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**SPECIAL ISSUE IN MEMORY
OF PROFESSOR PANOS PASHARDES (1949–2017)
CYPRUS ECONOMIC POLICY REVIEW EDITOR (2007–2016)**

This special issue of the Cyprus Economic Policy Review, the Economics Research Centre's in-house journal that Professor Panos Pashardes founded and edited until 2016, is dedicated in his memory.

On the 11th of September 2018, the Economics Research Centre and the Department of Economics of the University of Cyprus organised a small academic conference in memory of Professor Panos Pashardes. The aim of conference was to pay tribute to Professor Pashardes' contributions by bringing together some of his co-authors and colleagues from throughout his career.

The issue includes (i) a short bio and selected abstracts of Professor Pashardes' most influential published papers, (ii) memories of him narrated by some of his colleagues (iii) the opening comments at the conference by the Chairman of the Department of Economics, Professor Sofronis Clerides, (iv) the closing remarks at the conference by the Director of the Economics Research Centre, Professor Elena Andreou and by Mrs Dina Pashardes, Professor Pashardes' wife (v) the extended abstracts of papers presented at the conference as well as a research paper by Professor John Muellbauer, which is of great historical value in the literature.

We thank Panos for the legacy he left in the Department and in the University of Cyprus, his academic contributions and the establishment of the Economics Research Centre at the University of Cyprus. We also thank those who have supported Panos and the Economics Research Centre - the Center's sponsors, members of the Council of the Centre, faculty members and researchers at the University of Cyprus and universities abroad, all the researchers and permanent staff at the Centre of Economic Research, the administrative staff at UCY, the Rectorate, the speakers of this conference, his collaborators from the early years of his career in England who have sent their kind words to honor him, Professor John Muellbauer for his contribution to this volume, and last but not least his family, Dina and Mario.

Professor Elena Andreou, Director of Economics Research Centre

1. Short bio of Professor Panos Pashardes

Professor Panos Pashardes held a Doctor of Philosophy (Ph.D.) and a Master of Science (MSc.) in Economics from Birkbeck College, University of London. He worked as a Senior Research Officer and Director of Econometric Support at the Institute of Fiscal Studies (1984-1988), as a Lecturer/Reader of Economics at the City University in London (1988-1992) and as a Professor of Economics at the University of Cyprus (1992-2016). He chaired numerous committees, including the Research and Finance Committees (1992-1994) and the Department of Economics of the University of Cyprus (1992-1996). He was the EU Independent Expert on Poverty and Social Exclusion for Cyprus. His research interests were in the areas of consumer welfare and public economics. He published articles in top academic journals such as *American Economic Review*, *Journal of Public Economics*, *Economic Journal*, etc. He was the principal investigator of numerous research projects funded by the government, private organizations and the EU. He wrote/edited books and reports on issues concerning the Cypriot economy. The findings of his work on the Cypriot economy were regularly reported by the local media. He was the founder and director of the Economics Research Centre of the University of Cyprus (2002-2016).

2. Selected abstracts of Professor Panos Pashardes papers

2.1 Top International Journals

What Do We Learn About Consumer Demand Patterns From Micro-Data? (with R. Blundell and G. Weber), *American Economic Review*, 83, 570-597, 1993.

The aim of this paper is to assess the importance of using micro-level data in the econometric analysis of consumer demand. To do this we utilize a time series of repeated cross sections covering some 4,000 households in each of 15 years. Employing a number of different aggregation procedures, we conclude that aggregate data alone are unlikely to produce reliable estimates of structural price and income coefficients. However, once certain “aggregation factors” as well as trend and seasonal components are included, an aggregate model is not necessarily outperformed across all demand equations in terms of forecasting ability.

Bias in the Estimation of the Almost Ideal Demand System with the Stone Index Approximation, *Economic Journal*, 103, 908-916, 1993.

The Almost Ideal (AI) demand system is often estimated with the Stone index approximation as suggested by Deaton and Muellbauer (1980). So far the evidence about the effect of this approximation on the parameter estimates of the A1 model is mainly empirical and inconclusive. Deaton and Muellbauer (1980) estimate an eight-commodity system using aggregate annual UK data for the period 1954-74 and report that the differences between the parameters obtained from the linearly approximated and exact budget share equations are

empirically unimportant. Browning and Meghir (1991) estimate a seven commodity system using microdata drawn from the UK Family Expenditure Survey (FES) over the period 1979-84 and report that the parameter differences between the approximated and exact models are important. Neither of these two studies nor any other study that I am aware of provides analytical or numerical comparison of results obtained with and without the Stone index approximation. Exactly how the parameters of the A1 demand system are affected by the Stone index approximation is important because the popularity of this demand system is largely due to the fact that, while based on a flexible cost function, its shares can be estimated as linear equations. I examine this question by comparing analytical expressions and empirical findings obtained from the A1 model with and without the Stone index approximation. The results suggest that this approximation can result in biased parameter estimates, particularly when the A1 model is applied to microdata. This is important as it is at the micro level that the linear approximation is most useful because it facilitates the cure of measurement errors through simple IV methods and eases computational difficulties arising from the large number of variables and sample size. The use of microdata is encouraged by results showing that the restrictions required for aggregate demand analysis (Muellbauer, 1975) are not supported by empirical evidence, see for example Blundell et al. (1989) and Nicol (1989). The paper also shows that the price parameter bias can be largely corrected through a simple re-parameterisation. The empirical analysis is based on UK individual household and aggregate data from the FES, 1970-86.

Estimates of the Black Economy Based on Consumer Demand Approaches (with P. Lyssiotou and T. Stengos), *Economic Journal*, 114, 622-640, 2004.

We propose a consumer demand system approach to estimating the size of the black economy where alternative hypotheses affecting the empirical results can be tested in a nested framework. This approach allows for the estimation of the under-reporting of household income from various sources, dispensing with the need to use arbitrary criteria to classify households by their main source of income. It also avoids potential bias in black economy estimates arising from mistaking preference heterogeneity (substitution) as income effects. We illustrate these arguments by estimating the extent to which self-employment income in the UK is under-reported using parametric and nonparametric techniques.

Non-Linearities and Equivalence Scales (with R. Dickens and V. Fry), *Economic Journal*, 103, 359-368, 1993.

The subject of this paper is the implications for equivalence scale recent developments in micro empirical demand analysis. context for such estimation has been a demand system specified linearity and frequently heterogeneity in the (log) expenditure contrast, Blundell et al. (1989), Nicol (1989) and Browning and among others, have shown that in micro budget share systems expenditure effects and interactions between expenditure characteristics are empirically

important. Blundell and Lewbel (1991) and Pashardes (1991) discuss the identification of equivalence scales in the context of micro demand systems linear in (log) real expenditure. This paper focuses on the implications of non-linear utility effects in budget share equations for the identification and testing of the properties of equivalence scales. It is now well-established that not all the components of equivalence scales required to make welfare comparisons are identifiable from demand data alone (Pollack and Wales (1979), Deaton and Muellbauer (1986), Fisher (1987) and Blundell and Lewbel 1991)). The identification of meaningful equivalence scales from demand data requires that the scales be independent of the base utility level. This property has been variously termed Equivalence Scale Exactness (Blackorby and Donaldson, 1988) and Independence of Base (hereafter IB) (Lewbel, 1989; Blundell and Lewbel, 1991). Demand analysis cannot confirm IB because it cannot test whether monotonic transformations of utility are independent of the household characteristics. However, IB does have rejectable implications for demand behaviour, as it implies the independence of the parameters reflecting utility effects in Hicksian budget shares from the relevant demographic characteristics. If the log cost function is linear in utility this requires that the parameter of the real expenditure term in Marshallian shares be independent of those characteristics, a hypothesis which, in general, is empirically rejected (Nicol (1989) and Blundell et al. (1989)). However, in Section I below, we show that when the log cost function is non-linear in utility, this equivalence no longer holds; that is, the dependence of real expenditure parameters on demographic characteristics is no longer sufficient for the rejection of IB.

Equivalence Scales in a Rank-3 Demand System, *Journal of Public Economics*, 58, 143-158, 1995.

In the context of a rank-3 demand system equivalence scales measuring the cost of demographic characteristics independently of the base utility level can be identified from cross-section data without demographic separability restrictions. Although this can also be achieved with a rank-2 demand system that contains a nonlinear log expenditure term in its budget shares, tests performed in a nested framework suggest that the rank-3 demand system approach is empirically superior. The informative structure of the rank-3 demand system is used to estimate a detailed pattern of demographic costs including the cost of single parenthood and economies of scale within the family.

2.2 Cyprus Economic Policy Review Journal

Income Tax Evasion, Inequality and Poverty (with A. Polycarpou)

Vol. 2, No. 2, pp. 37-49 (2008)

This paper uses a consumer demand based method to estimate the extent to which households in Cyprus under-report their income from self-employment, capital income and income from agriculture. On the basis of these estimates, the size of black economy appears to be around 7–8% of GDP. We find that income underreporting biases measures of inequality and poverty downwards, suggesting that egalitarian and antipoverty policies need to become more generous, but also more carefully targeted to avoid false entitlement to social benefits. The high tax free income undoubtedly helps reduce the size of the tax evasion problem in Cyprus.

Factors Affecting House Prices in Cyprus: 1988-2008 (with C. Savva)

Vol. 3, No. 1, pp. 3-25 (2009)

In this paper we investigate the impact of various macroeconomic variables on house prices in Cyprus during the period 1988-2008. Furthermore, we examine how specific characteristics of the house affect its price. We find house prices to be particularly sensitive to changes in island's population. They are also sensitive to the cost of building materials and labour, economic growth and the sterling-euro exchange rate. As regards the question which of these factors contributed most to the large increase in house prices during the period 1988-2008, our analysis points to increase in the cost of materials and labour, the population and the per capita Gross Domestic Product (GDP). In contrast, developments in the stock market and the increase in the number of foreign workers helped towards restraining house price increases.

Cost and Value of Health Care in Cyprus (with M. Andreou and N. Pashourtidou)

Vol. 4, No. 1, pp. 3-24 (2010)

This paper presents some facts about aggregate health expenditure and analyses factors affecting the level of household health expenditure in Cyprus, with emphasis on the type of cover of household members. The implications of individuals' entitlement to free public care for the well-being of households are also investigated to determine the value of free medical care, as perceived by consumers.

We find that the age of household head and household income play a key role in determining the level of health expenditure. In particular, household spending on medical care decreases with the age of household head up to 40 years and increases for older heads. As income increases so does health expenditure but at a declining rate. Medical expenditure also varies with the type of cover of the head and members of the household. Additional household

members create economies of scale in health expenditure when members are covered by public/government, private employer or a combination of medical cover schemes. The well-being analysis shows that the provision of public health care in Cyprus mostly benefits poor households and those with older heads, in the sense that they enjoy a reduction in their total household health expenditure due to eligibility to freely provided public health care.

Poverty and Labour Market Participation of Public Assistance Recipients in Cyprus (with A. Polycarpou)

Vol. 5, No. 1, pp. 23-42 (2011)

This paper investigates the depth of poverty and the employment behaviour of public assistance recipients in Cyprus by combining data collected via questionnaire with data drawn from the EU-SILC dataset. Large income inequalities among public assistance recipients indicate the need for better targeting of benefits. Obstacles to employment are bad health, low education, lack of job experience, family dependants, old age and low self-esteem. Wrong perceptions about the labour market contribute to the failure of public assistance recipients to become/remain economically active. Measures to improve the public assistance system and encourage the participation of benefit recipients in the labour market are proposed.

3. Reminiscences from the scientific community

Professor Sir Richard Blundell

I was deeply saddened when I heard the untimely news about Panos. I am very sorry I cannot be with you all to celebrate his life and to share the deep sense of loss we all feel.

I first met Panos in the early 1980s. Panos was already a senior researcher at the Institute for Fiscal Studies and I had just become research director. Panos was a leader of a new breed of empirical micro-economists. He was particularly interested in consumer behaviour and welfare measurement. Specifically, on the impact of indirect taxes and of prices. Not just on average behaviour but on the whole distribution of behavioural impacts.

Panos was ahead of his time. He asked: What could micro data add to our understanding? Remember this was a time when the distribution of income, and inequality more generally, were not supposed to matter for aggregate behaviour and for aggregate welfare measures. He was sure they did, not only from a consumer theory perspective but from a substantive empirical perspective too.

Together with Guglielmo Weber we set out to study these questions in detail. A resulting paper we published in the American Economic Review, entitled "What do we learn about consumer behaviour from micro data?", showed exactly how distributions matter for consumer behaviour. It was probably the first full-blown flexible demand model estimated on repeated cross sections. It proved Panos was right and spawned a number of important follow up studies.

Panos was a very wise scholar. The discussions I had with Panos were key in the development of many new ideas. He cared about detail and honesty with data, almost to an annoying degree, but he was right to do so! I greatly valued his advice and friendship.

Perhaps most of all I remember Panos as a warm and caring personality. Always a true and reliable friend. I miss him very much.

Professor John Muellbauer

I first met Panos Pashardes at Birkbeck College, where I was fortunate to teach him in the MSc programme in 1975-6. Given his interests in econometrics and microeconomics, and obvious ability, I was delighted to supervise his PhD, which he obtained in 1979. His modest charm and 'can-do attitude' in everything he tackled made our contacts a real pleasure. Before I left Birkbeck in 1981, we worked together on research funded by the SSRC (later renamed ESRC). Our common interests were in improving systems of demand equations on aggregate time-series data and for pooled time series/cross-section data, and in understanding some of the implications of aggregating micro-behaviour to macro-level outcomes. We produced two joint papers which illustrate these interests. One paper tested dynamic specification and homogeneity in aggregate time series demand systems, using similar data to Deaton and Muellbauer's 'Almost Ideal Demand System' paper in the American Economic Review. Our paper was eventually published in the 1992 Festschrift in honour of Hendrik Houthakker. The second paper,

on testing the Barten hypothesis concerning the form of equivalence scales in a flexible form context, appeared as a Birkbeck College discussion paper in 1980. Fortunately, in several papers published later by Panos, he returned to and built on the themes of this paper. Indeed, he followed up in his later work many themes that had fascinated me in the 1970s, including measuring the cost of living, examining the distributional impact of inflation, hedonic analysis of quality change and the effect of changing demography on household behaviour. He also branched out into many other areas, bringing distinguished economic analysis to bear on important policy issues.

In 2002, he invited me to give a talk at the then new Economic Research Centre in Cyprus. It was a great pleasure for my spouse Janine and daughter Amy to meet Panos, Dina and Marios. Panos could not have been a kinder or more considerate host. It was with profound sadness that we learned of his untimely passing.

Professor Guglielmo Weber

I first met Panos in the mid-eighties at the Institute for Fiscal Studies, in London. I was at the time a Ph.D. student at the LSE, and my supervisor, Chris Pissarides, gently steered me away from aggregate data towards micro data. And the IFS was the place to be if you wanted to access micro data on consumer demand.

Panos was my senior in age and experience, and was always keen to talk about his and my own research. When I later moved to UCL, and started working with Richard Blundell on a project about indirect taxation and consumer demand, our research interest grew even closer, and the three of us, Richard, Panos and I, started an exciting new investigation on the way micro data can shed light on aggregate demand patterns.

