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This paper analyses the effects on consumers' welfare of the privatisation policy carried out in the UK since 1979. The approach we follow sees the privatisation of a State owned enterprise within the broader framework of the "policy reform" theory (Drèze and Stern, 1990). By adopting this perspective, the change in consumers' welfare "with" and "without" privatisations can be studied by appropriate welfare measures.
We claim that an advantage of our approach is that of being able to provide the required welfare assessment in a simplified way by means of a limited set of information. In particular, we show that a series of welfare measures only based on aggregate information can be used once one becomes ready to accept the use of first and second order approximations and a few "reasonable" assumptions on the shape of demand functions. These welfare measures are subsequently used for the evaluation of the welfare effects related to price variations in seven British privatised public utilities. We conclude that the contribution to consumers' welfare of the privatisation policy in the UK, when compared to the huge transfers involved in the process, has been rather modest.

Keywords: Privatisation, welfare measurement

JEL: L33, D6, D12

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Privatisations as price reforms: Evaluating consumers' welfare changes in the UK

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May 2002

Abstract

This paper analyses the effects on consumers' welfare of the privatisation policy carried out in the UK since 1979. The approach we follow sees the privatisation of a State owned enterprise within the broader framework of the "policy reform" theory (Drèze and Stern, 1990). By adopting this perspective, the change in consumers' welfare "with" and "without" privatisations can be studied by appropriate welfare measures. We claim that an advantage of our approach is that of being able to provide the required welfare assessment in a simplified way by means of a limited set of information. In particular, we show that a series of welfare measures only based on aggregate information can be used once one becomes ready to accept the use of first and second order approximations and a few "reasonable" assumptions on the shape of demand functions. These welfare measures are subsequently used for the evaluation of the welfare effects related to price variations in seven British privatised public utilities. We conclude that the contribution to consumers' welfare of the privatisation policy in the UK, when compared to the huge transfers involved in the process, has been rather modest.

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1. Introduction

The privatisation policy carried out in the UK by Conservative governments during 18 years (since 1979 until 1997) has represented the largest and most famous episode of a new attitude towards the economic role of the state in the economy. Moreover, British privatisations have also anticipated by several years similar policies in other countries, so that they constitute a benchmark for other countries where the process still is in its infancy.

This justifies an analysis based on strictly economic grounds. Given the high number and the variety of the agents involved (consumers, shareholders, workers, taxpayers), the evaluation of the overall welfare impact of a large scale divestiture represents a very extensive task. This paper is part of a wider project (see Florio, 2002) aimed at attaining this goal. Our more limited objective pursued here is that of assessing the welfare effects of British privatisations on consumers.

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For this purpose, the approach we follow here is a one which sees the privatisation of a state-owned enterprise within the broader framework of the "policy reform" theory (Drèze and Stern, 1990). Mainly known in its "tax reform" version, this approach allows for a normative analysis of policy regimes changes in a second best framework in the presence of small deviations from the status quo (Dixit, 1975). Whether or not the cases under examination can be considered a "small reform" with reference to the *ex ante* and *ex post* market values can be assessed from the price and expenditure values reported on the top of table 1. In any case, a policy reform approach maintains its validity also in the case of large reforms because it only entails the knowledge of the characteristics of the economic system in the neighbourhood of the starting point (which should be known by definition).

By adopting this viewpoint, the change in consumers' welfare "with" and "without" privatisations can be studied by means of the tools of applied welfare economics. The crucial variables are the prices, quantities and some characteristics of the demand functions (once opportune definitions or assumptions about them have been done).

Indeed, when looking through the seminal contributions by Guesnerie (1977) and Ahmad and Stern (1984), the tax-policy reform theory turns out to be a "price reform" theory, that is an approach where the value judgement are contingent to the "direction" (and the "length" in the case of non marginal reforms) of the price vectors considered in the analysis. As a consequence, also the evaluation of privatisation effects on consumers welfare must be first of all based on the scrutiny of the market price behaviour.[1]

However, the identification of the price variations constitutes a necessary but not a sufficient condition for a reliable welfare analysis. First, industry market prices have to be compared with the consumer price index, in order to check for increases or decreases in "real terms". Second, prices variations have to be compared with productivity changes determined by technological shocks or changes in demand conditions (so that in these cases it would be wrong to attribute to privatisation effects which would have happened even in public firms). Third, when privatisation is accompanied by a change in market structure, for example from a statutory monopoly to a system of oligopolistic competition, changes in prices could be wholly or partially attributable to increased competitive pressure and not to the change in ownership; similar considerations can be made for the particular system of public control of prices or quantities supplied, which for example may change from being a quite lax or discretionary cost-plus regime to being a stricter one (e.g. of a price cap "RPI-X" with a high "X" element). Fourth, by themselves, price and quantity variations do not capture welfare effects due to endogenous changes in the quality of the products (Newbery, 2000, discusses several examples).

[1] This approach is also implicitly taken in some empirical analyses (e.g., Waddams-Price and Hancock, 1998).

Having said this, all in all, the credibility of traditional welfare analyses is conditional on the close scrutiny of the determinants of price variations. However, once these problems are solved, we claim that the advantage of a price reform approach consists of being able to provide the required welfare assessment with a limited set of information on the characteristics of demand functions.

In fact, an unsatisfactory element regarding standard welfare analyses is that they often appear more an academic exercise, carried out with complex econometric methods and heavy investments, rather than an effective tool in the hands of the regulators or governments for promptly assessing the effects of privatisation programs which have been already carried out or simply designed. Indeed, this is in contrast with the "reform theory philosophy" and *de facto* limits the real relevance of applied welfare economics. It is an aim of this paper to foster the possibility of an easy implementation of this kind of analysis by showing that a series of "easy-to-implement" welfare measures are available once one becomes ready to accept a few "reasonable" assumptions. With the term "easy-to-implement" we mean a method which only requires the collection of information (at an aggregate level) easily accessible from the most common statistical sources, or at worse requires limited elaboration starting from them.

