter J. HAMMOND
Independence of Irrelevant Interpersonal Comparisons

ECO No. 90/6
Hal R. VARIAN
A Solution to the Problem of Externalities and Public Goods when Agents are Well-Informed

ECO No. 90/7
Hal R. VARIAN
Sequential Provision of Public Goods

ECO No. 90/8
T. BRIANZA, L. PHLIPS and J.F. RICHARD
Futures Markets, Speculation and Monopoly Pricing

ECO No. 90/9
Anthony B. ATKINSON/ John MICKLEWRIGHT
Unemployment Compensation and Labour Market Transition: A Critical Review

ECO No. 90/10
Peter J. HAMMOND
The Role of Information in Economics

ECO No. 90/11
Nicos M. CHRISTODOULAKIS
Debt Dynamics in a Small Open Economy

ECO No. 90/12
Stephen C. SMITH
On the Economic Rationale for Codetermination Law

ECO No. 90/13
Elettra AGLIARDI
Learning by Doing and Market Structures

ECO No. 90/14
Peter J. HAMMOND
Intertemporal Objectives

ECO No. 90/15
Andrew EVANS/Stephen MARTIN
Socially Acceptable Distortion of Competition: EC Policy on State Aid

ECO No. 90/16
Stephen MARTIN
Fringe Size and Cartel Stability

ECO No. 90/17
John MICKLEWRIGHT
Why Do Less Than a Quarter of the Unemployed in Britain Receive Unemployment Insurance?

ECO No. 90/18
Mrudula A. PATEL
Optimal Life Cycle Saving With Borrowing Constraints: A Graphical Solution

ECO No. 90/19
Peter J. HAMMOND
Money Metric Measures of Individual and Social Welfare Allowing for Environmental Externalities

ECO No. 90/20
Louis PHLIPS/
Ronald M. HARSTAD
Oligopolistic Manipulation of Spot Markets and the Timing of Futures Market Speculation

* Working Paper out of print

ECO No. 90/21
Christian DUSTMANN
Earnings Adjustment of Temporary Migrants

ECO No. 90/22
John MICKLEWRIGHT
The Reform of Unemployment Compensation:
Choices for East and West

ECO No. 90/23
Joerg MAYER
U. S. Dollar and Deutschmark as Reserve Assets

ECO No. 90/24
Sheila MARNIE
Labour Market Reform in the USSR: Fact or Fiction?

ECO No. 90/25
Peter JENSEN/
Niels WESTERGÅRD-NIELSEN
Temporary Layoffs and the Duration of Unemployment: An Empirical Analysis

ECO No. 90/26
Stephan L. KALB
Market-Led Approaches to European Monetary Union in the Light of a Legal Restrictions Theory of Money

ECO No. 90/27
Robert J. WALDMANN
Implausible Results or Implausible Data? Anomalies in the Construction of Value Added Data and Implications for Estimates of Price-Cost Markups

ECO No. 90/28
Stephen MARTIN
Periodic Model Changes in Oligopoly

ECO No. 90/29
Nicos CHRISTODOULAKIS/
Martin WEALE
Imperfect Competition in an Open Economy

***

ECO No. 91/30
Steve ALPERN/Dennis J. SNOWER
Unemployment Through 'Learning From Experience'

ECO No. 91/31
David M. PRESCOTT/Thanasis STENGOS
Testing for Forecastible Nonlinear Dependence in Weekly Gold Rates of Return

ECO No. 91/32
Peter J. HAMMOND
Harsanyi's Utilitarian Theorem:
A Simpler Proof and Some Ethical Connotations

ECO No. 91/33
Anthony B. ATKINSON/
John MICKLEWRIGHT
Economic Transformation in Eastern Europe and the Distribution of Income*

ECO No. 91/34
Svend ALBAEK
On Nash and Stackelberg Equilibria when Costs are Private Information

ECO No. 91/35
Stephen MARTIN
Private and Social Incentives to Form R & D Joint Ventures

ECO No. 91/36
Louis PHLIPS
Manipulation of Crude Oil Futures

ECO No. 91/37
Xavier CALSAMIGLIA/Alan KIRMAN
A Unique Informationally Efficient and Decentralized Mechanism With Fair Outcomes