This line of research eventually led the three of us to publish a paper in the American Economic Review, and Panos to also publish a solo paper in the Economic Journal. In the process I had the opportunity to learn a lot from Panos about consumer demand systems and price indices, but more importantly I had the privilege to get to know Panos as a caring, devoted and hard-working human being, who believed in the importance of bringing economic theory to the data and thus inform the public policy debate.

Professor Sir Christopher A. Pissarides

I met Panos in London when we were both starting an academic career. He was more or less my contemporary. It was lucky that we were not working in the same area of economics because the similarity of our surnames, at least to foreign ears, would have been an endless source of confusion for our colleagues. Indeed, many times I was called by his surname and I am sure he had the same experience with mine.

My acquaintance with Panos had as much to do with the social and political life of the Cypriot community in London as it had to do with economics. Panos was well versed with the community, I was a complete ignorant; every time I was approached about some activity I would first talk to Panos and

then decide what to do. He never let me down. He was always a calm person and a source of information about Cyprus and, to me at least, about microeconomics. We often met in London around LSE for a coffee and a chat. He taught me most things I knew at the time about systems of demand equations (ideal and almost ideal, with the rather unfortunate acronym AIDS) and about the Institute of Fiscal Studies, which approached me about a study on tax evasion at the time of our most frequent contacts. He enthusiastically said I should do it and I am very proud of it now, more than thirty years later. My former student and co-author on that study, Guglielmo Weber, subsequently became Panos's collaborator with excellent results.

Panos was an invaluable colleague to have outside LSE and I missed him terribly when he left for Cyprus. But there was another side to that equation, as I was involved on the setting up of the University of Cyprus and actively engaged in attracting good Cypriot academics from abroad to join its new faculties. I was delighted when Panos decided to come, as much as I was with the others who joined in the first and very strong cohort, including Louis Christophides and Aris Spanos, contributors to this special issue. The university started on a very strong basis because of them and it should be forever grateful for the sacrifices that they have made.

Professor Louis N. Christophides

It is very fitting that Panos Pashardes should be remembered by the Economics Research Centre (which he established), the Department of Economics and the University of Cyprus in a conference, open to the general public and devoted to policy-oriented issues. Panos, on his return from the UK, became absorbed in discussions involving Cypriot economic policy. When I came to the new University of Cyprus in the winter of 1993 along with three other colleagues in the Department of Economics and its first cohort of undergraduate students in the academic year 1992-93, Panos's pre-occupation with policy was already evident. We had many discussions on economic policy issues, the lack of economic analysis for them, and their treatment by the media as matters to be settled by politicians. This common interest in policy continued during my subsequent visits to the University of Cyprus and various collaborations began. A joint paper, published in Labour Economics explored a unique feature of a Cypriot data set to consider the simultaneous choices made by individuals for work by sector (public or private) and type of employment (paid or self-employment) and their implications for the wage earnings in the selected options.

Professor Thanasis Stengos

Panos Pashardes was a unique type of economist, someone who combined theoretical insights, with superior analytical and computational skills and a keen interest in policy outcomes. Over a period of more than twenty years we interacted and collaborated on a number of different projects where I have to confess I knew very little about when we were starting. Yet, Panos was a superb communicator of important policy issues that he cared about in a way that he made you care about the same issues with the same fervour, be it the measurement of the underground economy, the effects of demographics in expenditure patters such as the presence of children and the measurement of the costs of labour accidents just to name a few. I have to admit that from our collaboration I was the one that benefited the most.

Professor Aris Spanos

I have known Panos Pashardes since 1979, when I was first appointed Lecturer in Economics at Birkbeck College (London University), where he was working on his Ph.D. with John Muellbauer (a professor of Economics). Since we were both working in applied econometrics but had different perspectives on empirical modeling, it was natural to begin numerous fruitful discussions that sometimes included John Muellbauer. After completing his Ph.D. Panos was appointed computer programmer for the department of Economics. In 1983 he accepted a Research Officer position at the Institute of Fiscal Studies, and in 1988 moved to a Lecturer position at City University. The proximity of our houses in London during the period 1979-1987 gave us the opportunity to meet in a more family oriented setting. I left Birkbeck College in 1987 and lost touch with Panos until 1992 when I accepted a faculty position at the newly established University of Cyprus (UCY).

When I arrived at the UNC in early July of 1992, the two faculty members in the Economics department were Panos Pashardes and Panayiota Lysiottiou; they began their appointment in early 1992. My initial exuberance for a new beginning as a university teacher in my own country was right away tempered after my first meeting with Panos on the day I arrived at the Economics Department; at the time a second floor office in a building on Kennedy Avenue. Panos described (with a certain degree of despair) the chaotic state of affairs during the previous 6 months or so at the UCY that was dominated by endless meetings of department representatives that led nowhere but bad feelings among faculty members.

The urgent problem facing the faculty in July 1992 was that the UCY was going to accept its first 500 students in September of 1992 but there was no real structure in place for the university to operate normally and meet its basic obligations toward its first students. The situation with the endless meetings of department representatives became so bad that Panos refused to attend them. The first thing on his mind during our initial meeting was to make a case that as a full professor I had to take on that responsibility and replace Panayiota at these chaotic meetings. My initial thought was that Panos was exaggerating, but after attending the first of these meetings I realized that the situation was much worse than I thought. Tempers will flare quickly every few minutes and some faculty members would be screaming at each other like political pundits on TV. In the first few meetings I tried hard to find ways to cool things down with very limited success. It became clear to me that a major part of the problem was that the faculty members felt powerless because they had no authority to make any important decisions at the University level, and they were frustrated by the lack of any progress on crucial issues facing the university. At that time the UCY was governed by the Interim Governing Board (IGB) whose members were distinguished Cypriot and Greek Academics none of whom resided in Cyprus. All the important decisions were made by the IGB during their 2-3 day-long meetings in Cyprus every 3 to 6 months. Their attempt to govern an active university from afar created several additional problems. One such problem stemmed from the fact that a few faculty members had direct access to particular members of the IGB, and they were using this to promote their department's interests, creating resentment among the other faculty members.

After discussing several different options with Panos and Panayiota, I decided to call a general meeting of all faculty members to explain the dire situation we found ourselves in as faculty, and put forward a proposal on how to ameliorate our predicament in light of our responsibilities toward the incoming students in September. My proposal was twofold. The first component included a scheme to organize

ourselves into departments and schools with interim governing boards and an interim revolving Rectorship team in the spirit, but not the letter, of the law that founded the UCY. The second component was to ask the House of Representatives to appoint three UCY faculty members on the IGB to facilitate the day to day decision making at the university level. Despite some initial reservations and charges of 'power grabbing' by a few faculty members as well as members of the IGB, the proposal was adopted and a new normalcy began to establish itself at the UCY after the House of Representatives accommodated our request. Interim committees and temporary governing boards began putting forward proposals on urgent issues, including what to teach for each undergraduate degree and how the required teaching was going to be carried out. The meetings of the various interim boards and committees became a lot more productive and we could see the immediate fruits of our efforts.

On the negative side, as a full professor I found myself in the position of an acting interim Rector and a member of the IGB having to take numerous initiatives on a daily basis and defend them at the next meeting of the IGB; not an easy task. The most crucial and laborious task was to create an institutional framework by passing laws, written with the invaluable help of the office of the Attorney General, through the House of Representatives with a view to enable the UNC to operate as a first class university. The original law that founded the university created only the skeleton of the institution and the rest had to be completed in a few months. Second in importance was the annual budget of the university that had to be put together at the department, school and university levels, and then negotiated with several government agencies, as well as defended at the House of Representatives. Panos was extremely helpful on both of these crucial tasks in several different ways. My most challenging task, however, was to persuade faculty members to accept new responsibilities as members of the interim committees and temporary governing boards for the institution to begin working as a university should. To my pleasant surprise the initial enthusiasm of the faculty for being part of the first university in Cyprus returned rather quickly and the overwhelming majority accepted the new responsibilities with zeal. Among those people were my two colleagues, Panos and Panayiota. Panos accepted to be the first interim Chair of the Economics department and he would positively respond to my numerous requests for undertaking additional tasks at the university level as a chair or a member of several interim university committees, including Finance and Research.

For me the community spirit exhibited by the overwhelming majority of the faculty members during this initial period includes some of the most cherished memories of my 8 years at the University. Panos exemplified that spirit at its best! His lasting legacy will be the founding, directing and nurturing the Economics Research Centre. We had the first discussions for such a center in 1993, but it took almost a decade of hard work on his behalf to turn the initial idea into reality.

4. Opening and closing remarks of the conference

Professor Sofronis Clerides, Chairman of the Department of Economics

Dear Dina, dear friends and associates of Panos, dear all who are here today to pay their respects to our late colleague,

On behalf of the Department of Economics and the Economics Research Centre (ERC), I welcome you to this scientific workshop that is dedicated to the memory of our late friend and colleague Panos Pashardes. Panos worked with dedication at the University of Cyprus for the last 25 years of his life and left behind a valuable heritage. I would like to share with you a few words about Panos' academic career and his contribution to the University of Cyprus.

Panos began his studies in Economics at the University of Athens. After a short break due to the Turkish invasion of Cyprus, he went to Birkbeck College of London where he got his postgraduate degree and then his doctorate in 1980, under the supervision of John Muellbauer. It was the time when Muellbauer and Angus Deaton – a later Nobel laureate and recipient of an honorary doctorate from the University of Cyprus – were writing the article "An Almost Ideal Demand System," which was published in 1980 in the American Economic Review and was later selected as one of the top 20 articles published in the first 100 years of the journal.

The quality of Panos' work had been acknowledged early on. A common friend who is a few years younger than Panos recently shared his personal experience with me. When this friend was preparing to start his PhD, he was handed a few recent PhD theses to read in order to understand what was expected of him. The first one he read was Panos' thesis. When he was done, he wondered whether he should abandon his plans for a doctorate and consider other options. He knew that it would have been very difficult for him to match the quality of Panos' work. Fortunately he had the patience to read the rest of the theses and he understood that Panos was an exception. He carried on with his PhD, and today he is a distinguished University professor.

Panos' first job was not as an economist but as a programmer at Birkbeck College. This explains his familiarity with technology, which often surprised his much younger colleagues. A common trait I had with Panos was our preoccupation with the visual integrity of our texts. I learned from Panos, among other things, how to properly place stars next to regression coefficients in regression tables in Excel. The stars were perfectly aligned and at the correct distance from the coefficients they were referring to.

In 1983, after three years as a programmer, Panos secured a researcher position at the famous Institute for Fiscal Studies (IFS) in London. His experience at IFS was crucial because it gave him the opportunity to meet and work with people like Richard Blundell, who was later knighted for his services to Economics and Social Science. The IFS was the ideal place to work for anyone interested in analyzing microeconomic data, which were becoming available to researchers at the time. It was there that the seed was planted in Panos' mind, from which the Economics Research Center of the University of Cyprus grew many years later.

Panos worked for the IFS for five years. In 1988 he moved to City University in London as a Lecturer and very quickly, in 1992, he advanced to the rank of Reader. His career was on a very good track. He was already a well-known economist with recognized research work and collaborations with top economists of the time. His article with Richard Blundell and Guglielmo Weber, "What Do We Know about Consumer Demand Patterns from Micro-Data?" was at the gates of the American Economic Review.

At the same time in Cyprus the project of establishing the country's first University was under way. Panos had the ideal academic profile that the University was trying to attract in order to help it in this effort. Panos was recruited and he took on the challenge. He made the big decision to abandon an already successful and promising career to return to his home country and help its first university get on its feet.

He took up his duties at the newly established University of Cyprus in 1992. He contributed in many ways to the administration of the University, among others as the first head of the Finance and the Research Committee. He was also the first Head of the Department of Economics and had a catalytic contribution to the development of its teaching, administrative and research profile. The identity of an organization – and to a large extent its future course – is shaped in the first years of its life. Panos' contribution in molding the Department's identity and its future successful path was critical.

When the Department of Economics reached a critical mass and was on a promising trajectory, Panos turned his attention to his next step, his grand vision of creating an economics research center based on the IFS model in Cyprus. More about this effort will be presented by Panos' successor of at the ERC, Professor Elena Andreou.

Panos' research interests focused on public finance, namely inequality, consumer behaviour and demand, the design of tax and social policy policies and the analysis of their impact. We will hear more about the work he did during the UK phase of his career from some of his associates from that period. In the second phase of his career in Cyprus, he continued to work on the same topics but at the same time widened his interests through collaborations with various colleagues on issues such as wages and employment, productivity, incomplete information, education, energy and more. He also wrote many policy reports on a broad range of issues.

Panos was a tireless and dedicated scientist. He did not seek publicity, office, money, glory, recognition, or reward. He left a career with brilliant prospects in England to serve his country, and he worked hard for this purpose. Even at the time of his ill health, he did not quit. Whenever he could, he was in the office; whenever he could not, he was working at home.

Panos was interested in public affairs. He was politically active but his political affiliations did not cloud his economic thinking. On the contrary, he had an independent mind that was always guided by his scientific training and not by ideologies, sentiment, or personal preferences.

In the Economics Department, Panos was a calm force. I never remember him raising his voice. He treated his younger colleagues as equals and never tried to use his position to impose his point of view. He tried to convince with clear argumentation, and economic logic was always at the heart of his arguments. And when tensions would sometimes arise at Department meetings, we could always rely on Panos to defuse tension with a daring joke. His humor is something we miss.

Panos' achievements are indisputable. He was one of a handful of people - some of whom are here today, such as Aris Spanos, Louis Christofides, Christophoros Pissarides - who created the sound foundations

that enabled the Department of Economics to flourish into a respected entity. The Economics Research Centre was exclusively his own creation and can be credited for elevating the state of economic discourse in Cyprus.

All of us who knew him have benefited from his guidance, knowledge and experience. He left behind a legacy of academic rigor, hard work, public service and dedication to science, knowledge and research. Today's event is a signal of our commitment to carry on this legacy. Our aim is to continuously improve both the Department of Economics and the Economics Research Centre and to establish them internationally as centers of high quality scientific research and training grounds for aspiring young economists.

Last but not least, I would like to thank my colleague Professor Elena Andreou for taking on the lion's share of the organizational burden of this workshop, as well as the even greater challenge of heading the Economics Research Center during this difficult transition period.

Thank you all for being here today to commemorate Panos. Let's move on to the scientific part of the conference.

Professor Elena Andreou, Director of Economics Research Centre

In 2016, I had the honor to be appointed Director of the Economics Research Centre and to succeed Panos, who was the founder and Director of the Centre until his retirement. Therefore I would like to briefly talk about Panos' vision and contributions in the University of Cyprus (UCY) in relation to the Economics Research Centre.

When the Department of Economics began to consolidate in 1996, Panos felt he could turn his attention to his great vision. His vision was to establish a research center similar, but smaller in size, to the Institute of Fiscal Studies (IFS), where he worked in the early years of his career in the mid-1980s as Senior Researcher and Director of the support group of econometrics methods.

At that point there were no research centers at the University of Cyprus, and Panos had to start from the beginning. He worked tirelessly for five years until the establishment of the Economic Research Centre. He laid the foundation of research centres and today there are ten centers in different disciplines at the University of Cyprus. He helped create the framework for the operation of university research centers - including the research purpose and vision, the legislative framework, the administrative structure, the attraction of research funding and sponsorships, and the social contribution of the research centers. Panos formalized his first official report on the establishment and operation of the Research Unit of Economic and European Studies in 1996. The Centre's archives provide a detailed report analyzing all the above aspects.

