The Centre for Microdata Methods and Practice Phase II
The Case for Support

Executive Summary

This document is the Case for Support of the ESRC Centre for Microdata Methods and Practice (CeMMAP) for second phase funding.

Following this summary there is: the **Director's Introduction**, **Section A**, a Mid Term Review submission focussing on the Centre's achievements during its three years as an ESRC Research Centre, July 1st 2007 – June 30th 2010, and, **Section B** setting out the Centre's plans for the period up to June 30th 2017, explaining the output the Centre will produce and why it is important to support this work.

The mission of the Centre for Microdata Methods and Practice is to advance knowledge in economic and social science. It does this by developing and applying tools to extract information about human behaviour from observational data recording the environment, circumstances, actions and experiences of people, households, enterprises, and other decision making entities.

A major benefit of this work will be improved understanding of individual responses to changes in the socioeconomic environment and government policy. This improved understanding will lead to higher quality policy formulation and decision making and more effective policy evaluation with consequent benefits to society as a whole.

New and improved microdata methods bring no benefit unless they move into user practice. At the same time, practical issues facing users, spark ideas for research. For these reasons, CeMMAP sets great store by its programme of user engagement and knowledge transfer. Accordingly it offers a comprehensive programme of training at basic and advanced levels and a programme of workshops and conferences that stimulate research and inform users.

The remainder of this summary highlights the achievements of the Centre and sets out its ambitions for the future.

Achievements

The Centre for Microdata Methods and Practice started in 2000 with seed corn funding from the Leverhulme Trust. Since July 1st 2007 it has been an ESRC Research Centre.

The Centre has grown in strength through this period to its current position as an international hub for a network of researchers making major contributions to the development of microdata methods and practice.

The Centre is internationally renowned for the quality of its research. During the three year review period, Centre staff published 38 journal articles including 6 in *Econometrica*, 5 in the *Review of Economic Studies,* 3 in the *American Economic Review* and 10 in the *Journal of Econometrics*. Much of the research produced during the period of ESRC funding appears in the 28 CeMMAP working papers published by Centre staff since July 2007.

The Centre ran 29 training courses attended by over 500 participants including over 70 from the public sector, nearly 40 from the private sector and 145 from overseas. The courses were fully subscribed and favourably evaluated. 98% of completed course evaluations reported that the course quality was good or excellent. Some of the future courses already have waiting lists.

The Centre staged 9 masterclasses in which world-leading contributors to microdata theory and methods research delivered comprehensive surveys of active research fields. There were over 700 participants including over 100 from overseas.

The Centre organized over 30 conferences attended by over 2,000 participants. A very wide variety of topics was covered. Some of the meetings, for example, one on 'The Use of

Biomarkers in Social Science Research,' attracted considerable interest from researchers working outside social science.

Six of the Centre's conferences were co-organized with research centres based outside the UK and the Centre continues to build new international collaborations. There is great international interest in the work of the Centre which received over 120 visitors from abroad (not counting delegates at conferences).

Centre International Fellows made over 40 visits to CeMMAP, delivering masterclasses and seminars, organizing conferences and engaging in research collaborations. They published their research in the Centre's Working Paper series which issued over 100 titles during the three-year review period. Nearly 30 have already appeared in international journals and 15 were collaborations between International Fellows and CeMMAP staff.

The Centre's website carries information about its many events, advance notice of visitors, its Working Paper series and resources associated with past conferences and masterclasses. In the past year, the site has averaged over 15,000 visitors per month from over 100 countries. In this period, downloads of Working Papers exceeded 50,000.

Centre staff advised a variety of national and international organisations and their work contributed to the highly regarded and widely reported policy analyses carried out by the Institute for Fiscal Studies.

All these activities are described in more detail in Section A.

Ambitions

With two years of first phase funding to run, work from the original research proposal remains to be done, for example in the analysis of feedback effects in systems. The Centre will continue work on many of the research projects listed in Annex 1 and plans a range of new breakthroughs and publications in the remaining two years of Phase I. The programme of courses, masterclasses and conferences is in place for 2010/11 and in the advanced planning stage for the final year of Phase I of the Centre's ESRC funding. Plans are in place to complete the Centre's programme of activity in the next two years and lay the groundwork for Phase II.