2. Welfare effects of price changes: some approximated indicators

For the aim of this paper, we restrict the following analysis to the welfare effects referable to the price changes which can be associated to the transfer of some production from the public to the private sector. As a consequence, henceforth the term "price change" will be referred to a hypothetical "net privatisation effect" (someway computed).

By defining these (consumption) price changes with the symbol dq, the welfare variation dW can be recovered starting from a generic Bergson-Samuelson Social Welfare Function, which arguments are the following individual (indirect) utility functions

$$v^h \equiv v^h\left(\mathbf{q}(\mathbf{p}), y^h, \mathbf{z}^h\right), \tag{1}$$

where the vectors **q** and **p** respectively refer to consumption and production prices, y^h is the exogenous personal disposable income and $\mathbf{z}^h$ is a vector of social-demographic characteristics.

Marginal price variations

A variation of consumption prices implies a welfare variation equal to:

$$dW = \frac{\partial W}{\partial q_i} dq_i = \left(\sum_h \sum_j \frac{\partial W}{\partial v^h} \frac{\partial v^h}{\partial q_j} \frac{dq_j}{dq_i} \right) dq_i ,$$

which, by exploiting Roy's identity, becomes

$$dW = \frac{\partial W}{\partial q_i} dq_i = \left(\sum_h \sum_j \frac{\partial W}{\partial v^h} \frac{\partial v^h}{\partial y^h} \frac{dq_j}{dq_i} x_j^h \right) dq_i . \tag{2}$$

By introducing the concept of marginal social value of household h income and defining it as $\beta^h \equiv \frac{\partial W}{\partial v^h} \frac{\partial v^h}{\partial y^h}$, equation (2) becomes:

$$dW = \frac{\partial W}{\partial q_i} dq_i = \left(\sum_h \beta^h \sum_j x_j^h \frac{dq_j}{dq_i} \right) dq_i . \tag{3}$$

In the tax reform literature it is a customary simplification to consider irrelevant the cross demand effects. In this case the welfare variation reduces to

$$dW = \frac{\partial W}{\partial q_i} dq_i = -\sum_h \beta^h x_i^h dq_i . \tag{4}$$

Equation (4) represents a first useful formula for the case of privatisations with marginal effects on prices. From an empirical viewpoint, it is important to observe that, as long as marginal variations are considered, the assessment of the welfare effects of a price change does not need any behavioural parameter such as price or income elasticities. Remark that, in case no different welfare weights are given to households, equation (4) reduces to a Laspeyres price index

Previous two equations also clarify that, by adopting a Bergson-Samuelson Social Welfare Function, the value of welfare changes reduces to a double weighting of the price variation, where the weights consist of observable market data (the individual demand) and a value judgement (the welfare weight β^h).

A different way of expressing formulae (3) and (4) which is not constrained to the use of household level data, namely those referring to the individual demand of goods, relates the welfare variation to the so-called distributional characteristic (henceforth DC). By defining the latter as

$$d_i \equiv \frac{1}{X_i} \sum_h \beta^h x_i^h , \tag{5}$$

and substituting it into (4) we get:

$$dW \equiv -d_i X_i dq_i . \tag{6}$$

In principle, the value of previous expression can be immediately calculated with aggregate data only, provided that the information on the DC of good *i* is available. If this is not the case, a limited elaboration based on households expenditure surveys data is required.

As it is well known (e.g. Stern, 1987), the DC can be expressed in covariance form between consumption shares and welfare weights, so that equation (6) can also be written as:

$$dW = -X_i\left(\bar{\beta} + \operatorname{cov}\left(\frac{x_i^h}{\bar{x}_i}, \beta^h\right)\right)dq_i, \tag{7}$$

where $\bar{\beta} = \sum_h \frac{\beta^h}{H}$ is the average of welfare weights over the households, which value depends on the scale adopted for the β^h s.

Sometimes, a DC normalised for $\bar{\beta}$ (e.g. Newbery, 1995) is used, that is:

$$\tilde{d}_i \equiv \frac{1}{X_i}\sum_h \frac{\beta^h}{\bar{\beta}} x_i^h . \tag{5a}$$

In this case the equivalent of expressions (6) and (7) are:

$$dW = -\bar{\beta}\tilde{d}_i X_i dq_i, \tag{6a}$$

and

$$dW = -X_i\left(1 + \operatorname{cov}\left(\frac{x_i^h}{\bar{x}_i}, \frac{\beta^h}{\bar{\beta}}\right)\right)dq_i . \tag{7a}$$

The interpretation of (7) and (7a) is quite straightforward: the larger the share of a good consumed by the poorest households (those with a high β^h associated to them) the larger is the welfare loss.

When specific DC are to be calculated, the specification of the social weights β^h is required. As it is well-known, the most used parameterisation is derived from the following additive social welfare function of iso-elastic utility functions, originally proposed by Atkinson (1970):

$$\begin{aligned} W &= \sum_{h=1}^{H} k\frac{\left(E^h\right)^{1-e}}{1-e}, \quad \text{for } e \neq 1 \\ &= \sum_{h=1}^{H} k \ln E^h, \quad \text{for } e = 1 \end{aligned}, \tag{8}$$

where E^h is the personal expenditure by individual or household *h*. The parameter *k* is usually chosen in order to take into account the number of equivalent adults within each household or in order to assign a weight equal to 1 to the individual with the lowest expenditure or the average expenditure (which yields respectively weights of the form $\beta^h = \left(E^h / E^1\right)^{-e}$ and $\beta^h = \left(E^h / \bar{E}\right)^{-e}$). The choice of *e* determines the

degree of "inequality aversion". It is customary to undertake some sensitivity analysis by considering values ranging from 0 (the Benthamian case) to 5 (very high inequality aversion).