He began to share his vision and discusses his first ideas with a small group - Yiannos Kranidiotis, Simeon Matsis, Nikos Christodoulakis, Aris Spanos, among others. It consulted the Senate and the Council of the UCY about the operation and regulations of the research center/unit for two years. In 1999, the regulations for the establishment of Research Units were approved by the Parliament.

Panos consulted with the Planning Bureau and the UCY on the budget of the Research Centers, and in 2001 the Economics Research Unit was established. Panos was appointed Director of the Unit in 2001 and took on the next challenge - to find sponsors. Government agencies, Ministries, the Central Bank of Cyprus and the European Union were among the first sponsors of the Centre. Panos' dream, which he worked for five years, became a reality in 2001. In 2006, the Economics Research Unit was renamed Economics Research Center and while Panos was the Director until his retirement in 2016, he kept actively contributing to the Centre until after his retirement.

During this time, the Centre has acquired the reputation of an independent research unit that produces high-quality scientific work for the Cypriot economy and collaborates with academics in the UK and abroad, attracting research funding from the European Union and the national Research Promotion Foundation, for both academic and more applied research in economics.

The Centre currently employs 14 researchers and has published around 150 economic policy essays on the Cypriot economy. Panos himself has published a large number of studies, which have received extensive coverage in the media, have been a reference point in the public debate and contributed to shaping the socio-economic policy in Cyprus. Panos, along with a number of researchers at the Centre and academics (both in the UK and abroad), has analyzed a wide range of economic issues such as public finances, taxation, health and pension systems, the labor market, wage inequality, poverty, inequality and migration, tourism, competition issues, water management, environmental finances, the cost of invasion and equal burden sharing for refugee property and much more. So much that one feels awe for his contribution and the great inheritance he leaves behind in the university and in society. Overall, Panos has written, among other things, 70 economic policy essays for the EU and Cyprus, and 31 academic papers published in international journals, some of which are not only in the top journals of economics but are also highly cited.

Panos is characterized as the main founder of the quantitative economic analysis of many aspects of the Cypriot economy and has contributed decisively to the upgrading of the level of public debate on economic issues. He has been the driving force of the Economics Research Center which was exclusively its creation until his last days. Everyone at the UCY, as well as the Panos' family, knew how important the Centre was in his life - as his "youngest child". Even after his retirement, Panos came to the Centre almost daily, as a devoted academic and "father", often saying that the Centre continued to give him energy and purpose in life.

Over the years, Panos has been an academic, teacher and mentor for his colleagues, students, postdoctoral researchers. He supported his younger colleagues, worked with zeal and love for research late in the evening and until the early morning hours, supported his views with scientific arguments during in the various university board meetings, was insightful, sharp, accessible to everyone, and always had a good anecdote in his pocket for the right moment.

We thank Panos for everything that he leaves us as a legacy in the Department and in the University (both material and immaterial). We also thank those who have supported Panos and the Economics Research Centre - the Center's sponsors, members of the Council of the Centre, fellow academics in the Department, researchers at the Centre, the administrative staff supporting the Centre, the Rectorate, the speakers of this conference, his collaborators from the early years of his career in England who have sent their kind words to honor him and last but not least his family, Dina and Mario.

We consider it our duty to continue his vision as he writes in his report on 14/01/2002:

“The modern economy is characterized as a 'knowledge economy' to highlight the importance of investment in research for economic growth. This is linked to the globalization and liberalization of the economy and the intensification of competition in international and domestic markets. European orientation leads the Cypriot economy to this circuit of increasing competition and makes the upgrading of economic research a necessity.

The Unit can study the problems of the Cypriot economy on an ongoing basis. It also has the potential to attract established Cypriot and foreign scientists to engage in research on economic issues of interest to Cyprus. It can absorb research funds from the European Union and bring together public and private organizations to work and award research grants to the UCY.

The Unit does not only investigate issues related to the Cyprus economy but also issues of general economic interest. It produces research work that can be published in international scientific journals. The Unit's activities include distinguished Cypriot and foreign scientists as partners and collaborators in research projects.”

Dina Pasharde, Wife of Panos Pashardes

I would like to thank the Economics Research Centre and the Department of Economics of the University of Cyprus for organizing this special academic conference in memory of my husband Panos Pashardes.

I would also like to thank the Rector Professor Constantinos Christofides and the Head of the Department of Economics Professor Sofronis Clerides for their introductory and informative speeches.

I wish to express my full appreciation to all the distinguished speakers, each one separately, for honouring my husband with their presence. I would particularly like to thank Professors Christopher Pissarides, Louis Christofides, Thanasis Stengos and Aris Spanos. I understand that everyone has come from abroad specifically for this conference and this, of course, denotes their main concern to pay tribute to Panos.

I am extremely grateful to the Director of Economics Research Centre, Professor Elena Andreou, the successor of my husband, for her valuable help in organizing and participating in the conference.

It would be a great omission, on my part, not to mention and thank Angela Shekersavva, Panos' secretary for many years, for her continuous help and sincere support all these years to my husband and me.

In addition, I feel the need to convey the immense gratitude of my son, Marios, to all those who have contributed to the organization of this conference in memory of his father. He lives and works in Malaysia and although his great desire was to attend, unfortunately this was not possible due to professional obligations.

I was deeply moved by the introductory speeches of the Rector of the University of Cyprus and the Chairman of the Department of Economics as well as the speeches sent by his distinguished collaborators from abroad, Sir Richard Blundell, Prof. John Muellbauer and Prof. Guglielmo Weber. I believe that his colleagues are the most appropriate persons to talk about Panos' academic and scientific contribution.

I, myself, have known Panos as an exceptional and remarkable person, father and husband. Of course, I admired him both as a scholar and as a scientist, but what I admired most about him was the tremendous endurance and outstanding courage he showed during his prolonged illness as well as his astonishing dignity towards the end. Even his doctor, at the American Medical Centre where he was hospitalized for the last 11 days of his life, said to me that it was the first time in his career that he met such a courageous patient.

He was discussing with his doctor about the imminent end and how would eventually happen, as if it was an ordinary, everyday phenomenon. He used to tell me: "I am not afraid of death". In fact, he was looking forward to it. He refused to receive any pharmaceutical support towards the end. When he realized that his physical strength was about to abandon him, he said that there was no point in living if he could not continue doing what he used to do.

Panos was so well informed and entirely aware of his disease that he knew exactly the day he would pass away and he was trying to prepare us psychologically! His last thoughts were not about himself, but about us, who would be left behind. Even at his final moments and while in lucid mind, he was constantly giving us advice how to deal and cope with everything.

It is commonly said that time heals and eventually alleviates pain. I am still not completely certain about this, because his absence becomes more noticeable as time passes by.

I hope he is well wherever he is!

Thank you all, wholeheartedly, for your interest in attending this conference.

5. Extended abstracts of papers presented at the conference in memory of Professor Panos Pashardes, 11th of September 2018

Intergenerational Earnings Mobility in Post-Soviet Russia

Christopher A. Pissarides, London School of Economics and University of Cyprus (speaker)

Gleb V. Borisov, St Petersburg State University

This paper is one of those rare forays of mine into applied microeconomics, driven by the curiosity of what is happening in post-Soviet Russia. One hears a lot about corruption and mismanagement in Russian society, with its oligarchs and its inequalities, but when it comes to transfers between generations, are the children of high-income parents that much better off than the children of poorer households? Is post-Soviet Russian society really that different from “Western” societies which have been living in capitalist economic systems for many more generations? Well, the answer is no, it’s not that much different. Russia is not Scandinavia but then neither is Britain or the United States. Russian intergenerational transfers of income-earning capabilities are about as large as they are in the latter two countries.

Our work makes use of longitudinal data for the Russian economy over 1994–2016 to extract the intergenerational correlations of long-term earnings in post-Soviet Russia. We decompose those correlations into those due to educational qualifications and observable gender, family and regional characteristics, as well as unobservable family and personal characteristics, in line with the recent literature (see for example Solon 1999; Black and Devereux 2011; Blanden 2013).

The Russian Longitudinal Monitoring Survey (RLMS), which we use, was conducted in a consistent manner every year since 1994 (except for 1997 and 1999), covers virtually the entire period of post-Soviet Russia. It is a panel survey of household addresses containing a wealth of information about individuals and their families. We also use other national data sources to control for temporary macro fluctuations and the effect of the macro environment. As far as we know, our study is the only one so far that uses actual observations to estimate the intergenerational correlations of earnings. Previous work on intergenerational mobility in Russia focuses mainly on occupational or educational mobility, covering usually only men and using less detailed datasets that relied on recall questions (e.g. Roshchina 2012; Bessudnov 2016; Maleva and Burdyak 2016; Bukodi et al. 2017, etc.). We conduct two types of computations: first, we compute permanent earnings for parents and children to estimate the correlation between intergenerational earnings. Second, we decompose the covariance of intergenerational earnings into three groups: due to human capital, observed family and regional characteristics, and unobserved factors, such as ability and networks (Blanden et al. 2013).

We find that the best measure of long-term “permanent” earnings for our analysis is the decile rank of parents and children in the income distribution, with income measured by the residuals of a regression that nets out time-varying characteristics. The overall correlation between the parents’ and children’s rank is about 0.35, higher than respective correlations observed in the literature in the Nordic countries (0.2 or lower), but at about the same level as in the bigger economies of the USA, the UK and France (within the range of 0.3–0.4). The relatively high intergenerational earnings elasticity implies low earnings mobility, which means that, typically, children of high earners have high earnings themselves. When decomposing the correlation between the part due to education, observable characteristics such as local area, and unobservables, we find that the correlation due to education is the smallest, accounting for about 20% of the overall correlation, with the other two contributing approximately equal amounts of 40% each. It is noteworthy that educational attainment in Russia seems to play a smaller role in the intergenerational income correlations in comparison to other large economies (for the UK, see, for example, Blanden et al. 2007). Moreover, whereas the intergenerational transmission of education from parents to children is strong and at about the same level for sons and daughters of parents in similar educational and income categories, on average the sons reach higher income ranks than the daughters. Future research should be focusing on the channels that augment incomes outside the educational system.

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The Impact of Public Sector Reforms during Recent Crises on the Public-Private Sector Wage Gap

Louis N. Christofides, University of Cyprus (speaker)

Maria Michael, University of Cyprus and Cyprus Statistical Service

The paper deals with a subject which has become central to the process of European integration and has assumed urgent importance because the international and sovereign crises have placed significant fiscal burdens on many European countries.

It examines the evolution of the public-private pay gap in 31 European countries over the income years 2007 (the year before the crisis) to 2013 (a year by which most countries had exited their crisis) at both the mean, using the Oaxaca and Ransom (1994) decomposition, and at different quantiles, using the method proposed by Chernozhukov, Fernandez-Val, and Melly (2013). Major effort was involved in coding the public sector wage austerity measures adopted by the European countries (the EU28 plus Croatia, Norway, and Switzerland) included in the EU Survey of Income and Living Conditions and used in this paper. These measures were coded into the discrete variables Freeze and Cut. The impact of the public sector austerity measures should depend on whether they were imposed on largely explained or mostly unexplained wage gaps, on the particular point in the wage distribution that they applied to, and on the wage flexibility that prevailed in the private sector, where wage freezes and cuts adopted endogenously would have an impact on the wage gap in the upward direction. The paper investigates the econometric impact of Freeze and Cut on the pay gap, using a static fixed effects model and the Arellano and Bond (1991) dynamic panel method. The austerity effects measured in this paper constitute a minimum impact on the wage gap because of the endogenous private sector adjustments.

Decompositions at the mean showed that 14 countries, including all the Nordic and central/western European ones plus Iceland, the UK, Malta and Estonia, had a low or insignificant pay gap in 2007, and 9 of them did not adopt any austerity measures. Among the top pay gap countries in 2007 were 8 countries which were forced to apply for external financial assistance, including 4 countries that subsequently entered formal Memoranda of Understanding. Experience in the 8 countries during the crisis period to 2013 was varied, with ephemeral austerity effects on the wage gap in Romania and lasting ones in Greece.

Similar heterogeneity exists in the impact of public sector reforms on the wage quantile functions of the countries studied. Most countries displayed negatively sloping quantile functions in 2007, implying that the lowest paid public servants were better paid than similar colleagues in the private sector, while this was not necessarily true for the more highly paid. Regardless of the 2007 quantile shape, austerity tended to shield the lowest-paid public servants and to twist the wage distribution in their favour. In some cases, it drove the top of the wage distribution into the negative territory. Notable such cases include Spain and Ireland.

The econometric estimates obtained from the static and the dynamic panel analysis of the 31 countries over the period 2007-2013 for the impact of Freeze and Cut suggest that they had a negative and significant impact on the unexplained public-private sector pay gap. This was especially the case at the median and at the 90th quantile. At the 10th quantile, the impact of the measures on the gap were statistically weaker but generally positive. This suggests that private sector cuts were severe, increasing the pay gap for the low-paid between the two sectors.

The results obtained suggest that the initially prevailing wage gap quantile function and the extent to which it is unexplained by productivity characteristics such as education and age/experience, should be taken into account when austerity measures are designed. In some countries, e.g. Austria, the private sector wage distribution is taken into account when determining public sector compensation (see also Gomes (2015, 2016)).

A broader question posed by the results in this paper is whether the initially high wage gaps in some countries have a causal connection to the need for external financial support felt in the 8 countries that sought such assistance. Beyond the obvious link between the public sector wage bill and the general state of public finances, it is likely that the 14 low-gap countries had pursued more careful structural policies in the past, relative to the 8 high wage gap countries. Public sector remuneration and the implied public-private pay gap is but one indication of the ability of a government to balance the interests of lobby groups with those of the country as a whole.

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Beyond the human development index: a stochastic spanning methodology

Thanasis Stengos, University of Guelph (speaker)

Mehmet Pinar, Edge Hill University

Nikos Topaloglou, Athens University of Economics and Business

Well-being is inherently a multidimensional concept and it is commonly measured in that way (see, e.g., Fleurbaey 2009; Fleurbaey and Blanchet, 2013) as policy makers propose different frameworks to measure sustainable development that rely on multidimensional indices (Hall et al., 2010). For example, the European Commission's "Going beyond GDP" initiative aims to assess development indicators that go beyond GDP to measure the progress in the social, environmental, and economic aspects of development in a multidimensional manner. Stiglitz et al. (2009) proposed eight dimensions beyond GDP to measure multidimensional well-being, and these include standard of living, health, education, political voice and governance, among the other dimensions. Furthermore, there is an extensive list of composite indices that is being developed to measure the overall multidimensional welfare progress of countries (see Singh et al., 2012 for a recent overview of large set of composite indices). Some of these composite indices have been obtained by simple aggregation of different welfare dimensions. For example, the environmental sustainability index (ESI) is a measure of the overall progress towards environmental sustainability (Esty et al. 2005) measured by the arithmetic average of environmental indicators, while the United Nations' Human Development Index (HDI) is a geometric mean of the education, life expectancy and GNI per capita (Malik, 2013). Furthermore, the FEEM sustainability index (FEEM SI) aggregates 19 indicators under three main pillars -- environmental, social and economic -- through weights selected by experts (see Pinar et al. 2014) and OECD's Better Life Index (BLI) is aggregated through preferences of individuals on different well-being indicators (see OECD, 2011; Boarini and D'Ercole, 2013; Durand, 2015).