In the research agenda for Phase II, we plan to build on the success of Phase I and make further research advances. We will use the skills of the Centre to exploit and enhance ESRC's investment in data resources with a programme of research in longitudinal data methods. Research on computational social science will bring new methods into the reach of practitioners. Research on measurement will connect our work with the work of key data collectors. Research on dynamics and complexity will endeavour to produce and implement realistic behavioural models capturing the decision process of less than perfectly rational agents. Research on networks will lead to improved understanding of processes of interactions amongst groups of agents.

In Phase II, the Centre will maintain its popular programme of training courses looking to refresh its menu of offerings as new topics become popular. The Centre will continue its masterclass and conference programme mounting an exciting programme of new events with new co-funders and co-organisers. A new venture will be a biennial PhD Scholar's conference showcasing the best student talent from around the UK and the world.

International collaborations will continue with research centres in Europe and the US and will be expanded to include research centres in Asia and Australia. The Fellowship will be replenished to maintain its geographical coverage and to bring new talents and skills on board. We will expand the Centre's Working Paper series so that it becomes the medium of choice for first publication of all major new results in microdata methods and practice.

CeMMAP will be a world centre for development of microdata methods and their application in practice, the hub of an international research network and the leading source of training and instruction in microdata methods and practice.

Director's Introduction

The Centre for Microdata Methods and Practice has made excellent progress with its research agenda during the first three years of Phase I ESRC funding. It has secured a position as an internationally recognized and respected centre for the production of top-quality research and training. The evidence to support that is there to be seen in its publication record, in its Working Papers and in the international interest in its research and events. Section A sets out this record.

The Centre has placed great emphasis on its programme of training and advanced instruction. There are waiting lists for its training courses. Its masterclasses are ever popular and well attended. The Centre is set to carry this capacity building and knowledge transfer programme forward in Phase II with a refreshed programme of training courses continuing to spread best practice through UK social science and new masterclasses bringing leading international researchers to share new research frontiers with UK social scientists.

Building on its research success over the review period, the Centre's Phase II research agenda will focus on issues that are on the one hand important and on the other likely to lead to useful advances given the state of knowledge as it will be in 2012-17. The Centre will sponsor conferences, workshops and visitors to spark new research ideas, to disseminate research results and to further develop collaboration between UK and international social science researchers. These activities will make the Centre an international hub not only of research activity but also of innovation in microdata methods and practice with consequent benefits for all users and beneficiaries of social science research.

With little doubt the major challenge facing UK society over the next seven years, will be the consequences of the financial crisis. The crisis, which was on the horizon as we embarked on Phase I, has started to impact severely on UK households. It looks set to bring dramatic changes to the landscape in which people make decisions and live their lives. We are seeing a substantial rise in uncertainty about the course of the economy and the impact of that uncertainty on peoples' lives.

The rate of VAT dipped to 15% in late 2008 and will rise to 20% at the beginning of 2011. The unemployment rate reached 7.8% in July 2010. The Bank of England has dropped the Bank Rate to 0.5% enabling many to continue to pay their mortgages but causing others to see their savings income dry up. The Bank has injected £200 billion into the economy in a programme of quantitative easing and there are now some widely expressed fears of a major jump in inflation. The government talks of slashing housing and other benefits, abolishing mandatory retirement ages, and of pushing back the age at which state pensions can be obtained. At the same time, many final salary pension schemes have been abandoned.

What will be the reactions of people, households and firms to these unprecedented changes? How can the government tell which of these policies are effective and fair? Whose lives will be enriched and whose damaged by government's actions? The answer can only be found by carefully studying the microdata record of people's decisions and experiences thereby bringing high-quality economic and social science on board to deliver robust interpretations of the record.

The research of the Centre for Microdata Methods and Practice will produce and refine the tools to do this job. CeMMAP is one of the leading international centres focused on developing and applying tools for microdata research. Its publications, conferences and training programme will spread knowledge of, and the use of, those tools. Its capacity building programme will create the skills required to use those tools effectively. The Centre is

a joint venture by the Institute for Fiscal Studies and University College London. So, it will maximise the impact of these activities by exploiting the academic excellence of UCL and the top-quality policy analysis, engagement and external relations of IFS. The Centre's Phase II agenda of research, training and related activities is set out in Section B.