A reference value is often represented by e=1, which involves the value judgment that a marginal transfer to someone at half the expenditure level of another has a social value of twice that of the reference person. By setting k=1/H, in this case we obtain $\beta^h = 1/E^h$ and $\bar{\beta} = 1/\mathrm{HM}(E^h)$, where $\mathrm{HM}(E^h)$ is the harmonic mean of individual consumption. Hence, the expression (7a) reduces to:

$$dW = -X_i\left(\mathrm{HM}(E_i^h)\frac{\overline{w}_i}{\overline{E}_i}\right)dq_i \quad , \tag{9}$$

where $\overline{w}_i$ is the average budget share on good i.

By setting $\bar{\beta} = 1$, that is $\beta^h = \mathrm{HM}(E^h)/E^h$, previous equation can be additionally simplified to

$$dW = -X_i\left(\frac{\overline{w}_i}{\overline{E}_i}\right)dq_i \tag{9a}$$

As a general comment, it must be pointed out that these "socially weighted measures" do not account for one of the most elusive effects to capture in the transition from public to private firm, that is the change in the regime of price discrimination.[2]

Large price variations

For the case of large price variations, we make an option for the use of second order approximations,[3] which can refer both to money metric measures (Harberger, 1964) and more general welfare measures allowing for distributional considerations (Banks, Blundell and Lewbel, 1996).

Unlike the case of the evaluation of small reforms, the assessment of large price variations usually requires information about individual demand elasticities. For example, the second order welfare approximation proposed by Banks *et al.* (1996) takes the form (with redundant notation of the elasticities required for its implementation):

$$\frac{\Delta W}{\Delta q_i} \approx -\sum_h \beta^h x_i^h\left[1+\frac{1}{2}\frac{\Delta q_i}{q_i}\left(\frac{\partial x_i^h}{\partial q_i}\frac{q_i}{x_i^h}+\frac{\partial \beta^h}{\partial q_i}\frac{q_i}{\beta^h}\right)\right], \tag{10}$$

[2] In the case of multi-product firms, sometimes both public and private firms are capable of charging different prices to different consumers for the same product. In turn, the different types of consumers could have different functions of demand, so that variation in welfare due to the change in regime would need to be ascertained for the different types of consumers.

[3] The typical advantage of welfare approximate measures consists of their reduced informational requirements, as compared to the computation of "exact" measures based on the estimation of household expenditure functions. In Starrett words: " …the method gives up on collecting hypothetical information concerning demand conditions in unobserved parts of the economic environment and instead extrapolates to those areas using curvatures at the status quo" (Starrett ,1988, p. 246). In addition, exact welfare measures suffer major problems in aggregation (Auerbach, 1985).

that is:

$$\frac{\Delta W}{\Delta q_i} \approx -\sum_h \beta^h \left[1 + \frac{\Delta q_i}{2} \left(\beta^h \frac{\partial x_i^h}{\partial q_i} + x_i^h \frac{\partial \beta^h}{\partial q_i} \right) \right], \tag{10a}$$

whilst the equivalent money metric approximation by Harberger (1964) is:

$$\frac{\Delta X_i}{\Delta q_i} \approx -\sum_h x_i^{hc} \left[1 + \frac{1}{2} \frac{\Delta q_i}{q_i} \left(\frac{\partial x_i^{hc}}{\partial q_i} \frac{q_i}{x_i^{hc}} \right) \right], \tag{11}$$

where the "*c*" stands for "compensated".

Reliable estimation of individual elasticities requires the availability of microdata of adequate quality and the imposition of some identifying assumptions.[4] For the case in which these two conditions cannot be ensured by the analyst, a few additional restrictions or approximations are to be adopted in order to allow for an evaluation based on aggregated data (or, at least, elasticities) only.

The simplest solution for avoiding the use of household level information is to give up assigning different welfare weights in the equation (10) above. As a matter of fact, if we impose $\beta^h = 1$ for all h, we get:

$$\frac{\Delta W}{\Delta q_i} \approx -\left[\sum_h x_i^h + \frac{\Delta q_i}{2} \sum_h \frac{\partial x_i^h}{\partial q_i} \right],$$

from which:

$$\frac{\Delta W}{\Delta q_i} \approx -X_i \left[1 + \frac{\Delta q_i}{2 q_i} \eta_{X_i, q_i} \right]. \tag{12}$$

Hence, a second order approximation which keeps apart distributional concerns only requires information about the aggregate demand and demand elasticity.

The results are slightly more complex in the general case $\beta^h \neq 1$, for some *h*. Let us first rewrite equation (10) as

$$\frac{\Delta W}{\Delta q_i} \approx -X_i \left[\sum_h \frac{\beta^h x_i^h}{X_i} + \frac{\Delta q_i}{2 q_i} \eta_{X_i, q_i} \frac{1}{H} \sum_h \left(\beta^h \frac{\partial x_i^h}{\partial q_i} \Big/ \frac{\overline{\partial x_i}}{\partial q_i} \right) \right], \tag{13}$$

that is

[4] With *H* individuals, the estimation of *H* parameters would of course be impossible. In order to overcome this problem, somewhat *ad hoc* (identifying) hypotheses must be done about the constancy among the individuals of some values. For example, in the well known case of the AIDS model by Deaton and Muellbauer (1980), the expenditure elasticities are recovered through the assumption that: $\frac{\partial w_i^h}{\partial \ln\left(x^h / P\right)} = \beta_i$ for *h=1*, …, *H*.

$$\frac{\Delta W}{\Delta q_i} \approx -X_i\left[\sum_h d_i + \frac{\Delta q_i}{2q_i}\eta_{X_i,q_i}\frac{1}{H}\sum_h\left(\beta^h \frac{\partial x_i^h}{\partial q_i}\Big/\overline{\frac{\partial x_i}{\partial q_i}}\right)\right],$$

where an additional approximation has been done by assuming the price invariance of welfare weights.[5] By using the definition of distributional characteristic in (5) and exploiting again the definition of covariance we have:

$$\frac{1}{H}\sum_h\left(\beta^h \frac{\partial x_i^h}{\partial q_i}\Big/\overline{\frac{\partial x_i}{\partial q_i}}\right) = \bar{\beta} + b, \qquad (14)$$

where d_i is the distributive characteristics, η_{X_i,q_i} is the aggregate price elasticity, and $b = \mathrm{cov}\left(\left(\frac{\partial x_i^h}{\partial q_i}\Big/\overline{\frac{\partial x_i}{\partial q_i}}\right), \beta^h\right)$.