ECO No. 91/38
George S. ALOGOSKOUFIS/
Thanasis STENGOS
Testing for Nonlinear Dynamics in Historical Unemployment Series

ECO No. 91/39
Peter J. HAMMOND
The Moral Status of Profits and Other Rewards:
A Perspective From Modern Welfare Economics

* Working Paper out of print

ECO No. 91/40
Vincent BROUSSEAU/Alan KIRMAN
The Dynamics of Learning in Mis-Specified Models

ECO No. 91/41
Robert James WALDMANN
Assessing the Relative Sizes of Industry- and Nation Specific Shocks to Output

ECO No. 91/42
Thorsten HENS/Alan KIRMAN/Louis PHLIPS
Exchange Rates and Oligopoly

ECO No. 91/43
Peter J. HAMMOND
Consequentialist Decision Theory and Utilitarian Ethics

ECO No. 91/44
Stephen MARTIN
Endogenous Firm Efficiency in a Cournot Principal-Agent Model

ECO No. 91/45
Svend ALBAEK
Upstream or Downstream Information Sharing?

ECO No. 91/46
Thomas H. McCURDY/
Thanasis STENGOS
A Comparison of Risk-Premium Forecasts Implied by Parametric Versus Nonparametric Conditional Mean Estimators

ECO No. 91/47
Christian DUSTMANN
Temporary Migration and the Investment into Human Capital

ECO No. 91/48
Jean-Daniel GUIGOU
Should Bankruptcy Proceedings be Initiated by a Mixed Creditor/Shareholder?

ECO No. 91/49
Nick VRIEND
Market-Making and Decentralized Trade

ECO No. 91/50
Jeffrey L. COLES/Peter J. HAMMOND
Walrasian Equilibrium without Survival: Existence, Efficiency, and Remedial Policy

ECO No. 91/51
Frank CRITCHLEY/Paul MARRIOTT/
Mark SALMON
Preferred Point Geometry and Statistical Manifolds

ECO No. 91/52
Costanza TORRICELLI
The Influence of Futures on Spot Price Volatility in a Model for a Storable Commodity

ECO No. 91/53
Frank CRITCHLEY/Paul MARRIOTT/
Mark SALMON
Preferred Point Geometry and the Local Differential Geometry of the Kullback-Leibler Divergence

ECO No. 91/54
Peter MØLLGAARD/
Louis PHLIPS
Oil Futures and Strategic Stocks at Sea

ECO No. 91/55
Christian DUSTMANN/
John MICKLEWRIGHT
Benefits, Incentives and Uncertainty

ECO No. 91/56
John MICKLEWRIGHT/
Gianna GIANNELLI
Why do Women Married to Unemployed Men have Low Participation Rates?

ECO No. 91/57
John MICKLEWRIGHT
Income Support for the Unemployed in Hungary

ECO No. 91/58
Fabio CANOVA
Detrending and Business Cycle Facts

ECO No. 91/59
Fabio CANOVA/
Jane MARRINAN
Reconciling the Term Structure of Interest Rates with the Consumption Based ICAP Model

ECO No. 91/60
John FINGLETON
Inventory Holdings by a Monopolist Middleman

* Working Paper out of print

ECO No. 92/61
Sara CONNOLLY/John MICKLEWRIGHT/Stephen NICKELL
The Occupational Success of Young Men Who Left School at Sixteen

ECO No. 92/62
Pier Luigi SACCO
Noise Traders Permanence in Stock Markets: A Tâtonnement Approach. I: Informational Dynamics for the Two-Dimensional Case

ECO No. 92/63
Robert J. WALDMANN
Asymmetric Oligopolies

ECO No. 92/64
Robert J. WALDMANN /Stephen C. SMITH
A Partial Solution to the Financial Risk and Perverse Response Problems of Labour-Managed Firms: Industry-Average Performance Bonds

ECO No. 92/65
Agustín MARAVALL/Víctor GÓMEZ
Signal Extraction in ARIMA Time Series Program SEATS

ECO No. 92/66
Luigi BRIGHI
A Note on the Demand Theory of the Weak Axioms

ECO No. 92/67
Nikolaos GEORGANTZIS
The Effect of Mergers on Potential Competition under Economies or Diseconomies of Joint Production