The Centre will study: the analysis of government policies under robust assumptions, measurement issues that arise when trying to understand peoples' expectations and reactions to uncertainty, the imperfections that arise in peoples' calculations in complex dynamic environments, the uses of new sorts of data in understanding reactions to sudden changes, the modelling and inferential issues that arise when one employs plausible models of behaviour in dynamic contexts, properly allowing for non-linearities and multiple sources of variation. The Centre will exploit the UK's rapidly expanding longitudinal data resources which record peoples' lives and add value to those resources by developing new longitudinal data methods.

In preparing the Centre's research proposal we polled the Centre's distinguished International Fellows for opinions on the likely major foci of international research efforts over the Centre's Phase II funding period. Many of their suggestions appear in our proposal, for example: attention to bounded rationality in complex decision environments, implementation of modern Bayesian methods in social science with reduced reliance on implausible parametric models, analysis of network formation and interactions.

Two particular points sounded a resonant chord with the Centre's researchers.

Professor Charles Manski of Northwestern University suggested that the time is coming to bring the new methods of partial identification analysis into the hands of practitioners. These methods, on which the Centre has researched for some years, employ weakly restrictive and, importantly, plausible models to extract information about policy relevant magnitudes which may at best take the form of bounds and intervals. The spurious accuracy delivered by the tightly specified models used in the past to inform policy is replaced by a more realistic assessment of policy impacts leading to more truly evidence-based policy making.

Professor James Heckman of the University of Chicago, the year 2000 Economics Nobel Laureate, suggested that there will be greatly increased attention to *ex ante* policy evaluation. *Ex ante* policy evaluation has already being taken up enthusiastically at the World Bank. In an *ex ante* policy evaluation one constructs structural models of behaviour, well-founded in economic and social science, and estimates magnitudes relevant to a proposed policy that has never before been enacted using historic data in which there are variations similar to that which a policy will produce but driven by some other force.

Many elements of the Centre's research and activities bear on these two themes. This Phase II proposal gives an opportunity to support a Centre that is well placed to make a major contribution to the development and use of microdata methods and to build the skill base required to do research into individuals' behaviours in the face of change. The Centre will remain the hub of a growing network of international researchers on microdata methods and practice, engaging in new collaborations and keeping UK social science research at the forefront of the international agenda.

Section A: Achievements of the Centre

CeMMAP was established with a **mission** to advance knowledge in economic and social science through the development and application of tools for understanding human behaviour using microdata. These microdata are the survey and other non-experimental data that record the circumstances, choices, actions and decisions of individuals, variously defined as people, households or enterprises.

An essential feature of microdata is that it is mostly generated through the actions of reasoning, reacting and perhaps optimising individuals. This is a matter of great importance

when interpreting the results of statistical analysis of microdata, for example, when trying to find causal relationships amongst statistical associations.

This section is a review of the Centre's achievements between its launch on July 1st 2007 and June 30th 2010. It is organised as follows.

Section A1 details the Achievements of the Scientific Programme. Section A2 details Knowledge Transfer and the Social and Economic Impact of the Centre. Section A3 details External and International Interest in the Work of the Centre. Section A4 presents Key Performance Indicators, Section A5 details Capacity Building, Training and Development Activities. Section A6 details Relationships with Funders, Users and Beneficiaries. Section A7 concerns Direction and Management of the Centre and Section A8 provides summary Financial Tables. Detailed financial tables are provided in the Appendix.

A1   Achievements of the Scientific Programme

The Centre's approach to unlocking the information held in microdata has been to combine the development of theory with applications and to study the construction and identifying power of models that are informed by the knowledge embodied in economic and social science.

A research focus on identification analysis has aimed at revealing the relative roles of theory-based and statistical assumptions in models and has led to consideration of weakly restrictive models from which many assumptions of statistical convenience have been stripped away. This in turn has motivated the study of semi- and non-parametric estimation and inference. Identification analysis reveals the limits to knowledge imposed by observation and measurement processes and this motivates study of alternative measurement processes and the benefit to be obtained from linking data obtained from diverse sources. The methods developed at the Centre have been applied to deliver answers to substantive economic questions.