Hence, by substituting (14) into (13) we finally get:

$$\frac{\Delta W}{\Delta q_i} = -X_i\left[d_i + \left(\bar{\beta} + b\right)\frac{\Delta q_i}{2q_i}\eta_{X_i,q_i}\right]. \qquad (15)$$

In the case the use of $\tilde{d}_i$ is preferred, it easy to verify that the equivalent to equation (15) is:

$$\frac{\Delta W}{\Delta q_i} = -X_i\bar{\beta}\left[\tilde{d}_i + \left(1 + \tilde{b}\right)\frac{\Delta q_i}{2q_i}\eta_{X_i,q_i}\right] \qquad (15a)$$

where $\tilde{b} = \mathrm{cov}\left(\left(\frac{\partial x_i^h}{\partial q_i}\Big/\overline{\frac{\partial x_i}{\partial q_i}}\right), \frac{\beta^h}{\bar{\beta}}\right)$.[6]

Hence, the estimation of a second order welfare approximation based on aggregated data, again, requires some information about the DC associated to the good which provision is being privatised. In addition, an estimate of the aggregate demand elasticity to price is required. The importance of this behavioural parameter is enhanced or tempered by the presence of a second distributive parameter (*b*), which takes smaller values when the demand by the poorest is more rigid.[7]

[5] This actually is an usual assumption in the applied welfare analyses, although theoretically weak (e.g., Roberts, 1980; Banks *et al.,* 1996). For an empirical study in which welfare weights price elasticity is taken into account see Ray (1999).

[6] Equation (15) and (15a) become equal when scaling welfare weights so that $\bar{\beta} = 1$.

[7] With additive utility functions this is always the case for "necessities", due to the proportionality between price and expenditure elasticity implied by this functional assumption (cf. Deaton, 1974; Deaton and Muellbauer, 1980a, ch. 5).

Unfortunately, differently from the other parameters, the covariances *b* and $\tilde{b}$ can be computed only after having estimated the individual demand derivatives, which requires the use of microeconometric estimation techniques. As an alternative, one can make use of functional form assumptions. For example, in the case of linear Engel curves, expression (15) clearly simplifies to

$$\frac{\Delta W}{\Delta q_i} = -X_i \left[d_i + \bar{\beta} \frac{\Delta q_i}{2q_i} \eta_{X_i,q_i} \right] \tag{16}$$

given that we have b=0. The parameter *b* is also equal to 0 when the individual demand functions are linear, an hypothesis which can be seen as a good approximation of the real shape of the demand function in a neighbourhood of the starting point.[8]

Second order approximations in the case of Engel curves linear or quadratic in the logarithm of total expenditure.

Besides this limited case, it is of interest to infer at least what the sign of *b* could be. For this purpose, we can base our subsequent analysis on a much more accepted (in empirical microeconomics) Engel curve structure such as the Working-Leser one, which is implied by the well known "TRANSLOG" and "AIDS" demand systems, and its quadratic generalisations, such as the "QUAIDS" demand model by Banks, Blundell and Lewbel (1997).

In these models, the individual price derivatives are inferred from the estimation of the budget shares logprice derivatives, which we define as:

$$\frac{dw_i^h}{d\ln q_i} \equiv c_i^h .$$

As an example, let us consider the case of the AIDS model:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln q_j + \delta_i \ln\left[\frac{E^h}{a(\mathbf{Q})}\right], \tag{17}$$

where w_i is the individual budget share and $a(\mathbf{Q})$ is defined by the Translog price index formula:

$$\ln a(\mathbf{Q}) = \alpha_0 + \sum_i \alpha_i \ln q_i + \frac{1}{2}\sum_i\sum_j \gamma_{ij} \ln q_i \ln q_j .$$

In this case it is simple to show that:

$$c_i^h = \gamma_i - \delta_i \frac{d\ln a(\mathbf{Q})}{d\ln q_i} \tag{18}$$

More in general, it can be easily shown that the own-price elasticity in these models is equal to:

[8] Hence, this hypothesis is typically reliable only in case of small price reforms.

$$\eta_{x_i^h,q_i} = \frac{1}{w_i^h} c_i^h - 1. \tag{19}$$

From the previous formula, depending from c_i^h being smaller (larger) than 0, the demand for good *i* will be "elastic" ("rigid"). However, it must be remarked that, being c_i^h variable across the individuals, some intervals of the estimated parameters theoretically allow for the demand of a good to be elastic for some individuals and inelastic for others.

Actually, the elasticities' formula can tell us more. In particular, we can also recover the size of the individual demand derivatives. In fact, rearranging, we can write:

$$c_i^h = w_i^h \left(1 + \eta_{x_i^h,q_i}\right),$$

from which, after a some algebra,

$$\frac{dx_i^h}{dq_i} = \left(c_i^h - w_i^h\right)\frac{E^h}{q_i^2},$$

that is:

$$\frac{dx_i^h}{dq_i} = c_i^h \frac{E^h}{q_i^2} - \frac{x_i^h}{q_i}.^{9} \tag{20}$$

By itself, previous formula cannot help us so much given that an econometric estimation of c_i^h is required for its implementation. However, it is interesting to see which are its implications when setting *e*=1 for the second order approximated welfare measures when combined with the Engel curve functional form assumptions which lead to equation (20).