The above mentioned composite indices serve to convey a quick message to stakeholders and policy makers about the strengths and weaknesses of current policies that promote development (see e.g., Ness et al., 2007). Yet, they rely on implicit value judgements (i.e., selection of the indicators, normalization of indicators, and weight allocation to indicators) and as such they have drawn criticisms in the literature (see Decancq and Lugo, 2013 for a comprehensive discussion on the topic). For instance, the construction of HDI received many criticisms with respect to the selection of indicators (e.g., Ranis et al. 2006 suggested inclusion of more indicators to the already existing set of indicators; Bravo, 2014 analyzed the inclusion of environmental dimension to the HDI; additional dimensions beyond the three components of the HDI are suggested by Stiglitz et al., 2009, among many others), normalization of indicators prior to aggregation (see e.g., Noorbakhsh, 1998 and Pollesch and Dale, 2016 for further discussion on how normalization plays a role on implicit weights and affects the composite scores), and weight allocation across the well-being dimensions (see e.g., the effects of choice of weights on both the ranking and composite achievement levels are examined by

Cherchye et al., 2008; Permanyer, 2011; Foster et al., 2013; Pinar et al. 2013; Tofallis 2013; Athanassoglou, 2015, among many others).

Our paper adopts a data driven methodology that allows for the possible inclusion of additional well-being components to HDI based on stochastic dominance (SD) spanning analysis. More specifically, we examine whether the inclusion of some other indicator to the already existing composite HDI index leads to an improvement in well-being by comparing the empirical achievement distribution of the benchmark HDI with that of the new augmented index. The comparison of the empirical achievement distributions with and without the included indicator will be done using stochastic spanning (SD), which extends the SD efficiency methodology to test whether inclusion of an indicator to the existing composite index (i.e., HDI) leads to welfare improvements. SD is a powerful framework of analysis that has been used in a wide variety of applications in economics, finance and statistics (see e.g., Levy (2015) for an overview and references). Due to its non-parametric attractiveness, SD is particularly appealing for comparisons of variables with asymmetric profiles (e.g., income, life expectancy, education, etc. among different countries). Recent developments in the SD methodology has given rise to multivariate well-being comparison of countries (see, e.g., Duclos et al., 2006), yet none of these papers allowed for differential weights to be assigned to each dimension in the multivariate context. In a recent paper, Pinar et al. (2013, 2017) used the SDE methodology to obtain the best-case scenario weighting scheme for the HDI with the sub-indices used prior and after the 2010 edition. In their paper, Pinar et al. (2013) found that if one were to weight the education index relatively more than the pre-determined equal weights, that would tend to result in a more optimistic way of measuring welfare, where the education index would be assigned a higher implicit weight. This approach results in a new HDI with weights that are given to the component(s) where most countries have been most successful in fulfilling. However, since the majority of countries would have already achieved good levels of literacy and enrolment ratios (i.e., the indicators used to measure the education index prior to the 2010 edition of Human Development Report), it would appear that these indicators would not serve any longer much of a purpose for relative welfare comparisons. In that case the optimistic scenario would not be very useful from a policy perspective as it showcases a weighted average of components where most countries would be already successful.

The opposite case would be to derive the pessimistic scenario which would highlight the components with the least success. In such a case, HDI rankings using the pessimistic weights would give incentives to countries that lag behind to make improvements on the respective components where they are least successful in achieving.

The concept of SD spanning has been recently introduced by Arvanitis et al. (2017) as a model-free alternative to mean-variance spanning (Huberman and Kandell, 1987). In the context of HDI, SD spanning occurs if there is no benefits from a particular expansion of the given feasible choice set (i.e., income, life expectancy, education) or to put it differently, the exclusion of some other potential component would not worsen-off the distributional achievements of countries. The null hypothesis in the SD spanning testing framework is that the introduction of a new component of human development is not welfare enhancing. Consequently, we test the null hypothesis that the components of the benchmark HDI provide the best welfare outcome

available when compared with alternative sets which also include one of each of 13 different indicators that measure different aspects of governance (or institutional quality). From a behavioral perspective, spanning implies that the problem presentation can be simplified by excluding the redundant choice alternatives. If the inclusion of an indicator leads to a welfare improving augmentation of the choice set of indicators, this indicator's inclusion would imply rejection of the null hypothesis as the original set does not form a spanning set. On the other hand, not rejecting the null hypothesis would suggest that the inclusion of the additional indicator would not lead to any welfare gain. SD spanning can be considered as an assessment tool to test the inclusion of indicators and allow policy makers to implement changes in the indicator list that make up the given index (in our case the HDI). In other words rejection of the benchmark spanning set would allow policy makers to augment the set of welfare components beyond the standard ones and assess the relative progress of a given country, if well-being were to be measured as a weighted average of the components in the new enlarged set.

We applied SD spanning testing to examine the inclusion of additional indicators to the component list of the HDI. In particular, we tested for the inclusion of thirteen governance indicators to the component list of the HDI, since governance is deemed to be a socially and economically important factor for development. The SD spanning tests allowed us to examine whether the inclusion of any governance indicator may provide additional welfare gains to the benchmark HDI index. We found that when democracy index from the Polity IV, economic freedom and regulation indices from the FI are combined with some of the sub-components of the HDI (mainly the health index), these indices second-order stochastically dominate the cumulative distribution of any combination of the three components of the benchmark HDI (which also includes the equally-weighted benchmark HDI). This suggests that the inclusion of these governance indicators to measure the well-being across countries leads to marked welfare gains across the countries in our sample. We further computed country rankings when these three governance indicators are included in the list of the standard benchmark HDI components. We found that even though the rankings obtained with the composite indices that include governance indicators were positively and highly correlated with the rankings obtained with the equally-weighted HDI, most countries exhibited major rank reversals using the two types of composite indices. Furthermore, we also showed that the composite achievements with the governance indicators were relatively higher than those with the equally-weighted HDI.

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The Perils of Curve-fitting: Goodness-of-fit vs. Model Validation

Aris Spanos, Virginia Tech, USA (*speaker*)

The paper attempts to make a case that viewing empirical modeling as curve fitting (estimating) a substantive (structural) model using data, guided primarily by goodness-of-fit measures, will almost certainly give rise to untrustworthy evidence. This is because such a quantification of a structural model treats substantive information as ‘established knowledge’ instead of tentative conjectures to be tested against the data before accepted as valid. The curve fitting perspective is unduly influenced of the mathematical approximation perspective, and insufficient attention has been paid to the statistical modeling aspects of the problem. As shown in Spanos (2010), optimal mathematical approximation theorems run afoul statistical adequacy because they are based on residuals [approximation errors] which are both functions of the conditioning variables as well as systematic (non-white noise). That is, using goodness-of-fit as the primary criterion for ‘best’, the mathematical approximation perspective invariably undermines the reliability of inference by yielding optimal selection rules that ignore the adequacy objective of ‘accounting for the regularities in the data’. Indeed, excellent goodness-of-fit is neither necessary nor sufficient for statistical adequacy. Moreover, goodness-of-fit criteria often pressure the validity of the underlying statistical model; see Spanos (2007).

The end result of foisting a substantive model on the data in an attempt to quantify the unknown structural parameters will invariably be an estimated model which is both statistically and substantively misspecified with no principled way to separate the two sources of error; an awkward problem philosophers call Duhem’s quandary. To address this conundrum one needs to separate the statistical model, denoted by:

$$\mathcal{M}_\theta(\mathbf{x}) = \{f(\mathbf{x}; \boldsymbol{\theta}), \boldsymbol{\theta} \in \Theta \subset \mathbb{R}^m\}, \mathbf{x} \in \mathbb{R}_X^n, m < n,$$

where $f(\mathbf{x}; \boldsymbol{\theta})$ denotes the *distribution of the sample*, from the substantive model

$$\mathcal{M}_\varphi(\mathbf{x}) = \{f(\mathbf{x}; \boldsymbol{\varphi}), \boldsymbol{\varphi} \in \Phi \subset \mathbb{R}^p\}, \mathbf{x} \in \mathbb{R}_X^n, p \leq m,$$

by distinguishing, *ab initio*, between the substantive subject matter information stemming from a theory or theories, and the statistical information stemming from the data in the form the chance regularities exhibited by the particular data x_0 . Using a purely probabilistic construal for $\mathcal{M}_\theta(\mathbf{x})$ one can define it as comprising the probabilistic assumptions imposed on data x_0 , ensuring that behind every substantive model there is a statistical model that is often implicit but needs to be brought out explicitly; see Spanos (1990). This disentangling of the two model types enables the modeler to distinguish between two different but related questions:

[a] statistical adequacy: does $M\theta(x)$ account for the chance regularities in x_0 ? Statistical inadequacy arises when any of the probabilistic assumptions comprising $M\theta(x)$ are invalid for data x_0 .

[b] substantive adequacy: does the model $M\varphi(z)$ adequately captures (describes, explains, predicts) the phenomenon of interest? Substantive inadequacy arises, not from invalid probabilistic assumptions, but from highly unrealistic structural models, flawed *ceteris paribus* clauses, missing confounding factors, systematic approximation error, etc.

In this sense, probing for substantive adequacy should be pre-dated by securing statistical adequacy because without it the reliability of any substantive probing will be questionable. When the statistical adequacy of $M\theta(x)$ is established one can proceed to probe questions of substantive adequacy, beginning with testing and confirming the validity of the overidentifying restrictions stemming from $G(\theta, \varphi) = 0$, $\theta \in \Theta$, $\varphi \in \Phi$.

An effective strategy to secure the statistical adequacy of $M_0(x)$ is to make another distinction between the *modeling* and *inference facets* of statistical analysis. The former begins with the chance regularities exhibited by data x_0 with a view to select the probabilistic assumptions underlying the stochastic process $\{X_t, t \in \mathbb{N} := (1, 2, \dots)\}$ so as to render x_0 a typical realization thereof. The link to the substantive model comes in the form of parameterizing this process so as to ensure that the substantive parameters $\varphi \in \Phi$ constitute a reparameterization /restriction of the statistical parameters $\theta \in \Theta$. Establishing a statistically adequate $M\theta(x)$ calls for trenchant Mis-Specification (M-S) testing and respecification when the original model is found to be wanting. This iterative process constitutes the modeling facet as opposed to the inference facet that begins with a statistically adequate $M_0(x)$. Crudely put, conflating modeling with inference is analogous to mistaking the process of constructing a boat to preset specifications with sailing it in a competitive race; they are inter-related but separate facets. To borrow a phrase from Claeskens and Hjort (2008), p. xi, detaching the modeling from the inference facet is *not* 'the quiet scandal of statistics' as they claim, the real scandal is imposing invalid assumptions on one's data and drawing inferences regardless.

Revisiting Instrumental Variables (IV). The distinction $M\varphi(z)$ vs. $M\theta(z)$ sheds very different light on IV estimators (including GMM) and the choice of 'optimal' instruments (Z_t). In the context of the linear model:

$$y_t = \alpha_0 + \alpha_1^T X_t + \varepsilon_t, \varepsilon_t \sim \text{NIID}(0, \sigma_\varepsilon^2), t \in N \tag{1}$$

the moment conditions (i)-(v) defining an IV estimator (table 1), implicitly specify the statistical model behind the substantive model to be

$$(y_t|x_t|Z_t) \left(\begin{pmatrix} \beta_1 Z_t \\ B_2 Z_t \end{pmatrix}, \begin{pmatrix} \omega_{11} & \omega_{12} \\ \omega_{21} & \Omega_{22} \end{pmatrix} \right) \quad (2)$$

What is often insufficiently appreciated by practitioners is that when (2) turns out to be statistically misspecified, the IV estimators and associated inference procedures will give rise to unreliable inferences resulting in untrustworthy evidence. That is, the choice of instruments is not just a matter of substantive information, but it also involves securing the statistical adequacy of implicit statistical model in (2). If misspecified, (2) should be respecified with a view to secure statistical adequacy, e.g. include lags and trends for time series data. That is, statistical information plays a crucial role in determining the optimal instruments needed to secure the statistical adequacy of the implicit reduced form; see Spanos (1986).

TABLE 1

Moment conditions defining IV

(i) $E(\mathbf{X}_t \varepsilon_t) = \mathbf{d} \neq \mathbf{0}$,	or (i) _{α} $(\frac{1}{n} \mathbf{X}^\top \boldsymbol{\varepsilon}) \xrightarrow{\mathbb{P}} \mathbf{d} \neq \mathbf{0}$,
(ii) $E(\mathbf{Z}_t \varepsilon_t) = \mathbf{0}$,	or (ii) _{α} $(\frac{1}{n} \mathbf{Z}^\top \boldsymbol{\varepsilon}) \xrightarrow{\mathbb{P}} \mathbf{0}$,
(iii) $E(\mathbf{X}_t \mathbf{Z}_t^\top) = \boldsymbol{\Sigma}_{23}$,	or (iii) _{α} $(\frac{1}{n} \mathbf{X}^\top \mathbf{Z}) \xrightarrow{\mathbb{P}} \boldsymbol{\Sigma}_{23} \neq \mathbf{0}$,
(iv) $E(\mathbf{Z}_t \mathbf{Z}_t^\top) = \boldsymbol{\Sigma}_{33}$,	or (iv) _{α} $(\frac{1}{n} \mathbf{Z}^\top \mathbf{Z}) \xrightarrow{\mathbb{P}} \boldsymbol{\Sigma}_{33} > \mathbf{0}$,
(v) $E(\mathbf{Z}_t y_t) = \boldsymbol{\sigma}_{31} \neq \mathbf{0}$,	or (v) _{α} $(\frac{1}{n} \mathbf{Z}^\top \mathbf{y}) \xrightarrow{\mathbb{P}} \boldsymbol{\sigma}_{31} \neq \mathbf{0}$.

The discussion in the paper advocates a number of actions that journal editors and referees can implement to improve the trustworthiness of published empirical evidence, including the following.

(a) Reject papers that make no effort to show – using effective M-S testing – that their invoked inductive premises $[M\theta(x)]$ are approximately valid for data x_0 .

(b) Reject papers with inference results based on a sample size n that is not large enough to allow effective testing of the adequacy of $M\theta(x)$; n is not large enough for reliable inference.

(c) Insist that authors show evidence that they probed adequately for any potential substantive misspecifications pertaining to their $M_\varphi(x)$, after they secured the adequacy of the underlying statistical model $M_\theta(x)$, including testing and confirming the validity of the overidentifying restrictions stemming from $G(\theta, \phi) = 0, \theta \in \Theta, \phi \in \Phi$.

(d) Demand from authors to ensure that their evidential interpretation of p-values

and accept/reject H_0 results is cogent in the sense that no unwarranted inferences are drawn by falling prey to the fallacies of acceptance and rejection; see Spanos (2018).