To achieve its mission, the Centre established five **objectives**, as follows:

1. To make major advances in understanding of the identifying power of models of behaviour in the context of the limits imposed by microdata.
2. To create and improve tools of estimation and inference built on microdata.
3. To advance understanding and development of dynamic, stochastic models of economic and social behaviour.
4. To construct a robust set of tools for empirical analysis of feedback effects in economic systems in order to study the impacts of large-scale changes in the economic environment.
5. To stimulate research on microdata methods, to spread knowledge of microdata methods and to foster good practice in the analysis of microdata.

The rest of this section gives an assessment of the Centre's achievements in relation to these objectives and highlights some of the main advances made.

Annex 1 lists the externally and internally funded research projects on which Centre staff have been working. Many of these will continue through the remainder of the five-year period of Phase I funding. So, further progress towards achievement of the objectives will be made during the two years of Phase I funding that remain.

Much of the research done during the review period appears in the 28 CeMMAP Working Papers published by Centre staff, to which reference is made below[1]. Some of these papers are part way through the publication process. Where publication has occurred or is forthcoming, this is noted. During the three-year review period, Centre staff published 38

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[1] Referred to as CWPnn/yy where yy indicates year, e.g. 09, and nn denotes the working paper number within year. Articles referred to in this Section and written by Centre staff are listed in Annex A3.

journal articles including 6 in *Econometrica*, 5 in the *Review of Economic Studies,* 3 in the *American Economic Review,* and 10 in the *Journal of Econometrics.*

Objective 1. To make major advances in understanding of the identifying power of models of behaviour in the context of the limits imposed by microdata

The microdata on which CeMMAP's research is focused are observational data. They are not generated in the laboratory under controlled conditions. Rather, they are generated by agents making decisions in real-life situations, perhaps based on an assessment of the potential outcomes of these decisions.

The single most important and widely used method for untangling the underlying causal relationships from the various statistical associations present in such data is the instrumental variables (IV) method, which was introduced in the 1920s. Yet, until our recent research was completed, there was no IV method available for cases in which an outcome is discrete – for example, recording binary or ordered choice, counts of events or positions on an attitudinal scale. This is in contrast to the case in which an outcome is continuous.

Discrete outcomes are common in many areas of economic and social science. For example, they arise as indicators recording choices amongst two or more, ordered or unordered alternatives, as indicators of the occurrence of events (sickness, unemployment, marriage), as counts (e.g. of children, items purchased) and as indicators of attitudes or preferences measured on ordinal scales.

Our results show that in the absence of complete models specifying the genesis of all the variables determined by the process being studied (the endogenous variables), there is essential ambiguity regarding the magnitudes of structural features. No amount of data can dispel this ambiguity. We have made a major advance (published in *Econometrica*, Chesher, 2010), showing that the classical IV model can only achieve partial or set identification when an outcome is discrete. This is the case even when parametric restrictions are imposed.

Until this work, knowledge of structural features of processes generating discrete outcomes required the use of either fully parametric models (Heckman, 1978) or models with a recursive structure with a structural function specified for every endogenous explanatory variable (Chesher, 2003, Blundell and Powell, 2004). Our results allow information about processes producing discrete outcomes to be obtained using far less restrictive models.

In developing set identification results such as these, it is useful to obtain the smallest possible (sharp) set within which a parameter lies, but this can be challenging. In the *Econometrica* 2010 paper, sharp set identification is obtained for the binary outcome case with discrete or continuous endogenous explanatory variables. Sharp set identification is characterised for binary and non-binary outcomes with binary endogenous variable models in CWP37/09, Chesher and Smolinski (2009), and in the general discrete outcome, discrete endogenous variable case in CWP11/10, Chesher and Smolinski (2010).

The work just outlined employs models embodying classical instrumental variable exclusion and independence restrictions, but sometimes the independence restriction may be suspect. Partial identification results are reported in CWP16/08, Nevo and Rosen (2008), which allows instruments to be correlated with unobserved heterogeneity under some sign restrictions on correlations. This work is important because it allows inferences to be made about structural parameters under very weak conditions.

In a separate major strand of CeMMAP's identification research, there have been significant advances in the study of the identifying power of the restrictions on individuals' optimising behaviour that form the basis of the widely employed models of individual demand. This work has focused on the revealed preference conditions, which summarise and exhaust the empirical implications of economic optimisation theory. These restrictions provide conditions for the empirical falsifiability of models and, subject to these, allow for the identification of features of the theoretical model.