As it was seen in the previous section, in this case the social weights can be set equal to $\beta^h = 1/E^h$. Let us first note that the covariance term $\widetilde{b}$ in equation (15a) can be rewritten as:

$$\widetilde{b} = \frac{1}{H}\left(\overline{\frac{\partial x_i^h}{\partial q_i}}\right)^{-1} \sum_{h=1}^{H} \frac{\partial x_i^h}{\partial q_i} \frac{\beta^h}{\overline{\beta}} - 1.$$

The application of the relationships between the parameters defined by equation (20) yields:

[9] When c_i^h <0, for all *h*, i.e. the demand is elastic for each individual, both terms on the right hand side of this equation are negative. This implies (provided that *i* is not an inferior good), that the individual demand responses become higher in absolute terms as the individual expenditure increases. As a consequence, the distribution of these price demand responses is negatively correlated to the distribution of the social weights (which are a negative function of E^h). Hence, for the linear- and quadratic-in-logs family of Engel curves, the term *b* in the equation (15) is negative (positive) if the demand for the good to which the price reform is referred is elastic (inelastic). Even without knowing the size of *b,* we can therefore conclude that equation (16) represents an upper (lower) bound of a second order welfare approximation if the individual demand of the good under scrutiny are elastic (inelastic).

$$\widetilde{b} = \frac{1}{H}\left(\overline{\frac{\partial x_i^h}{\partial q_i}}\right)^{-1} \sum_{h=1}^{H} \frac{1}{q_i^2}\left(c_i^h - w_i^h\right)E^h \frac{\beta^h}{\overline{\beta}} - 1 .$$

Without lack of generality we can set $\overline{\beta} = 1$.[10] By substituting the $\beta^h = 1/E^h$ into the previous equation we therefore get,

$$\widetilde{b} = \frac{1}{q_i^2}\left(\overline{\frac{\partial x_i^h}{\partial q_i}}\right)^{-1} \left(\overline{c}_i - \overline{w}_i\right) - 1 . \qquad (20a)$$

We leave to the appendix to show that previous formula simplifies to:

$$\widetilde{b} = \widetilde{d}_i - 1 \qquad (21)$$

Hence, it immediately follows that equations (15) and (15a) reduce to:

$$\frac{\Delta W}{\Delta q_i} = -\widetilde{d}_i X_i \left[1 + \frac{\Delta q_i}{2q_i}\eta_{X_i,q_i}\right], \qquad (22)$$

that is to an expression which is a function of the DC and aggregate demand price elasticity.

Overall, general expressions such as (13) or more specific ones based on functional assumption such as (22) show us that the value of a second order approximation is always smaller than a first order one. In fact, second order approximations depict some efficiency effects by means of the aggregated elasticity parameter, which usually is negative. As it was remarked above, the proximity to the first order approximation is partially restored when the demand for the good is elastic (being the covariance *b* negative).

To summarise, in this section we showed how and under what conditions the estimation of the effects on consumers' welfare of the price changes referable to the privatisation of some previously publicly provided goods can be based on aggregated data. In the next section, we briefly report on the British privatisation policies which welfare effects we would like to estimate.

3. Price trends in the British privatised industries

The privatised industries which we examine in this paper are the following ones: Telecommunications, Railways, Bus services, Electricity, Gas, Water and Coal. All of them were privatised by the British

[10] In this case we also have $d_i = \widetilde{d}_i$

Conservative Governments in a period ranging from the early Eighties to mid Nineties (the reference years for each privatisation are reported on the top of table 1).

This large spread among the changes of ownership dates has of course entailed a certain degree of heterogeneity in the forms of public divestitures which were chosen and in the following regulatory initiatives adopted. However, on the whole the common feeling has been that of a unique policy ("privatisation") carried out in successive steps. We are also taking this perspective as well, but the limits of this assumption should be borne in mind.

A case which is particularly affected by this lack of synchrony is represented by the analysis of the price trends in the various industries after privatisation. In fact, while for some sectors such as telecommunications and gas industry we dispose of about 15 yearly observations since their privatisations, for the rail and coal industries the "after privatisation" period reduces to 4 years only.[11] As a consequence, while for some cases a clear-cut judgement could be reliably expressed (e.g., "telephony prices have decreased", or "water is more expensive than it was before privatisation"), for some other sectors a definite trend has not emerged yet.

While referring the reader to Florio (2002, ch. 7) for a more detailed description of the evolution of the prices and of the institutional aspects, such us the price cap systems adopted by the sectors' regulators, here we briefly focus on a point particularly important when analysing privatisation policies as "price reforms", i.e. the fact that trends in nominal prices "before" and "after" privatisations in the UK does not show a clear structural break, at least until the end of the "Conservative era".

More in detail, in the case of electricity -- which privatisation started in 1990,[12] -- prices had been falling for over a decade under public ownership and they increased in preparation for privatisation and in the years that followed, especially prices for the residential users. Subsequently they started falling again in a way not too different from the long term trend up to 1995, date which seems to mark the starting point of a more clear decreasing trend (of course still in its infancy).

In the case of gas there was a net drop in prices after privatisation in 1986, but prices had been falling with respect to the Retail Price Index also in the Seventies when British Gas was a nationalized industry. Conversely, a relative increase was again registered by considering the 5 years preceding the privatisation

[11] Being 1999 the last year for which adequate information has been made available.

[12] In that year the twelve Regional Electricity Companies in England and Wales were privatised, followed by the two Scottish companies in 1991.

of British Gas. As in the case of electricity, an apparent stronger decreasing trend has started since the mid Nineties.