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6. Historical Introduction to the Political Economy of Price Indices by John Muellbauer*

Measuring the cost of living and the distributional impact of inflation was a major pre-occupation of mine in the 1970s. It resulted in a 1974 working paper, revised in 1976, and which, though never published, is of considerable historical significance. I therefore welcome the belated publication of a slightly shortened version of the paper in this *Cyprus Economic Policy Review*, dedicated to the memory of Panos Pashardes. In Fry and Pashardes (1985,1989), Panos examined the distributional impact of inflation in the UK and pioneered better approximations to the cost of living at the household level, building on a form of preferences for which my 1974 (rev. 1976) paper was the starting point. In my paper, published below, I began with the question: are we able to locate a position in the distribution of total household expenditure, where the weights in the consumer price index replicate the weights in the official index (which are constructed from aggregate expenditure on each item divided by total aggregate expenditure on all items)? Since, by Engel's Law, the budget share of food falls as total expenditure rises, this suggests that a first approximation would be to find that point in the distribution across households where the food-share is the same as in the official index. Since household size differs, this needs to be done for the distribution of 'equivalised' total household expenditure (i.e. scaled by factors based on household size and economies of scale). The paper provides some UK evidence for this approach (in Section 2) and finds that the food-share of the official index corresponds to a level of total household expenditure well *above* median levels, and even above mean levels. This suggests that the official index corresponds to the expenditure patterns of surprisingly affluent households.

The paper then asks (in Section 3): are there preferences for which the complete set of budget shares of some 'representative household' are equal to those in the official index? This turned out to be an interesting and creative question, as up to this point most economists would have argued that only in the case of linear and identically sloped Engel curves was there such a 'representative household'. This conventional wisdom turned out to be wrong. I named the new, more general class of preferences for which such a representative household exists: 'generalised linearity' (GL). I wrote up this finding in Muellbauer (1976). Under GL, the total expenditure level, x_0 , of the representative household, depends on the price vector and the distribution across households of x_h , where the subscript h refers to household h. There is a more restrictive form of preferences where x_0 does not depend on the price vector. These I named 'price independent GL', or PIGL. A special case in which all the budget shares are linear functions of $\log x_h$, I called PIGLOG. The case of PIGL and PIGLOG was described in Muellbauer (1975). The demand system most widely used in applied work the world over, the 'Almost Ideal Demand System' of Deaton and Muellbauer (1980), is a member of the PIGLOG preference class.

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The work described in Muellbauer (1975, 1976) inspired a whole new literature, further extending forms of Engel curves and of preferences with useful aggregation and other properties. Gorman (1981) introduced the notion of the rank of a system of Engel curves. Rank 1 corresponds to homothetic preferences where budget shares do not depend of the level of total expenditure. Rank 2 includes linear Engel curves and GL, the latter being the necessary and sufficient condition for the representative household concept discussed above. Engel curves of rank 3 further extend functional forms, and with useful aggregation properties, see Lewbel (1988, 1989 and especially 1991¹). The 'Quadratic Expenditure System' of Howe, Pollak and Wales (1979) is an example of such an extension of GL; while the Translog form of demands of Jorgenson, Lau and Stoker (1982) is an application within the GL class. In two papers in 1999 with Lyssiotou and Stengos, and his 1995 paper on equivalence scales, Panos himself did empirical work on systems with rank 3. Engel curves in the GL class and beyond have also had applications in measuring the distributional effects of inflation, for example in Fry and Pashardes (1989).

Another literature was also inspired by my 1974 paper. Prais (1959) had originally raised the question of 'whose cost of living' is represented by the aggregate index. He suggested an alternative to the conventional 'plutocratic' weighting of official price indices, in which effectively each household's index is weighted by the total expenditure share of that household. He defined a 'democratic' index as one in which each household's price index is equally weighted. In section 4 of my paper, I generalised Prais's concept to introduce the notion of a 'Social Price Index' or 'Social Cost of Living Index' (now also called 'Group Cost of Living Index'), where distributional weights, based on the distributional position of equivalised total household expenditure, are used to weight the budget shares of individual households. These distributional weights, as in the Bergson-Samuelson social welfare functions, embody the degree of equality preference (or inequality aversion). I focused on the case where the distributional weights depend on a power function of equivalised total expenditure, so that a single parameter governs the degree of equality preference. Then, given the PIGL class of preferences, I showed how the position of the representative level of total expenditure x_0 varies with two parameters, one governing the curvature of the Engel curves and the other the degree of equality preference. In section 5 of my paper, I examined the problem a government might face of minimising the Social Price Index subject to raising a given amount of revenue, and I suggested that a greater degree of equality preference would result in lower commodity tax rates on those commodities most heavily consumed by lower income households. Similar results can be obtained in an optimal commodity tax problem where a social welfare function is maximised subject to a resource constraint. I also pointed to the link between the Social Price Index and a social welfare function, defined on household expenditure and deflated by household-specific price indices.

The analysis in sections 4 and 5 of my paper inspired a significant literature on 'Social' or 'Group Cost of Living Indices', beginning with Pollak (1980, 1981), followed by Jorgenson and Slesnick (1983, 1990), Diewert (1983, 1984), and Slesnick (1998).

¹ Lewbel's empirical evidence, p.723, suggests "that for most households, demands are reasonably modeled as rank 2 in general and PIGLOG in particular", when households in the top and bottom 5% of the distribution of total expenditure are excluded.

In section 6 of my paper, I discussed issues raised by the fact that different households often pay different prices. The empirical examples discussed there are now quite dated and I have therefore made some cuts in the version printed below. However, one of the types of divergences mentioned, that between costs of housing paid by owner-occupiers and by tenants, and differences between tenants in the social housing and private sectors, has become an even more important policy issue. Otherwise, the paper published below, in honour of the late Panos Pashardes, is essentially the same as the 1976 revision of the original 1974 working paper.

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The Political Economy of Price Indices [±]

John Muellbauer

"Giving equal weight to all dollars of income is mathematically the simplest rule, and our data come that way in any event." A.C. Harberger

1. Introduction

It has been argued that western industrial societies reflect the outcome of an ongoing struggle between two opposing structures. The first is the private enterprise market economy in which power is distributed primarily according to power to buy and sell in the market place. The second, however, is the one-citizen-one vote democratic political structure. Over time, the operation of the latter is supposed to modify or deflect many of the social decisions that would otherwise be made through the first structure. In this view, a central role of government is to redress the balance towards those who are weak in the market structure. This role is emphasized as against the traditional roles economists assign to government such as macro-stabilization and the repair of market failures.

One of the most distinguished and influential expositions of this view is given in T. H. Marshall's essay "Citizenship and Social Class" [1963] which was presented in the Marshall Lectures, Cambridge, 1949. To quote (p. 87) "In the twentieth century, citizenship and the capitalist class system have been at war". To be fair, Marshall recognizes that the educational component of citizenship is an important element in the maintenance of class stratification. Otherwise, however, he takes an optimistic view of the role of the state and of the relative force of the right to vote (universal suffrage) in overcoming the capitalist class system.

This optimistic position has come under attack from several directions. In part the arguments have been theoretical – for example, those derived from Michels' [1911] 'Iron law of Oligarchy'. In part they have been empirical. Thus it is pointed out that income and wealth distributions before and after tax have been quite stable over time and that the egalitarian pull of the political system seems to be remarkably ineffective².

[±] I am indebted to Hugh Davies, Ben Fine, Carl Hamilton, Sue Himmelweit, Richard Portes, Martin Rudd, Stephen Shenfield and Sami Zubaida for valuable discussions and to Bernard Pearson, Peter Pierpoint and Earl Sweet for assistance with some of the computations. None of the above should be responsible for the views expressed.

² For the U.K., Stark (1972) found little change in the personal income distribution over the period 1954 to 1963. The first report of the Royal Commission on the distribution of income and wealth (1975) although careful to point to the difficulties of making these kinds of comparisons because of demographic and other changes also finds little change up to the early 1970's. If anything, the evidence seems to suggest a slight reduction in inequality at the top but an increase of inequality at the bottom, especially towards the end of the period. The only estimates corrected for demographic changes, those by Semple (1975), suggest widening inequality of original incomes but little change after taxes and benefits in cash and kind have been taken into account. The third report of the Royal Commission on the distribution of income and wealth (1976) has some evidence that in very recent years the earnings of professional and managerial employees have tended to increase more slowly than those of manual employees. However, comparisons of this kind are made difficult by the inadequate information available on various kinds of fringe benefits. The data on wealth distribution are even more difficult to evaluate. It seems to be true that the share of the top 1% has fallen but since it has been mostly absorbed in the top 5%, it can be explained by changes in tax laws and increased sophistication on the part of the rich; see Atkinson [1973(a)] and Lydall and Tipping [1961], and Gartrell [1974] and Horsman [1975] on avoiding estate duty.

For the U.S., income distribution data in Budd [1970] suggest that there has been little overall secular change in the post-war-period. However there is some evidence that while inequality became less near the top of the distribution, it increased near the bottom. As for the concentration of personal wealth, Smith and Franklin [1974] conclude that

I want to suggest that there is a connection between these observations and the role of economists and economics. Whether this connection involves direct causality or is merely a reflection of some more fundamental reasons, I shall not attempt to establish.

Instead, I shall examine one aspect of this connection. This is the extent to which government takes over the implicit power weighting of the market in its own decision making because of the way its economic policy instruments, objectives and information are coded. One aspect of this is the growth of cost benefit analysis whose main purpose is to simulate the market where the market does not operate. The quote at the head of this paper comes from a well-known article by Harberger [1971] one of whose central points is that distributional questions should be ignored in cost benefit analysis of proposed projects. Another aspect on which I want to focus here is the basing of policy on aggregate index numbers of prices and incomes which by their construction give one vote to every £ or \$ rather than to every citizen.

This problem is not only of some underlying importance but also very topical. Recently, the U.K. government, for a time, followed the example of a number of other governments in tying wage increases in the form of threshold agreements to an index of retail prices. This caused a shift in the role of the price index from being primarily part of the information flow to being an instrument of policy itself. The magnitude of the relative weights in this index are important for two reasons.

The first of these two reasons concerns the measurement of inflation when relative prices are changing and the nature of the redistribution which then occurs when different social groups are indexed to the same price index. Research by Brittain [1960], Piachaud [1974] and others including myself suggests that over the last 25 years in the U.K. there was a significant bias in inflation against the poor in 1951-56, 1956-61 and 1971-76³, a slight bias against the poor in 1961-66, and zero bias in 1971. For the U.S., according to Hollister and Palmer [1972], there was almost no differential effect of inflation over 1940-1967. In the 1970's however, evidence reported by Michael [1975] and the B.L.S. annual indices for pensioner couples and 4 person urban households at three reference income levels⁴, suggests a significant bias against the poor.⁵

Of course, it may be that in the long run the bias in inflation may reverse and then lower income households may be over-compensated for inflation. But even if we ignore Keynes's dictum about the long run or question the empirical likelihood of this eventuality, I do not regard the historical bias in inflation as the most important issue. The most important issue is the role of relative prices in the impact of governments on distribution. Government policy has a number of direct and indirect effects on relative prices. This is clear even without the recent example of Chile. Taxes and subsidies, pricing policy in state run sectors, international trade policy, price controls, policy on monopoly, and investment policy all have price repercussions. Given that keeping down inflation is such an important policy goal, it is

it "has remained essentially unchanged since 1945". On the role of the State, Okner and Pechman [1974] find that "the tax system is virtually proportional for the vast majority of families in the U.S.". The exceptions are the rich and the poor, who pay higher percentage rates. Sawers and Wachtel [1973] and many of the papers in Boulding and Pfaff [1972] indicate that in some major respects the role of the state in the American income distribution is regressive.

³ Some of the difficulties in this research are discussed in my 1974a paper.

⁴ See Monthly Labour Review, special articles usually in June to October issues.

⁵ However, these sorts of biases seem minor when compared with the Chilean experience under the Pinochet regime, documented, for example, in Chossudovsky [1974]. The redistribution through the price system brought about there overshadows even the distributional differences in price structures between countries with such different economic systems as the U.K. and Poland (see my 1974b paper for a U.K. - Poland comparison).

natural that governments should be very sensitive to the effects of policy changes on the official price index.

Official indices such as the U.K. Retail Price Index (RPI) or the U.S. Consumer Price Index (CPI) compare the cost of purchasing a basket of commodities at different prices. In some countries, e.g. the U.S., the same basket is used for a number of years. In the U.K. new weights are used in the RPI every 12 months and the year to year price changes are obtained by observing the aggregate purchases of the different goods for some sample of consumers. In the RPI the sample is that of the 'Index households', a subsample of around 87% of the annual sample of around 7000 households in the Family Expenditure Survey.⁶ The prices of some 350 commodities are taken as representative of the many more commodities actually consumed.

In addition to the monthly RPI, quarterly price indices excluding housing are also published for one and two pensioner households.

In the U.S. the CPI is currently based on the aggregated expenditure patterns of a 1960-61 sample of urban wage earner or clerical worker households⁷ corresponding to about 55% of the urban population. From April 1977 it will be replaced by two indices based on 1972-73 expenditure patterns. One index will be a CPI for urban Wage Earners and Clerical Workers and the other a CPI for All Urban Households.⁸ That practical men well recognize the political importance of the weights in the official index as well as the consequences of differential inflation is seen in the response which greeted the Bureau of Labour Statistics' April 1974 announcement that it intended to discontinue the former index. The President of the United Auto Workers argued: "In principle we are totally opposed to the abolition of a CPI geared to workers in favour of one geared to nobody ... there is a presumption that (the new index) would record lower rates of inflation than the current CPI, at least if prices continue to behave as they have done in the last decade. This is because items whose prices have generally been rising fastest are precisely those which figure most prominently in the budgets of lower income families."⁹

The BLS also publishes regional and city CPI's which are used in some labour contracts with escalator clauses. For several years it has also been publishing annual indices, usually about 10-12 months after the date of the prices to which they refer, which give an indication of price movements for three income brackets for four person urban households and pensioner households. These have not been used in escalator clauses.

In the U.S. 5.9 million workers are covered by major agreements (those covering at least 1000 workers) with cost of living escalator clauses mostly linked to the CPI. In addition, many Federal employees are given CPI linked salary increases. See Monthly Labour Review, January 1976, p. 42-48.

In the U.K. at the time of writing in 1976, income maintenance, unemployment and other benefits are linked to the Retail Price Index or to the index of average earnings whichever has the greater rise. Some financial assets, e.g. Post-Office Savings accounts, and many pension

⁶ Those not included are those pensioner households who obtain $\frac{3}{4}$ or more of their income from state pensions or supplementary allowances. This accounts for about 10%. The remaining 3-4% are households whose heads have high weekly incomes (£120 or more in 1975). The RPI is explained in non-technical terms in "The unstatistical reader's guide to the RPI", Department of Employment Gazette, October 1975.

⁷ Defined so that 50% or more of household income comes from wage and clerical occupations and where at least one member worked for a minimum of 37 weeks of the year.

⁸ See Shiskin [1974] for details.

⁹ Quoted in Shiskin [1974], p. 13.

schemes are indexed to the Retail Price Index. Apart from its formal role, the RPI is, of course, of major importance in wage negotiations throughout the economy. However formal indexation sharply increases the political importance of an official price index. In Brazil, for example, where formal indexation has been a central tool of economic policy, the official price index has played a major role, together with the repression of trade unions, in the changes in distribution which have taken place there since 1964.

The rest of this paper analyses the representativeness and the distributional implications of official price indices. Some empirical illustrations from the U.K. are provided. However, the analytical framework and the questions raised are just as relevant outside the U.K. Similar empirical investigations for other countries would be of considerable interest.