Papers published in *Econometrica* and the *International Economic Review*, Blundell, Browning and Crawford (2008) and Blundell, Browning and Crawford (2007) respectively, show that it is possible to produce tight predictive bounds on consumer responses to price changes. They further show how to use these to distinguish the different behavioural effects for rich and poor households of policies that work by changing relative prices e.g. indirect tax reforms. This work is important because it shows how accurate predictions of price responses can be made without relying on specific assumptions about the functional forms of demand functions while exploiting fundamental restrictions flowing from economic theory.

Attention was given to a particular form of the standard model of optimising consumer behaviour which focuses on consumers' preferences for product characteristics. This model is used widely in modern applied empirical work on demand for differentiated products and in applications of industrial organisation theory. We were able to deduce the conditions that would allow for falsification of the model and identification of its features. This work was published in the *Review of Economic Studies,* Blow, Browning, and Crawford (2008).

Other work has drawn on this core methodological research to look at applied topics such as the measurement of international comparisons of living standards (published in the *American Economic Review*, Crawford and Neary, 2008). Research in this area has been extended to behavioural models of intertemporal choices (saving and consumption decisions) which, crucially, allow for habit formation. This research, first published in CWP30/07, has been published in the *Review of Economic Studies*, Crawford (2010). Recently, in CWP17/10, we developed new theoretically based measures of predictive success which are relevant to all of these kinds of non-stochastic models. This work is now forthcoming in the *American Economic Review*, Crawford and Beatty (2010).

The Centre's research on identification analysis in programme and policy evaluation contexts and in models providing for potential (counterfactual) outcomes has produced a number of advances. Very general results are given in CWP30/09, Kitagawa (2009). The identifying power of alternative types of restrictions in programme evaluation models is studied in CWP26/08 (published in the *Journal of Human Resources*, Blundell and Costa Dias, 2009). Identification of marginal policy changes is studied for the first time in CWP21/09 (published in *Econometrica*, Carneiro, Heckman, and Vytlacil, 2010).

Identification has also been studied in a number of other contexts. One of these relates to models in which some measurable object of interest is subject to influence by a number of unobservable factors. Our results allow researchers to identify the maximal number of unobserved factors that can be identified. This work also contributes to our research on the development of dynamic, stochastic models of economic and social behaviour (see Objective 3 below). Part of this work is now published in the *Journal of Econometrics*, Bonhomme and Robin (2009).

There has been substantial progress in identification analysis using hedonic models. This class of models relates the prices that consumers pay for market goods and firms' costs of production to the attributes of these products. Our work presents methods to estimate these relationships using functions that relax the usual additivity assumptions regarding unobservable random terms. This kind of model is capable of generating equilibria that exhibit the often-observed phenomenon of bunching, as well as other types of equilibria, and the conditions under which the model is identified are described for the first time. This work, the initial development of which began in CWP03/05, is now forthcoming in *Econometrica*, Heckman, Matzkin and Nesheim (2010). Other work on identification includes CWP08/09, Chen (2009), which considers models of dynamic discrete choice, CWP26/09, Rosen (2009), which studies panel data models and quantile based restrictions, and CWP14/10, Lee and Lewbel (2010) which looks at models of competing risks.

Objective 2. To create and improve tools of estimation and inference built on microdata

In order to implement the partial identification results developed in CeMMAP's research, it is necessary to develop new estimation and inference procedures that apply in situations where the object of interest is a set of parameter values rather than a unique single value. Results published in *Journal of Econometrics*, Rosen (2008), (a revised version of CWP25/06) give a new way to construct confidence sets for a parameter of interest in models that imply a finite number of moment inequalities. A major advance has been made in developing methods for drawing inferences about the size and extent of sets in models that define sets via *conditional* moment inequalities. In this case, identified sets are obtained as the simultaneous intersection of sets delivered at each value of the conditioning variables. Estimated sets obtained by intersecting naïve estimates of sets obtained at each value of conditioning variables are generally severely biased, estimated sets generally being too small or even empty. CWP19/09, Chernozhukov, Lee and Rosen (2009), provides a method for correcting this bias using the methods drawn from the theory of the statistics of extreme values.