ECO No. 92/68
Robert J. WALDMANN/ J. Bradford DE LONG
Interpreting Procyclical Productivity: Evidence from a Cross-Nation Cross-Industry Panel

ECO No. 92/69
Christian DUSTMANN/John MICKLEWRIGHT
Means-Tested Unemployment Benefit and Family Labour Supply: A Dynamic Analysis

ECO No. 92/70
Fabio CANOVA/Bruce E. HANSEN
Are Seasonal Patterns Constant Over Time? A Test for Seasonal Stability

ECO No. 92/71
Alessandra PELLONI
Long-Run Consequences of Finite Exchange Rate Bubbles

ECO No. 92/72
Jane MARRINAN
The Effects of Government Spending on Saving and Investment in an Open Economy

ECO No. 92/73
Fabio CANOVA and Jane MARRINAN
Profits, Risk and Uncertainty in Foreign Exchange Markets

ECO No. 92/74
Louis PHLIPS
Basing Point Pricing, Competition and Market Integration

ECO No. 92/75
Stephen MARTIN
Economic Efficiency and Concentration: Are Mergers a Fitting Response?

ECO No. 92/76
Luisa ZANCHI
The Inter-Industry Wage Structure: Empirical Evidence for Germany and a Comparison With the U.S. and Sweden

ECO NO. 92/77
Agustín MARAVALL
Stochastic Linear Trends: Models and Estimators

ECO No. 92/78
Fabio CANOVA
Three Tests for the Existence of Cycles in Time Series

ECO No. 92/79
Peter J. HAMMOND/Jaime SEMPERE
Limits to the Potential Gains from Market Integration and Other Supply-Side Policies

* Working Paper out of print

ECO No. 92/80
Víctor GÓMEZ and Agustín MARAVALL
Estimation, Prediction and Interpolation for Nonstationary Series with the Kalman Filter

ECO No. 92/81
Víctor GÓMEZ and Agustín MARAVALL
Time Series Regression with ARIMA Noise and Missing Observations Program TRAM

ECO No. 92/82
J. Bradford DE LONG/ Marco BECHT
"Excess Volatility" and the German Stock Market, 1876-1990

ECO No. 92/83
Alan KIRMAN/Louis PHLIPS
Exchange Rate Pass-Through and Market Structure

ECO No. 92/84
Christian DUSTMANN
Migration, Savings and Uncertainty

ECO No. 92/85
J. Bradford DE LONG
Productivity Growth and Machinery Investment: A Long-Run Look, 1870-1980

ECO NO. 92/86
Robert B. BARSKY and J. Bradford DE LONG
Why Does the Stock Market Fluctuate?

ECO No. 92/87
Anthony B. ATKINSON/John MICKLEWRIGHT
The Distribution of Income in Eastern Europe

ECO No.92/88
Agustín MARAVALL/Alexandre MATHIS
Encompassing Unvariate Models in Multivariate Time Series: A Case Study

ECO No. 92/89
Peter J. HAMMOND
Aspects of Rationalizable Behaviour

ECO 92/90
Alan P. KIRMAN/Robert J. WALDMANN
I Quit

ECO No. 92/91
Tilman EHRBECK
Rejecting Rational Expectations in Panel Data: Some New Evidence

ECO No. 92/92
Djordje Suvakovic OLGIN
Simulating Codetermination in a Cooperative Economy

ECO No. 92/93
Djordje Suvakovic OLGIN
On Rational Wage Maximisers

ECO No. 92/94
Christian DUSTMANN
Do We Stay or Not? Return Intentions of Temporary Migrants

ECO No. 92/95
Djordje Suvakovic OLGIN
A Case for a Well-Defined Negative Marxian Exploitation

ECO No. 92/96
Sarah J. JARVIS/John MICKLEWRIGHT
The Targeting of Family Allowance in Hungary

ECO No. 92/97
Agustín MARAVALL/Daniel PEÑA
Missing Observations and Additive Outliers in Time Series Models

ECO No. 92/98
Marco BECHT
Theory and Estimation of Individual and Social Welfare Measures: A Critical Survey

* Working Paper out of print