In Section 2 of the paper an attempt is made to find out whether the RPI is representative of households with low, intermediate or high levels of total expenditure. This is done by the rather empiricist procedure of fitting budget share equations for food for some of the main household types and from these equations deducing at what levels of total expenditure the shares of food are the same as in the RPI. The position of these levels in the distributions of total expenditure gives a rough idea of the representativeness of the RPI. In Section 3 this idea is made rigorous. The notion of the 'representative household' is defined precisely. It is used empirically to find at what point in the distribution of total expenditure corrected for household size for all households, a household would have the same budget shares as those used to construct the RPI. Section 4 considers alternative weighting schemes for price indices and relates these to distributional questions. Section 5 considers the tax incentives for governments stemming from the weights in the price index. The relationship with social welfare functions is discussed. Section 6 considers problems in the political economy of price indices stemming from the fact that in the real world consumers do not all face the same prices. Conclusions are in section 7. An Appendix proves a theorem used in Sections 3, 4 and 5.

Readers with limited patience for mathematics will, I hope, find that the main ideas will emerge from reading Sections 2, 6, and 7.

2. Whose RPI? The Budget Share of Food

A rough way of posing the question of what standard of living is represented in the RPI is as follows. Take the budget share for food used in constructing the RPI and find out for each of the main household types at what level of total expenditure the same budget share for food is reached. The reason for selecting food is that it has the biggest share of the main commodity groups and its budget share has the strongest and most systematic variation with total expenditure. The food shares used in the RPI were 25.1% in 1972, 24.8% in 1973, and 25.3% in 1974. From these figures one can deduce the food share of the Index Households. It is not the same as the RPI share because it is known that the survey understates purchases of beer, wines and spirits, cigarettes and tobacco. Correcting for this, the corresponding Family Expenditure Survey (FES) shares would have been approximately 26.2%, 25.8% and 26.4% respectively.

Now we ask: what total expenditure levels for each of the main household types would have been required at the prices of 1972, 1973 and 1974 respectively to give these food shares? The question could be answered by plotting on a graph the share of food against total expenditure for the survey data in those years. However, this suffers from the problem of sampling variation. I choose to use a slightly more sophisticated procedure which makes more systematic use of the published data by econometric estimation of food equations using all the published data for 1965 to 1973. These equations, take into account the effects of the prices

of the main commodity groups as well as of total expenditure.¹⁰ We can then examine the published total expenditure distributions for the years 1972-74 and find out at what percentiles in the distributions the above total expenditure levels come. The answers are given in Table 1.

It is clear that for each of the 5 household types¹¹ examined, the RPI food share corresponds to a total expenditure level in the top half of the distribution. Roughly speaking, the more children in the household, the higher up in the distribution for that household is the RPI food share appropriate. To get an overall picture, one needs to have some idea of the position in the overall distribution of each household type. In 1974 the average expenditure levels of households with children relative to the average expenditure level of 1 man and 1 woman households were 1.22, 1.29, 1.39, 1.39 for households with 1, 2, 3 and 4 children respectively.

TABLE 1

Percentiles in the distribution of total expenditure for 5 household types at which the predicted food share corresponds to the respective RPI shares

	1972	1973	1974	R ²
1 man and 1 woman	54%	55%	55%	.977
1 man, 1 woman and 1 child	60%	54%	54%	.861
1 man, 1 woman and 2 children	68%	71%	64%	.849
1 man, 1 woman and 3 children	78%	74%	73%	.888
2 adults and 4 children ¹	80%	73%	71%	.888

Notes: ¹ Same budget share equation used as for 1 m, 1, w and 3 children.

Distribution data from FES Annual Reports Table 49, 1972; Table 54, 1973; Table B, Appendix 7, 1974. Linear interpolation used to compute percentiles.

Most observers would argue that compensation by respectively 22%, 29%, 39% and 39% would not be adequate to cover the extra expenditures caused by the respective extra numbers of children. Certainly, the estimates by Mc Clements [1975] and those which will be used below of equivalence scales for children suggest this. In particular, households with 2, 3 and 4 children are on the average worse off than households without children or households with only 1 child.¹² This means that in an overall household size corrected distribution, the above percentiles for households would move up for 1 man and 1 woman households, probably also for 1 man, 1 woman and 1 child households and down for larger households.

¹⁰ The generic form of the equations is $w_i = A_i(p) \log y + B_i(p)$ where w_i is the share of good, y is total expenditure, p the price vector. In fact a system of such equations for 11 commodity groups was fitted by maximum likelihood methods.

¹¹ Unfortunately, I did not fit such equations for single person households.

¹² Single person households contain many poor pensioners and are also worse off on the average than 2 person households.

A number of objections could be raised against the results in Table 1. The expenditure distribution data includes the value of free and concessionary goods while the expenditure data on which the food shares are calculated does not. This causes some downward bias in the stated percentiles which is greater, the greater the value of these goods. Another possible objection is that before 1975, the RPI weights are based on the average expenditure pattern of Index Households over the last 3 available years (reweighted, to current year prices). This is done mainly because the current weights are not available at the time of construction of the RPI.¹³ In a sense, by calculating the current expenditure levels to which they correspond, I am doing slightly better. A further objection is that I used the published distribution data instead of that for the Index Households from which the RPI weights come. My answer to this is that the FES distribution is more representative of the actual distribution. It is arguably more relevant since most people would regard the RPI as holding for some kind of average household.

This discussion raises some issues discussed by Prais [1959], Marris [1958], Nicholson [1975, but written in 1958] and Gillingham [1974]. The basic point is that there are TWO kinds of weighting problems in an index such as the RPI: what should the commodity weights be and what weights should households be given in the construction of the commodity weights from FES data. The second kind of weights I shall call 'votes'. What is done effectively is to weight the budget shares of the Index Households by the total expenditure of each household in constructing the average budget share. This means that the richer the household, the bigger its 'vote' in the construction of the RPI weights. Prais [1959] suggested a Democratic index giving each household the same weight. Nicholson [1975] suggests an alternative: to construct a Democratic index by giving each household a 'vote' proportional to the number of 'equivalent adults'. These are not the only alternative 'voting' schemes. The issues involved will be systematically examined in the subsequent sections. One of them concerns also the question hinted above: under what circumstances is it possible to collapse the separate distributions of the total expenditure for the different household types into one household size corrected distribution and hence find one level of expenditure to which an official price index corresponds.

3. The Representative Household

The argument necessary to answer the question posed at the end of Section 2 is built up through a number of short steps. To make the logic clear, each step is assigned to a subsection. After discussing the price index, the representative level of total expenditure y_0 for one good and one household type is defined. By imposing several behavioural assumptions this notion is extended to different household types, then to all goods but one household type, then to y_0 being price independent for all goods and one household type and finally to y_0 being price independent for all goods and for different household types. After some economic interpretation and some qualitative discussion of y_0 empirical estimates are presented.

¹³ The food share tends to decrease as real income increases and increase as the relative price of food increases. For example, the fall in real income in 1975 implies that the 1975 RPI food weight is rather "too low". The sharp relative increase in food prices in 1973 meant that reweighting at January 1974 prices, the 1974 RPI food weight increased relative to the 1973 share. Since consumers would probably have engaged in some substitution, the 1974 RPI food weight is probably "too high".

1) The price index

For a single household, a Laspeyres price index compares current prices p with base period prices p^0 and is written

$$\frac{\sum_i p_i q_{ih}^0}{\sum_i p_i^0 q_{ih}^0} = \sum_i w_{ih}^0 \left(\frac{p_i}{p_i^0} \right) \quad (1)$$

where q_{ih}^0 is the amount of good i bought by household h at time 0, $w_{ih}^0 = \frac{p_i^0 q_{ih}^0}{y^0}$ is the budget share of good i and where $y^0 = \sum_i p_i^0 q_{ih}^0$ is total expenditure at time 0. Aggregating over a sample of N households facing the same prices, the aggregate version of (1) becomes

$$\frac{\sum_i p_i \bar{q}_i}{\sum_i p_i^0 \bar{q}_i^0} = \sum_i \bar{w}_i^0 \left(\frac{p_i}{p_i^0} \right) \quad (2)$$

where $\bar{q}_i^0 = \sum_h q_{ih}^0 / N$ and

$$\bar{w}_i^0 = \sum_h p_i q_{ih}^0 / \sum_h y_h^0 = \frac{\sum_h y_h^0 w_{ih}^0}{\sum_h y_h^0} \quad (3)$$

The CPI is constructed in just this way and so is the RPI except that it is chain linked annually.¹⁴ Notice that, as pointed out above, the 'vote' of household h in the construction of \bar{w}_i^0 is y_h^0 i.e. richer households have bigger votes.

2) y_o for good i and one household type

Suppose that households of each type have the same food budget share equation $w_{ih} = w_i(y_h, p)$. Then

$$w_i(y_o(y_1, y_2, \dots, y_H, p)) = \frac{\sum y_h w_i(y_h, p)}{\sum y_h} \quad (4)$$

implicitly defines the representative total expenditure level y_o , a function of the distribution vector for that household type, where there are H households of that type. y_o has the property that at that expenditure level, the food share $w_i(y_o, p)$ equals the aggregate food share \bar{w}_i for that household type. This, of course, is just what was being computed in Section 2 for each of the main household types. It is one thing to define y_o in this way for each household type, i.e. a homogeneous subgroup of households which can be assumed to have identical budget share equations. It is another to define a y_o which applies to the whole population.

3) y_o for good i and different household types

Under what circumstances can y_o be defined in terms of the household size corrected vector of the distribution of total expenditure so that all household types can be considered together? To correct total expenditure y_h for household size, y_h is replaced by y_h/k_h where k_h is a scalar which in principle could depend on y_h, p and which varies across household type, e.g., increases with the number and age of the dependents. k_h is often called the 'adult equivalent scale'. This household size correction is possible if and only if the food budget share equations have the form,

¹⁴ In fact, because the budget shares are not fully up to date, it compares prices p^2 with prices p^1 by taking $\sum(p_i^2/p_i^1)w_i^*$ where w_i^* are weights obtained by uprating the three-year moving average of the preceding year's average budget shares to the prices of year 1, scaling by the respective ratios of prices in year 1 to those of previous three years.

$$w_{ih} = w_i (y_h/k_h (y_h, p), p) \quad (5)$$

Then y_0 is defined by the modified version of (4),

$$w_i (y_0, p) = \frac{\sum y_h w_i (y_h/k_h (y_h, p), p)}{\sum y_h}$$

4) y_0 for all goods and one household type

So far, the notion of a representative level of total expenditure has been discussed only in the context of one commodity. It does not necessarily follow that if commodity j is selected that even for a given household type, (4) implicitly defines the same y_0 as does commodity i . In fact, Muellbauer (1975a) proves the following theorems.

Theorem 1: Suppose that a group of households with identical budget share equations faces the same prices and each household consumes more than two commodities. Then y_0 is the same for all commodities, if and only if each has budget share equations,

$$w_i (y_h, p) = v(y_h, p) A_i (p) + B_i(p) \quad \text{all } i \quad (6)$$

where $\sum A_i = 0, \sum B_i = 1$.

This condition has been termed 'generalized linearity'. Secondly,

5) y_0 price independent for all goods and one household type

Theorem 2: If and only if $v(y_h, p) = \frac{y_h^\varepsilon - 1}{\varepsilon}$ is y_0 dependent only on the distribution vector of total expenditure and independent of prices.

Notice that Theorem 2 implies $v(y_h, p) = \log y_h$ as $\varepsilon \rightarrow 0$.

6) y_0 price independent for all goods and different household types

Now we combine the two conditions: that one y_0 applies for all household types and all commodities. To aggregate across different household types, we make use of Theorem 2 and of equation (5). Then

$$w_i (y_h, p) = \frac{(y_h/k_h)^\varepsilon - 1}{\varepsilon} A_i (p) + B_i(p) \quad \text{all } i, \quad (7)$$

$$\text{If } \varepsilon \rightarrow 0, w_i (y_h, p) = \log(y_h/k_h) A_i (p) + B_i(p) \quad \text{all } i, \quad (8)$$

Aggregating (7) across all households gives

$$\bar{w}_i = \left(\frac{y_0^\varepsilon - 1}{\varepsilon} \right) A_i (p) + B_i(p) \quad \text{all } i, \quad (9)$$

$$\text{where } y_0^\varepsilon = \frac{\sum y_h (y_h/k_h)^\varepsilon}{\sum y_h} \quad (10)$$

which, when $\varepsilon \rightarrow 0$, becomes

$$\log y_0 = \frac{\sum y_h \log(y_h/k_h)}{\sum y_h} \quad (11)$$

It must be made explicit also that for y_0 to be price independent, each k_h must be price independent too. In principle k_h might depend upon total expenditure y_h but this lacks intuitive appeal when prices change.

In fact, Muellbauer (1976) shows the following:

Theorem 3: Suppose that households maximize utility¹⁵ but have, in general, different preferences. Then (7) or (8) with k_h constant is the only form of the individual budget share equations which satisfies the most general form of the 'representative consumer' condition in which y_0 is independent of p , i.e.

$$w_i(y_0(y_1, \dots, y_N), p) = \frac{\sum y_h w_{ih}(y_h, p)}{\sum y_h}, \quad \text{all } i. \quad (12)$$

7) Interpretation

These results are not difficult to interpret. For (4) to define the same representative level of total expenditure for aggregation across a given household type for every commodity, the way in which each budget share varies with income must be similar in some sense. Not surprisingly, the 'generalized linearity' of (6) defines this similarity. It will be noticed that (6) is a powerful generalization of the well-known linear form which permits aggregation:

$p_i q_{ih} = y_h \beta_i(p) + \alpha_i(p)$ which implies

$$w_{ih} = (1/y_h) \alpha_i(p) + \beta_i(p) \quad (13)$$

Extending this linear Engel curve to permit differences in needs across household types gives

$$w_{ih} = (y_h/k_h)^{-1} \alpha_i(p) + \beta_i(p) \quad (14)$$

Which is just the special case of (7) when $\varepsilon = -1$.

One implication of (7) is that, abstracting from corner solutions, given the budget shares w_{ih} of household h there exists some total expenditure level for any other household m , so that it has exactly the same budget shares.¹⁶ This implication is central to the analysis: it is what makes it possible to define the representative expenditure level y_0 . It follows from two kinds of restrictions: restrictions on the budget share equations of any given household type which make similar the shapes of the income responses for different commodities, and restrictions on differences in preferences across households. Finally, (7) incorporates a third kind of restriction which constrains the shapes of the income responses and which makes y_0 independent of prices. It is obvious that some restrictions of this type would be necessary to extend the analysis of Section 2. There we defined a different representative expenditure level for each household type and defined it through the budget share equation for one commodity, food. The only assumption made in Section 2 was that the households belonging to a given type have identical budget share equations for that commodity (food).

¹⁵ This is the only place in the paper where mention is made of maximizing behaviour. Theorem 3 indicates that (10) is in a precise sense the most general result obtainable. It is not necessary to establish the intuitive appeal of the results in this section, which while not contradicting maximizing behaviour, do not rest on it.

¹⁶ Then, of course $y_h/k_h = y_m/k_m$.

8) Characterization of y_o

A little more can be said about the characterization of the representative level of total expenditure. I now write this as $y_o(\varepsilon)$ to make it explicit that it depends on the shape of the Engel curves. In the linear Engel curve case (14) in which $\varepsilon = -1$,

$$y_o(-1) = \frac{\sum y_h}{\sum k_h} = \bar{y} \quad (15)$$

where \bar{y} is defined as the average household size corrected level of total expenditure. Distributions of total expenditure are in almost all countries skewed to the right. Then mean expenditure is above the median of the distribution, often somewhere between the 55th and 75th percentile. That for linear Engel curves the representative total expenditure level should be somewhere in the upper part of the distribution should, after the discussion in Section 2, come as no surprise. After all, the 'votes' of households in the construction of the weights in the official index are proportional to their purchasing power in the market. Hence better off households have bigger 'votes'.