The privatisation of British Telecom dates back to 1984. Although the construction of a price index for this industry represents a very difficult task (due to the variety of contracts, the changes in the pricing methods and the difficulty in obtaining disaggregated data for each category of user), the existing aggregate estimates suggest that after privatisation there has been a reduction in the unit cost for business users and, for a number of years, an increase in the unit cost for domestic and public phone users. More recently (and a couple of years before the aforementioned cases), a generalised reduction in tariffs has been taking place, following a change in the regulatory constraint and increased competition.[13]

No clear trend emerges also for those services which have registered relative price increases since privatisation. In the case of water, the tariffs rose considerably after privatisation, but the lack of adequate previous information does not allow us to control for the behaviour of the prices under the public ownership. Also in the case of buses and rail the price of the service increased after privatisation, but the same had happened before.

4. Empirical analysis.

In this section we present a some preliminary estimates of the effects of the British privatisation policy on consumers' welfare. These estimates were carried out by applying a number of the measures introduced in section 2. As a matter of fact, although the analyst's preference should be given to the second order welfare change approximations, at least in the presence of adequate information, those measures mainly suited to marginal changes still remain useful for comparison purposes and evaluating the likely magnitude of the errors associated to first order approximations.

The first data from which to start is the direction of the market price changes. The time series by ONS (various editions) display a dichotomous behaviour, with a relative reduction for telephony, electricity and gas and an increase for water and transport. The size of these variations and the overall families' expenditure in the related sectors is, however, not homogenous. Our broad calculations suggest a diminution of 16% of the prices of the privatised sector as compared to the path of the Retail Price Index (RPI) since 1987 to 1999.[14] To set 1987 as the starting year for evaluating the price effects of the British privatisation policy as a whole is, of course, an ad hoc hypothesis.

[13] For more details see Florio (2001).

[14] We obtained this value by building an aggregate Laspeyres index of the privatised sector centered on 1987 by using the industry-level ONS time series.

The same applies for those assumptions which define the share of the price variation actually attributable to the change of ownership. The determination of this percentage always is a difficult task (which should be handled by drawing a counterfactual scenario) and becomes particularly critical when looking to privatisation as a price reform. As a starting point, one could argue that a benchmark hypothesis about privatisation effects on price changes lies between either assuming that privatisations were responsible for all price changes or that continuation of public ownership would have generated exactly the same price changes as those observed.

In the estimates we are presenting in the next subsection, we substantially escape this problem by considering the most favourable scenario about privatisation effects, that is by attributing to the change of ownership regime the whole deviation of the prices of the privatised industries with respect to the RPI.[15] In this sense, the following results constitute an upper bound to any positive or negative welfare effects.

The results of the analysis carried out at the individual industry level are presented in tables 1 and 2. The first part of these tables contains the information used for the implementation of the various measures reported therein. In particular, the privatisation year[16] has been used for determining the "price reform" interval. Having taken into consideration 1999 as the final year of our analysis, for each commodity the welfare variations have been calculated in one case (table 1) as the effects of a unique price reform which size is given by the difference between the percentage variation of the related prices index and the overall RPI in the interval "privatisation year—1999", and as the sum of yearly price reforms in the other case (table 2).

The second order measures need to compute the aggregate demand price elasticities. For the aims of this paper, we have limited our choice to the values reported in Florio (2002).[17]

As for the distributional characteristics reported on the top of the tables which were used in the implementation of the various formulae, we calculated them by using the 1994 edition of the Family Expenditure Survey.[18] Following the more standard approach, the social weights have been derived by

[15] Of course, this is true since, on the whole, we are evaluating a price decrease.
[16] For those cases in which the privatisation has been carried out in subsequent steps, a median year has been considered.

[17] In general, the specialised economic literature offers several studies on aggregate demand to which the analyst can refer without undertaking new specific estimations. We plan to refer to this literature in future research.

[18] As we said in the introduction, this paper aims to promote the adoption of "easier" approaches in applied welfare analyses in which, in principle, only the use of aggregated data should be required. Under this perspective, also well-defined distributional value judgements (such as DC) on the consumption of single commodities could be considered as an aggregate information. By making direct use of a micro-level dataset we are someway weakening the consistency of our approach, but the supply of tabulated DC (which would not constitute a difficult task!) is not at present foreseen in the national household expenditures reports.

using an Atkinson's Social Welfare Function like that in (8) and scaled so that to set their mean $\bar{\beta}$ equal to 1, which makes the implementation of formulae (15) easier. The total household expenditure data which is needed for the computation of the DC has been expressed in terms of equivalent adult. The OECD equivalence scales were used for this purpose.[19] The DC used in the tables are only those corresponding to a "coefficient of inequality aversion" equal to one.

As said when we derived equation (15-15a), the only very micro level data which we would need when implementing a second order welfare approximation are the covariance "*b*" and "$\tilde{b}$". In order to overcome this problem, a Working-Leser (or its quadratic extension) functional form assumption has been done with respect to the latent Engel curves of the observed demands so that, having set to 1 the coefficient of inequality aversion, equation (22) could be used when computing the second order welfare approximation.

As for the sector expenditures, we have used "median year expenditures" (between privatisation and 1999) for the calculations reported in table 1, when we considered price variations as a "one shot" change; and annual expenditures when computing the welfare effects as a sum of yearly changes. In order to keep a direct "monetary" interpretation of the welfare measures, we have scaled price indexes so to set the price of the reference year equal to 1. This allows us to consider the recorded expenditures as if they were "quantities" and directly apply the approximated measures (which are usually based on quantity indexes). All the welfare changes are expressed at 1994 prices.[20] The values reported in these tables are millions of pounds so that, in principle, they could allow for an immediate cost-benefit analysis of the other net gains or losses by other agents involved in British privatisations.