The question now arises, if ε is different from -1 does this raise or lower $y_o(\varepsilon)$? A consequence of Theorem 4 below, which is proved in the Appendix, is the following:

Corollary 1: $y_o(\varepsilon)$ is increasing in ε .

From this follows that $y_o(-1) < y_o(0)$. Thus, in the log - case (11), i.e. $\varepsilon \rightarrow 0$, y_o is even higher in the distribution than when $\varepsilon = -1$. If $\varepsilon = 1$, i.e. when the budget share equations are quadratic in total expenditure, the position of y_o in the distribution is higher still. Thus it would be of considerable practical interest to know the order of magnitude of ε .

9) Empirical estimates of y_o

Some aggregate time series estimates of budget share equation done with Angus Deaton give a point estimate of ε close to 1. However, these are not necessarily the same as the cross-section shapes of the budget shares equations which are relevant to the problem of finding the representative expenditure level. Pooling published data from the 1971 Family Expenditure Survey for seven different household types, distinguishing ten commodity groups, and using values for k_h specified a priori¹⁷, it turned out that the likelihood peaked at around $\varepsilon = 0$, being fairly flat between $-0.2 < \varepsilon < 0.2$ and then dropping away fairly rapidly. As is usual in applied work, a number of empirical difficulties with such estimation can be pointed out. For example, it is well known that the FES suffers from systematic recording errors of drink and tobacco expenditures. Owner-occupiers' imputed rentals and council tenants' actual rents which are likely to vary differently with total expenditure are lumped into one category in the published data. Also, the data comes aggregated according to fairly wide income brackets and as is well known, with non-linear functions there is likely to be some aggregation bias.¹⁸ Finally, the hypothesis that ε is the same across household types could be accepted for 5 out of 7 household types. Thus, it is not clear that the underlying hypothesis that (7) holds for all 7 household types is empirically valid. On the other hand, $\varepsilon = -.66$ was the lowest point estimate which was discovered. This suggests that at least the robust conclusion can be drawn that the non-linearities of the budget shares equations are all such as to make y_o greater than \bar{y} . And this is a very important point. Not only do the higher

¹⁷ The values used were the same as used in my 1974b paper, which were the same as those used by Prest and Stark [1967]. These values do not vary with the expenditure level.

¹⁸ Unless y_o/\bar{y} is the same for each income bracket which could only be true for special kinds of distributions.

votes of the rich put y_o into the upper part of the distribution, but budget share equations have shapes which in practice raise t_y significantly above mean expenditure.

To get some idea of the effect, I have in Table 2 computed $y_o(\epsilon)$ for different values of ϵ using the 1970 FES distribution of total expenditure deflated by the equivalence scales used in estimating ϵ .

TABLE 2

Estimated positions of $y_o(\epsilon)$ in the 1970 expenditure distribution expressed in terms of adult equivalents

ϵ	-2	-1	-.33	0	.33	1	1.5	2.5
% from the bottom	56	61	65	71	73	78	81	88

This suggests that mean expenditure is about at the 61st percentile in the distribution while $y_o(0)$, i.e. the representative expenditure level based on the estimated value of ϵ , is about at the 71st percentile in the distribution. However, because the published distribution data which was used is semi-aggregated, it tends to understate inequality and hence understate the percentile both of $y_o(-1) = \bar{y}$ and of $y_o(0)$.

I also computed the position of \bar{y} and of $y_o(0)$ using some semi-aggregated data which the Department of Employment was kind enough to provide on the expenditure distribution for the 87% of the FES sample which makes up the 'Index Households' sample. The corresponding percentiles here were 60% and 70%. This is not surprising, since some of the inequality in the distribution is removed in narrowing the sample to the Index Households.

4. Social Price Indices

As we have seen, if different households face the same price vector, official price indices are the weighted average of the price indices of the individual households each weighted by y_h .¹⁹ Now consider a wider class of price indices which I shall call Homogeneous Social Price Indices.²⁰ If $P(y_h/k_h)$ is household h 's price index, the Social Price Index on a household basis is

$$P_\beta \text{ (household basis)} = \frac{\sum (y_h/k_h)^{1+\beta} P_h(y_h/k_h)}{\sum (y_h/k_h)^{1+\beta}} \quad (16)$$

Regarding y_h/k_h as the appropriate welfare indicator for household h , we are here using a more flexible weighting procedure to find the aggregate price index. Clearly, the lower, is β , the lower is the 'vote' given to households with high expenditure. Given the assumed form (7) for the budget share equations, the weighting procedure is equivalent to using the following definition of the 'socially representative' level of total expenditure:

$$y_{0,\beta}(\epsilon, \text{household basis}) = \left[\frac{\sum (y_h/k_h)^{1+\beta} (y_h/k_h)^\epsilon}{\sum (y_h/k_h)^{1+\beta}} \right]^{1/\epsilon} \quad (17)$$

¹⁹ This is equivalent to saying the aggregate budget shares are constructed that way.

²⁰ Homogeneous because the weighting functions $(y_h/k_h)^{1+\beta}$ are homogeneous.

In the special case $\beta = 0$ and $\varepsilon = -1$ (linear Engel curves),
where N is the number of households,

$$(18) \quad y_{0,0} (-1, \text{household basis}) = \left[\frac{\sum (y_h/k_h) (k_h/y_h)}{\sum (y_h/k_h)} \right]^{-1} \\ = \frac{1}{N} \sum (y_h/k_h)$$

When $\beta = -1$, each household is given the same weight and

$$P_{-1} (\text{household basis}) = \frac{1}{N} \sum P_h (y_h/k_h)$$

and
$$y_{0,-1} (\varepsilon, \text{household basis}) = \left[\frac{1}{N} \sum (y_h/k_h) \right]^{\frac{1}{\varepsilon}} \quad (19)$$

In a sense, this is 'Democratic' since each household is treated equally. However, if households vary in the number of persons, this procedure would be grossly unfair to larger households.

There seem to be three alternatives that have a special appeal:

$$P_\beta (\text{voter basis}) = \frac{\sum s_h (y_h/k_h)^{1+\beta} P_h (y_h/k_h)}{\sum s_h (y_h/k_h)^{1+\beta}} \quad (20)$$

where s_h is the number of voters in the h^{th} household.

$$P_\beta (\text{persons basis}) = \frac{\sum f_h (y_h/k_h)^{1+\beta} P_h (y_h/k_h)}{\sum f_h (y_h/k_h)^{1+\beta}} \quad (21)$$

where f_h is the number of persons in the h^{th} household.

$$P_\beta (\text{adult equivalents basis}) = \frac{\sum k_h (y_h/k_h)^{1+\beta} P_h (y_h/k_h)}{\sum k_h (y_h/k_h)^{1+\beta}} \quad (22)$$

where k_h is the number of adult equivalents in the h^{th} household.

The advantage of the voter basis is that it uses the principle which governs participation in elections also to govern 'voting' in the construction of the price index. However, it ignores children and immigrants whose interests are therefore under-represented.

These disadvantages are overcome in the persons basis. A child whether baby or teenager, has the same 'vote' in the construction of the index. One possible objection is that the needs of babies are less than those of teenagers which are less than those of adults. Since the index influences the way in which economic policy affecting households is made, there is a case for suggesting that the economic weights, i.e. economic needs measured in terms of adult equivalents, ought to be used to decide the 'votes' each household should have in the index. This is an argument for the adult equivalents basis. It also does not discriminate against immigrants.

On the adult equivalents basis,

$$y_{0,\beta} (\varepsilon, \text{adult equivalents basis}) = \left[\frac{\sum k_h (y_h/k_h)^{1+\beta+\varepsilon}}{\sum k_h (y_h/k_h)^{1+\beta}} \right]^{\frac{1}{\varepsilon}}$$

In the special case $\beta = 0, \varepsilon = -1$

$$y_{0,0} (-1, \text{adult equivalents basis}) = \left[\frac{\sum k_h}{\sum y_h} \right]^{-1} = \bar{y}$$

as defined above. It is easy to see that the adult equivalents basis alone gives, in the case $\beta = 0$, the same values for the representative level of total expenditure as the ones which actually

result using the 'market votes' aggregation procedure which underlies the construction of official price indices. Thus

$$P_0 \text{ (adult equivalents basis)} = \frac{\sum y_h P(y_h/k_h)}{\sum y_h} \quad (23)$$

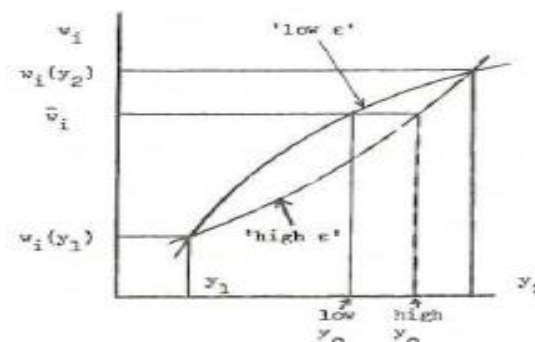
which defines an official index. Given that the proposed framework for examining social price indices is intuitively acceptable, this is another reason for the adoption of the adult equivalents basis.²¹

Aside from this appeal, the adult equivalents basis has a considerable analytical advantage: it makes it possible to carry out the analysis as if the population consisted of individual consumers (equivalent adults) with identical tastes and differing only in expenditure levels. In what follows I shall adopt this basis.

Now we can state a fundamental theorem which is proved in the Appendix. Part A shows that given ε , the higher is β , the higher is y_0 , and part B shows that the higher is ε , the higher is y_0 .

Theorem 4A: $\frac{\partial y_{0,\beta}(\varepsilon)}{\partial \beta} > 0$

Theorem 4B: $\frac{\partial y_{0,\beta}(\varepsilon)}{\partial \varepsilon} > 0$



Part A precisely captures the effect of giving better off households bigger 'votes'; part B, precisely captures the effect of changing the shape of the budget share equations. Part A is intuitively obvious. Part B can also be given an intuitive justification. Imagine that there are two consumers, identical but for their expenditure levels $y_1 < y_2$. In Fig. 1 the representative expenditure level y_0 is constructed corresponding to the aggregate budget share:

$$\bar{w}_i = \frac{y_1 w_i(y_1) + y_2 w_i(y_2)}{y_1 + y_2}$$

Notice that \bar{w}_i is closer to $w_i(y_2)$ than to $w_i(y_1)$.

The value of y_0 corresponding to the budget share curve with a low ε is low and that corresponding to a high ε is high. It is easily checked that the degree of concavity of the budget share curve increases as ε falls.

The Democratic Price Index on an adult equivalent basis is

$$P_{-1} = \frac{\sum k_h P(y_h/k_h)}{\sum k_h} \quad (24)$$

and $y_{0,-1}(\varepsilon) = \left[\frac{\sum k_h (y_h/k_h)^\varepsilon}{\sum k_h} \right]^{\frac{1}{\varepsilon}} \quad (25)$

We have already seen one corollary of Theorem 4, see corollary 1 above. From (23) and Theorem 4, other corollaries follow.

²¹ The adult equivalents basis was used in Section 3's empirical application to U.K. data.

Corollary 2: $y_{0,-1}(\varepsilon) < y_o(\varepsilon)$ i.e. the 'Democratically representative' expenditure level $y_{0,-1}$ is less than the 'officially representative' expenditure level y_o .

Corollary 3: $y_{0,-1}(-1)$ is the harmonic mean. This arises when Engel curves are linear.

Corollary 4: $y_{0,-1}(0)$ is the geometric mean. This arises when budget share curves are semi-log as in (8).

Corollary 5: $y_{0,-1}(1)$ is mean expenditure \bar{y} . This arises when budget share curves are linear, i.e. Engel curves are quadratic.

One consequence of Theorem 4 is that $y_{0,-1}(1) > y_{0,-1}(0) > y_{0,-1}(-1)$ which is a well-known inequality. One interesting aspect of these corollaries is that the concavity of the budget share curves might be such as to dominate the egalitarian tendencies built in by using a Democratic voting procedure. In other words, even with a Democratic voting procedure the representative expenditure level might well be in the upper half of the distribution.

Now we consider some aspects of the measurement of inflation which follow from (7) and (9). Given ε

$$P(y_h/k_h) = \left[\frac{(y_h/k_h)^\varepsilon - 1}{\varepsilon} \right] \sum A_i(p^0) \left(\frac{p_i^1}{p_i^0} \right) + \sum B_i(p^0) \left(\frac{p_i^1}{p_i^0} \right)$$

Where $\sum A_i(p^0) = 0$ and $\sum B_i(p^0) = 1$. The sign of A_i defines whether good i is a luxury or a necessity, i.e. has an expenditure elasticity above or below unity. This means that the term

$P_A = \sum A_i(p^0) \left(\frac{p_i}{p_i^0} \right)$ immediately reveals that inflation has a bias in favour of the rich if it is negative and in favour of the poor if it is positive. Since the official price index is

$$P_o = \left[\frac{y_{0,0}^\varepsilon - 1}{\varepsilon} \right] P_A + P_B \quad \text{where } P_B = \sum B_i(p^0) \left(\frac{p_i^1}{p_i^0} \right)$$

it is obvious what the distributional effects of proportional index-linking of total expenditure to the index P_o would be. If $P_A < 0$, everyone with (y_h/k_h) greater than y_o becomes better off and everyone below y_o becomes worse off. The effects are reversed if $P_A > 0$. Also, the further from y_o is (y_h/k_h) the bigger is the difference between the individual and the official price index. The bias in inflation is therefore monotonic in (y_h/k_h) .

It is easy to see what the effects would be of using a Social Price Index, e.g. the Democratic Index. It is clear that if everyone is linked to the same index, the lower is β , the lower is the point in the distribution at which households become worse off when the bias is against the poor. P_A is a simple and convenient statistical indicator of the bias in inflation. It is related to Afriat's [1974, 1975] marginal price index which however, takes a unique value only when Engel curves are linear.

5. Taxation and Distributional Weights

It is not difficult to see what the implications are for commodity taxation if the government minimizes the official price index subject to the constraint of raising a given revenue. Let T , the tax objective, be $\sum (p_i - r_i) Q_i = T$ Where r_i is the fixed producer price of good i so that $p_i - r_i = t_i$ is the tax rate and Q_i is the aggregate amount sold of good i . The problem is

$$\text{Min } P = \sum \bar{w}_i^0 (p_i/p_i^0) \text{ subject to } \sum t_i Q_i = T$$

The marginal conditions can be expressed in the form

$$-\frac{1}{\gamma} = \frac{Q_i + \sum t_j \frac{\partial Q_j}{\partial p_i}}{\bar{w}_i^0 / p_i^0}$$

where γ is the Lagrangian multiplier in the minimization problem.

This results in a tendency towards lower rates of tax on goods with larger negative $\partial Q_j / \partial p_i$ terms and higher rates of tax on goods with higher Q_i / \bar{w}_i^0 ratios. To the extent that income inelastic goods tend to be price inelastic, the former tendency is regressive. One would expect the $\frac{Q_i}{\bar{w}_i^0 / p_i^0}$ ratios to be fairly constant over i if the tax changes are small and if the sample on which the official price index weights are based is representative of the population. The effect of a Democratic Price Index or some other Social Price Index with $\beta < 0$ is easy to see. Then $\frac{Q_i}{w_{i\beta} / p_i^0}$ would be lower for necessities, where $w_{i\beta}$ is constructed using the same weights as in (22) (or see (27) below). This tends to push the pattern of commodity taxation in a progressive direction.

Conceptually this analysis is very similar to the distributional aspects of taxation and pricing considered, for example, by Feldstein [1972] and Diamond and Mirrlees [1971]. There the objective function is a Bergson-Samuelson welfare function.

Now I shall relate the weighting scheme used in the construction of Social Price Indices to the notion of distributional weights which Little and Mirrlees [1974] and the UNIDO Guidelines [1972] recommend be used in project evaluation. Suppose that at given prices, a planner's Bergson-Samuelson welfare function is specified in terms of the consumption levels y_h / k_h and is additive and homogeneous:

$$W = \left(\sum k_h \left(\frac{y_h}{k_h} \right)^{1+\beta} \right)^{1/1+\beta}$$

Deflating money consumption expenditure y_h / k_h by the price index $P(y_h / k_h)$ gives W in real terms:

$$W = \left(\sum k_h \left(\frac{y_h}{k_h} / P \left(\frac{y_h}{k_h} \right) \right)^{1+\beta} \right)^{1/1+\beta} \quad (26)$$

It turns out that working in derivatives makes the connection between the Social Price Index and the social welfare function a little clearer. So define

$d \log P(y_h / k_h) = \sum_i w_i (y_h / k_h) d \log p_i$. Then the Social Price Change Index is

$$d \log P_\beta = \sum_i w_{i\beta} d \log p_i$$

where
$$w_{i\beta} = \frac{\sum_h k_h (y_h / k_h)^{1+\beta} w_i (y_h / k_h)}{\sum_h k_h (y_h / k_h)^{1+\beta}} \quad (27)$$

is the 'social budget share' of good i .

Differentiating (26) and normalizing $P(y_h / k_h) = 1$,

$$d \log W = \frac{\sum k_h \left(\frac{y_h}{k_h}\right)^{1+\beta} d \log y_h}{\sum k_h \left(\frac{y_h}{k_h}\right)^{1+\beta}} - \frac{\sum k_h \left(\frac{y_h}{k_h}\right)^{1+\beta} d \log P(y_h/k_h)}{\sum k_h \left(\frac{y_h}{k_h}\right)^{1+\beta}} \quad (28)$$

Hence $d \log W$ breaks into its rate of change in money terms minus the Social Price Change Index. Given (7), the latter corresponds to the socially representative expenditure level $y_{0,\beta}(\epsilon)$. The weights

$$\frac{k_h (y_h / k_h)^{1+\beta}}{\sum k_h (y_h / k_h)^{1+\beta}}$$

can be interpreted as distributional weights in the proportional rate of change formulation of the welfare measure. When $\beta = 1$, $W = \sum k_h \log (y_h / k_h)$. Then each adult equivalent's proportionate change in total expenditure is given equal weight. This corresponds also to the Democratic Price Change Index. In Atkinson's [1970] terminology, β is the degree of inequality aversion of the welfare function. Suppose $\beta = -1$. Then the percentage increase in W from a £10 increase for someone with £2000 is twice as great as a £10 increase for someone with £4000. However, I doubt whether most people would regard that as wildly egalitarian.

6. Price Differences

Not only do different households vary in the proportions of expenditure of different goods, but in practice not all face the same prices for all goods. Among reasons for such price differences are information asymmetries for buyers and sellers which, as Spence [1974] and Stiglitz [1975] have argued, can lead to situations where different people pay different prices and yet there may be no mechanisms causing this situation to change. Other reasons include monopoly elements, quantity allocation mechanisms and transactions costs for durable goods whose "service prices" in principle ought to be the relevant price measures.

In the construction of a single aggregate price index there is therefore also the question of which prices to use and what weights or 'votes' to give the prices paid by different households. In the U.K. in recent years the means tested components in State income maintenance policies have increased. For example, medical prescription charges, school meals, rates and rents are all subject to means tested rebates. Instead of treating these rebates as income, they are included in the RPI. For example, for school meals "the price used is found in effect by taking the total amount of money paid in cash by children and parents for school meals and dividing this by the number of meals consumed, including free meals".²²

A good which is heavily subsidized has for that very reason a low weight in the RPI. A given total subsidy of £ x millions therefore has the same effect on the RPI whether it goes to rich or to poor households.

Housing services is probably the good for which price differences are most important. For this reason it is worth looking at the issues involved in the recent change in the treatment of housing in the RPI. In the U.K., there are four major tenure types each facing substantially different prices and price changes. In its February 1975 report, the RPI Advisory Committee recommended that the old procedure of imputing rents to owner occupiers be replaced by a new one in which mortgage interest costs (but not capital repayment) net of income tax relief

²² From R.P.I. Advisory Committee (1975), p. 10.

of those in the process of purchase be included. The Trades Union Congress (T.U.C) was also in favour of this and the change was made from the beginning of 1975.

Among the consequences are a reduction in the weight on rents, which means that the interests of tenants are now less well represented - though arguably over-represented previously. Secondly, the new procedure seems to be in breach of the old convention that income and prices be measured separately: a change in the income tax provisions for mortgage interest tax relief would have a direct and significant effect on the RPI. These two factors together make it politically even more difficult to reduce the tax advantages of owner-occupiers but ease somewhat the difficulty of raising council rents.

Short of producing separate indices for those who rent, those who are paying off a mortgage and those who own outright, there does not seem to be a satisfactory way of treating housing. Any one index must involve some political judgements.

7. Conclusions

In the introduction I argued that aggregate index numbers are politically important. One aspect of the importance of official price indices such as the CPI and RPI, the UK's Retail Price Index, is that when relative prices change, a single measure of inflation becomes inappropriate. This is one important reason for being interested in whom such an index represents. The other, even more significant aspect, is the role of the weights as forces which push government policy affecting relative prices into particular directions. Aggregate index numbers are NOT neutral statistical indicators.

In Section 2 some empirical evidence is presented which suggests that the food weights in the RPI corresponds to total expenditure levels for the main household types which are in the upper half of the distributions and especially high for households with two or more children. In part, this is due to the fact that the budget shares used to weight the price relatives in an official price index are constructed by weighting the individual budget shares of the sample which is used by the total expenditure levels. Thus better off households have bigger 'votes'. However, the shapes of the budget share equation are important also.

Section 2's set of crude indicators of the representativeness of the RPI is specialized in Section 3. The aim is to find a single indicator which is relevant not only for the food weight but all the other commodity weights in the RPI and which makes it possible to pin-point one level in the household size corrected distribution of total expenditure as being the one to which the RPI corresponds. To reach this aim, some assumptions are necessary which restrict the nature of differences in budget share functions across households and the nature of the differences in income responses between different goods for a given household. Then it turns out, see equation (10), that the representative expenditure level is

$$y_0 = \left[\frac{\sum y_h (y_h / k_h)^\varepsilon}{\sum y_h} \right]^{1/\varepsilon}$$

where k_h is the number of adult equivalents in household h and ε is a parameter which defines the degree of concavity or convexity of the budget share equations. y_0 is increasing in ε , and y_0 when Engel curves are linear (i.e., $\varepsilon = -1$) is the mean level $\sum y_h / \sum y_k = \bar{y}$.

Some estimates for the U.K. suggest $\varepsilon = 0$ which implies that while the mean is around the 61st percentile, y_0 is around the 71st percentile. This means that the 'voting' procedure and shapes of the budget share equations are systematically such as to push y_0 high in the distribution. I am confident that most people who are aware of the RPI would be surprised at the suggestion that it is representative of such a high position in the distribution.

Section 4 introduces Social Price Indices which allow alternative 'voting' schemes in the aggregation of individual household's budget shares to construct the weight in the overall price index. The parameter β captures the way the 'votes' vary with the household's level of total expenditure. The lower is β , the bigger the relative 'vote' of poorer households. Among alternatives to 'votes' proportional to total expenditure are 'votes' according to the number of registered voters per household, according to the number of persons per household, one 'vote' per household or 'votes' according to the number of adult equivalents. These alternatives might all be called 'Democratic' in the some sense. Some reasons for preferring the last alternative are mentioned. It is shown that the socially representative level of total expenditure $y_{0,\beta}(\varepsilon)$ increases with ε and with β , i.e. is higher, the bigger the relative 'votes' of richer households. Finally, the measurement of inflation and some implications of indexation are discussed. Given the behavioural assumptions made so that the representative household is defined, the bias in inflation is monotonic in (y_h/k_h) . If the bias favours the rich, everyone with $y_h/k_h > y_o$ faces a lower inflation rate than that in the official price index and everyone with $y_h/k_h < y_o$ a higher rate than that in the official price index. The converse holds if the bias favours the poor.

Section 5 briefly examines the incentives for governments who want to raise a given amount of tax revenue with the minimum increase in the price index. It is suggested that a more egalitarian voting scheme in the construction of the RIP would make commodity taxes less regressive. Formally the problem is very close to the theoretical discussion in the literature on optimal commodity taxation where the objective is a Bergson-Samuelson welfare function. Indeed, some connections between social welfare functions and Social Price Indices are sketched in the remainder of Section 5. In rate of change form, the Democratic Price Index corresponds to social welfare defined as the product or geometric mean of individual consumptions.

Section 6 raises an important issue of realism which has been left aside so far. In reality, not everyone faces the same price vector. The reasons for this are numerous. They include rationing elements in the allocation of some goods, indivisibilities and the durability of some goods, together with imperfect competition. No good illustrates this better than housing. There are four main types of tenure in the U.K. with relatively limited opportunities for mobility between them. These are council housing, the private rented sector, owner-occupiers with mortgages and who own outright. Recently, in part because of a T.U.C. initiative, the treatment of housing in the RPI was changed to include mortgage interest payments. One consequence was to reduce the weight of council rents in the RPI. No doubt, this makes it politically easier to raise council rents. In some ways, the existence of market segregation, makes the 'voting' issue in the construction of the weights in the RPI even more important than it would be if there were merely total expenditure related differences in the budget shares. How big should the 'votes' be of those who own outright relative to council tenants?

Let us conclude then with a brief discussion of the 'voting' issue. In principle, there is no reason why the existing distribution of 'votes' in accordance with purchasing power is either necessary or desirable. There is no a priori reason why households could not be treated 'democratically' or indeed why households, with a lower standard of living should not be given relatively bigger 'votes'. This would introduce an egalitarian tendency which is similar to choosing budget shares which correspond to a lower level of total expenditure. However, in order to reduce sampling variability it is better to use the budget shares from the whole sample weighting by the voting scheme which has been selected rather than the budget shares corresponding to the few households which correspond to a particular total expenditure level. Finally, I must emphasize that this proposal is quite practical, does not require the estimation

of budget share equations and, other than through the notion of adult equivalent scales, implies no restrictions on the forms of household preferences. Though the theoretical framework of the representative household adds force and empirical evidence to the argument, it is not necessary to understand the most elementary and basic point: in the construction of indices such as the RPI and the CPI, households have votes which are proportional to their total expenditure. There are no technical reasons why indices have to be constructed in this way.

Appendix

We prove Theorem 4 which states

$$(A) \quad \frac{\partial y_{0,\beta}(\varepsilon)}{\partial \beta} > 0$$

$$(B) \quad \frac{\partial y_{0,\beta}(\varepsilon)}{\partial \varepsilon} > 0.$$

Proof:

$$(A) \quad [y_{0,\beta}(\varepsilon)]^\varepsilon = \frac{\sum k_h x_h^{1+\beta+\varepsilon}}{\sum k_h x_h^{1+\beta}} \quad \text{where } x_h = (y_h / k_h).$$

Take logs and differentiate:

$$\frac{\partial}{\partial \beta} [\varepsilon \log y_{0,\beta}(\varepsilon)] = \frac{\sum k_h x_h^{1+\beta+\varepsilon} \log x_h}{\sum k_h x_h^{1+\beta+\varepsilon}} - \frac{\sum k_h x_h^{1+\beta} \log x_h}{\sum k_h x_h^{1+\beta}} \quad (1)$$

We can prove our result using an inequality which follows from the properties of concave and convex functions (see Hardy, Littlewood and Polya [1952]: if $g(a)$ is strictly concave, then

$$\frac{\sum \lambda_h g(a_h)}{\sum \lambda_h} < g\left(\frac{\sum \lambda_h a_h}{\sum \lambda_h}\right) \quad \text{where } \lambda_h \geq 0, \text{ all } h$$

and some $\lambda_h > 0$.

The reverse inequality holds if $g(a)$ is strictly convex. Since $\log a$ is strictly concave and $(a \log a)$ is strictly convex,

$$\frac{\sum \lambda_h \log a_h}{\sum \lambda_h} < \log\left(\frac{\sum \lambda_h a_h}{\sum \lambda_h}\right) < \frac{\sum \lambda_h a_h \log a_h}{\sum \lambda_h a_h}. \quad (2)$$

Put $\lambda_h = k_h x_h^{1+\beta}$, $a_h = x_h^\varepsilon$ in the extreme inequality in (2).

$$\frac{\sum k_h x_h^{1+\beta} \log x_h^\varepsilon}{\sum k_h x_h^{1+\beta}} < \frac{\sum k_h x_h^{1+\beta+\varepsilon} \log x_h^\varepsilon}{\sum k_h x_h^{1+\beta+\varepsilon}}. \quad (3)$$

Hence $\frac{\sum k_h x_h^{1+\beta} \log x_h}{\sum k_h x_h^{1+\beta}} < \frac{\sum k_h x_h^{1+\beta+\varepsilon} \log x_h}{\sum k_h x_h^{1+\beta+\varepsilon}}$

Hence, the right hand side of (1) is positive. Hence $\frac{\partial y_{0,\beta}(\varepsilon)}{\partial \beta} > 0$.

$$(B) \quad \frac{\partial \log y_{0,\beta}(\varepsilon)}{\partial \varepsilon} = \frac{\partial}{\partial \varepsilon} \left(\frac{1}{\varepsilon} \log \sum k_h x_h^{1+\beta+\varepsilon} - \frac{1}{\varepsilon} \log \sum k_h x_h^{1+\beta} \right) \quad (4)$$

$$= \frac{1}{\varepsilon} \frac{\sum k_h x_h^{1+\beta+\varepsilon} \log x_h}{\sum k_h x_h^{1+\beta+\varepsilon}} - \frac{1}{\varepsilon^2} \left(\log \sum k_h x_h^{1+\beta+\varepsilon} - \log \sum k_h x_h^{1+\beta} \right) \quad (5)$$

$$= \frac{1}{\varepsilon^2} \left[\frac{\sum k_h x_h^{1+\beta+\varepsilon} \log x_h^\varepsilon}{\sum k_h x_h^{1+\beta+\varepsilon}} \right] - \log \left(\frac{\sum k_h x_h^{1+\beta+\varepsilon}}{\sum k_h x_h^{1+\beta}} \right). \quad (6)$$

But let $\lambda_h = k_h x_h^{1+\beta}$, $a_h = x_h^\varepsilon$ in (2). Then it follows from the RHS inequality in (2) that (6) is positive. Hence $\frac{\partial y_{0,\beta}(\varepsilon)}{\partial \varepsilon} > 0$.

Q.E.D.

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