As reported in the left columns of the tables, we have computed both first and second order welfare change approximations, whether without or with distributive corrections. The "socially unweighted" first order measure is a Laspeyres Index in case of table 2 (welfare variations as a sum of yearly changes). In case of table 1 (price variations considered as a one shot change) we have used a modified version of the Waddams Price-Hancock (1998, appendix B) welfare measure, where expenditures and prices are those of the median year between privatisation and 1999. The second order measures do correspond to formulae (16) and (22).

Let us finally turn to the results. Due to the dissimilarity in the direction of the price changes, consumers had both losses and gains. In both tables, the larger gain is clearly referable to telephony, surely

[19] According to these scales, the first adult counts as 1, additional adults as 0.7 and children as 0.5.

[20] Similarly to the computation of DC, we chose 1994 as a reference year given that, between the various industries, it represents the "median of the median years between the privatisation year and 1999".

determined by the relative importance of this service within the privatised basket, the length of the "post reform" period (privatisation of BT occurred in 1984), but also by the substantial price decrease recorded since its privatisation. The second privatised industry which has substantially contributed to the increase of consumers' welfare has been the gas one (which privatisation dates 1986). By looking to the yearly welfare variations (not reported in this paper) one would observe that the importance of the benefits deriving from this sector has been decreasing in the recent years, as a result of its reduced weight in consumers' expenditures. This is the opposite of what has happened with respect to the water sector, which presently represents the larger source of losses for British consumers among the privatised utilities.

Besides being an important part of the consumers' privatised good basket, this sector exhibit price variations of more than 30% in absolute terms. In these cases it becomes particularly important to focus on second order measures, given the high monetary values which can be involved, and check for the different implications of the procedures which respectively lead to table 1 and table 2 results. In table 1, the difference between first and second order approximations can reach values close to 15% (e.g., see the row reporting the "first order error" between the first and second order "socially weighted" measures, which indicate underestimates of the welfare gains of about 11% for the telephone industry and an overestimate of about 14% for the water sector).[21] Conversely, in table 2 the first order error is usually less than 3%. If no reliable aggregate demand elasticities are available, this clearly advocates for a computation of the welfare effects on a yearly price variation base, which reduces the overall result to a sum of "small price reforms".

The use of the simpler procedure adopted in the case of table 1 also has some consequences in the determination of the size of the welfare change. When an "older" privatised industry is considered, the use of the median year as unique base for the computation leads to strong underestimates of the welfare effect (this is the case of telephony). On the contrary, we incur in a likely overestimate when a large price variation occurs in a small interval (as in the water case).

As for the distributional corrections,[22] in general their size is substantially determined by the value of the DC also in the case of the second order approximation.[23] Moreover, in the exercise reported in these tables even the slight differences existing in the general case disappear due to effects of the functional form hypothesis (linear or quadratic-in logs "latent" Engel curves of the goods under examination) which was used in order to obtain the simplified formula (22).

[21] It can be easily seen that this percentage value is nearly independent of the size of the price variation.

[22] These corrections do not include the impact of rebalancing of tariffs within each industry and by different types of consumers.

[23] This is immediate when looking how the DC enters equation (15). For first order approximation this relationship is trivial.

The last column of the tables provides an indicator of the aggregate effects on consumer welfare. As for the differences between first and second order measures, the aggregation seems to exacerbate the first order error in both cases, but the effects are particularly severe in the first case (28.7%). When summing over yearly variation, the difference is limited to 3.4%.[24] Let us finally note that the procedure adopted in table 2 leads to a definitely more positive evaluation about the overall gross impact of the privatisation policy.

5. Conclusions

This paper has investigated the possibilities of applying a (price) reform approach to the analysis of the effects of the British privatisation policy on consumers' welfare. To this aim, a series of first order and second order approximated measures has been discussed and introduced, fostering the use of distributional characteristics as an aggregate indicator of some distributional implications of policy reforms.

The implementation of the proposed measures has revealed the presence of relevant effects at the single industry level, although with a heterogeneous behaviour. At an aggregate level the effects partially compensate each other. Considering that we have attributed to privatisations the whole price chance, and that a much less favourable scenario about privatisation effects on prices could have been adopted, particularly under a counterfactual of continued nationalised industry, we conclude that the overall contribution to British consumers' welfare of the privatisation policy has been rather modest, if compared to the huge monetary values involved in the process. The range of gross welfare impacts we find is between £ 2.8 billions with socially weighted first order approximation for a "median year" change, and £ 5.7 billions for unweighted second order approximation as a sum of yearly variations. This is equivalent to 50-100 pounds per capita. The net impact, we may conjecture, was less than this because it is unlikely that the nationalised industry were totally unable to pass to consumers exogenous savings in costs (e.g., decreasing cost in telecommunications and in fuel prices).

Of course, what is lacking at this stage of our investigation is just the construction of a plausible counterfactual scenarios regarding price evolution under continued public ownership. Once these scenarios are somewhat determined (for example looking at cost trends and determinants), the researcher (or the regulator) can easily go through welfare computations. For this purpose, a series of "ready-to-

[24] Remember that, to this difference, one should add the likely difference existing between approximated and "exact" measures. In the well-known Banks *et al.* (1996) exercise, the difference between second order approximations and exact measures (in the form of a Quadratic Almost Ideal Demand System expenditure function), amounted only to 0.3%.

implement" formulae are available also for large "price reforms", and they do not need the estimation of a micro-level demand system, once one is ready to give up determining an "exact measure" of the welfare change. Besides, at an aggregate level, even a first order approximation (which does not take into account the curvatures of aggregate demands) seem to provide a quite accurate indication of the overall welfare effects if one considers the whole "reform" as a sum of small yearly changes.

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Appendix:

In this appendix we must show that

$$\widetilde{b} = \frac{1}{q_i^2}\left(\overline{\frac{\partial x_i^h}{\partial q_i}}\right)^{-1}\left(\overline{c}_i - \overline{w}_i\right) = \widetilde{d}_i - 1 . \tag{A.1}$$

From equation (19), remember that the following relationship holds:

$$\overline{\eta}_{x_i^h, q_i} = \frac{\overline{\partial x_i^h}}{\partial q_i}\frac{q_i}{\overline{x}_i} = \frac{1}{\overline{w}_i}\overline{c}_i - 1,$$

from which:

$$\frac{\overline{\partial x_i^h}}{\partial q_i}\frac{q_i}{\overline{x}_i} = \frac{\left(\overline{c}_i - \overline{w}_i\right)}{\overline{w}_i} . \tag{A.2}$$

Solving by $\left(\overline{c}_i - \overline{w}_i\right)$ and substituting into the covariance expression we therefore get:

$$\widetilde{b} = \frac{1}{q_i^2}\left(\overline{\frac{\partial x_i^h}{\partial q_i}}\right)^{-1}\overline{\frac{\partial x_i^h}{\partial q_i}}\frac{q_i}{\overline{x}_i}\overline{w}_i - 1,$$

from which

$$\widetilde{b} = \frac{1}{\overline{x}_i H}\sum_h \frac{x_i^h}{E^h} - 1,$$

which by using the value $\beta^h = 1/E^h$ deriving from the hypothesis e=1 allows us to write:

$$\widetilde{b} = \frac{1}{X_i}\sum_h x_i^h \beta^h - 1, \tag{A.3}$$

that is, remembering the definition of distributive characteristic,

$$\widetilde{b} = d_i - 1. \tag{A.4}$$

Table 1: Welfare variations (in millions of pounds) for each privatised industry (computed at "median years" expenditures).

	Privatised utilities							
	Phone	*Rail*	*Bus*	*Electricity*	*Gas*	*Water*	*Coal*	*TOTAL*
Privatisation year	1984	1995	1989	1990	1986	1990	1995	
Median year	1991	1997	1994	1994	1992	1994	1997	
E*	6842	3144	2808	8082	5684	4014	499	
P*	0.88	1.19	1.14	1.01	0.85	1.52	0.82	
P1	0.98	1.18	1.04	0.97	1.02	1.14	0.85	
P2	0.6	1.22	1.19	0.8	0.71	1.7	0.8	
η_{X_i,q_i}	0.6	0.8	0.9	0.5	0.7	0.5	0.2	
$\widetilde{d}_i$	0.875	0.573	0.756	0.893	0.9	0.938	0.992	
Welfare measures								
First order approximations								
"Modified WP-H": M= E* (p1 – p2)/p*	2779.243	-113.960	-417.030	1360.337	1815.768	-2225.584	22.609	3221.382
"Socially weighted": $dW \equiv -d_i X_i dq_i$	2431.837	-65.299	-315.274	1214.781	1634.191	-2087.598	22.428	2835.065
Distributive correction	*-12.50%*	*-42.70%*	*-24.40%*	*-10.70%*	*-10.00%*	*-6.20%*	*-0.80%*	*-11.99%*
Second order approximations								
"Unweighted" : $\Delta W \approx -X_i\left[1+\frac{\Delta q_i}{2q_i}\eta_{X_i,q_i}\right]\Delta q_i$								
	3092.939	-112.155	-389.159	1417.579	2010.828	-1917.087	22.721	4125.666
"Socially weighted" (Linear or quadratic-in-logs Engel curves)								
$\Delta W = -\widetilde{d}_i X_i\left[1+\frac{\Delta q_i}{2q_i}\eta_{X_i,q_i}\right]\Delta q_i$	2706.322	-64.265	-294.204	1265.898	1809.745	-1798.228	22.539	3647.807
First order "error"	*11.29%*	*-1.58%*	*-6.68%*	*4.21%*	*10.74%*	*-13.86%*	*0.50%*	*28.67%*

Note: The symbol * refers to median year values.

Table 2: Welfare variations (in millions of pounds) for each privatised industry (computed as a sum of yearly variations).

	Privatised utilities							
	Phone	*Rail*	*Bus*	*Electricity*	*Gas*	*Water*	*Coal*	*TOTAL*
Privatisation year	1984	1995	1989	1990	1986	1990	1995	
Median year	1991	1997	1994	1994	1992	1994	1997	
η_{X_i,q_i}	0.6	0.8	0.9	0.5	0.7	0.5	0.2	
$\widetilde{d}_i$	0.875	0.573	0.756	0.893	0.9	0.938	0.992	
Welfare measures								
First order approximations								
"Laspeyres index": M= X1(p1 – p2)	4211.055	-132.640	-411.214	1438.416	2072.856	-1701.746	33.601	5510.329
"Socially weighted": $dW \equiv -d_i X_i dq_i$	3684.673	-76.003	-310.878	1284.506	1865.570	-1596.238	33.332	4884.963
Distributive correction	*-12.50%*	*-42.70%*	*-24.40%*	*-10.70%*	*-10.00%*	*-6.20%*	*-0.80%*	*-11.35%*
Second order approximations								
"Unweighted"								
$\Delta W \approx -X_i\left[1+\frac{\Delta q_i}{2q_i}\eta_{X_i,q_i}\right]\Delta q_i$	4290.320	-133.820	-397.713	1469.587	2111.365	-1675.905	33.674	5697.508
"Socially weighted" (Linear or quadratic-in-logs Engel curves)								
$\Delta W = -\widetilde{d}_i X_i\left[1+\frac{\Delta q_i}{2q_i}\eta_{X_i,q_i}\right]\Delta q_i$	3754.030	-76.679	-300.671	1312.341	1900.229	-1571.999	33.405	5050.655
First order "error"	*1.88%*	*0.89%*	*-3.28%*	*2.17%*	*1.86%*	*-1.52%*	*0.22%*	*3.39%*

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