We have made advances in non- and semi-parametric estimation and hypothesis testing in weakly restrictive point identifying models. For example, CWP21/08 (published in *Econometrica*, Lee, Linton and Whang, 2009) develops a non-parametric test of stochastic monotonicity. The hypothesis to be tested posits that the conditional distribution function of a variable Y given a conditioning variable X is increasing in X at every value of Y. This sort of stochastic dominance might be expected to arise when X measures the intensity of some supposedly beneficial policy. In that case, it is important to be able to test whether there are beneficial effects throughout the distribution of outcomes.

Non-parametric estimation and inference is an important area of research and is the focus of a series of CeMMAP Working Papers. In CWP36/09, Lee and Whang (2009), a general class of non-parametric tests for treatment effects conditional on covariates is studied. In CWP03/08 (published in the *Review of Economic Studies*, Bonhomme and Robin, 2010) an empirical characteristic function based, non-parametric estimator of distributions of latent factors in additive factor models is developed. The method is applied to estimate distributions of permanent and transitory components of individual log earnings.

In CWP01/09 (published in the *Journal of Econometrics*, Carneiro and Lee, 2009) a non-parametric estimator of the distributions of potential outcomes is developed using an extension of Heckman and Vytlacil's local instrumental variable method. The procedure is used to gain understanding of the causal effect of US college enrolment on wage inequality. In CWP19/10, Horowitz and Lee (2010), uniform confidence bands for functions estimated non-parametrically with instrumental variables are developed. It is shown that a particular sieve non-parametric instrumental variables estimator is pointwise asymptotically normally distributed. All of this work leads to improvements in the quality of information extracted from microdata and reduced reliance on unjustifiable parametric assumptions.

CeMMAP's research on estimation and identification for time series data has looked at new econometric methods for evaluating the performance of econometric models in the realistic situation in which there is structural instability in the economy. The research delivered techniques to perform estimation and inference about the time-varying performance of models, in terms of either their in-sample fit or their out-of-sample forecast accuracy. We developed methods for estimating the usefulness of imposing restrictions on the parameters of a forecasting model that are based on economic theory, which also allows one to test whether the usefulness of the economic restrictions is constant over time. Part of this work was published in the *Journal of Applied Econometrics,* Giacomini and Rossi (2010), with further developments forthcoming in the *Journal of Econometrics*, Giacomini and Carreiro (2010). There is other Centre work on forecasting issues appearing in the *Review of Economic Studies*, Giacomini and Rossi (2009).

The Centre also produced research on estimation of unobserved factor models – a broad class of empirical models used to recover a 'signal' from multiple noisy measurements in a range

of applications. These results build on the identification results described under Objective 1 above. Based on these results, we developed methods to estimate semi-parametrically noisy linear factor models with independent factors. Some of this work is now published in the *Journal of Econometrics*, Bonhomme and Robin (2009).

Objective 3. To advance understanding and development of dynamic, stochastic models of economic and social behaviour

A primary goal in this area is to integrate non-parametric statistical methods with parametric structural models of economic dynamics in order to study a range of practical questions in the areas of human capital formation, housing investment, and household consumption and saving. In doing so, one aim is to produce new computational tools to expand the scope of application of dynamic stochastic modelling. A second aim is to gain understanding of important dynamic behaviours and outcomes.

In CWP02/08 (published in the *Review of Economic Studies*, Bonhomme and Robin, 2009) a model of earnings dynamics is developed that combines a flexible specification of marginal earnings distributions (to fit the large cross-sectional dimension of the data) with a tight parametric representation of the dynamics (adapted to the short time series dimension). The model is used to study the development of employment/earnings inequality in France over the 1990–2002 period.

Centre staff have studied the dynamics of health and income. In work published in the *Journal of the European Economic Association*, Adda, Banks, and Von Gaudecker (2009) studied the effect of permanent income innovations on health for a prime-aged population. Using information on more than half a million individuals sampled over a 25-year period, this work exploited structural and arguably exogenous changes in cohort incomes over the 1980s and 1990s to uncover causal effects of permanent income shocks on health. This research found that unanticipated positive (negative) shocks to income seem to have little effect on a wide range of health measures, but they do lead to decreases (increases) in mortality and risky health behaviour.

Household investment in housing is made under conditions of considerable uncertainty and has long-term impacts on welfare. Centre staff have calibrated a life-cycle model of housing investment and consumption using data from the UK Family Expenditure Survey. Measures of the shadow price of housing are developed that take into account uncertainty in house prices, interest rates and incomes, dynamic life-cycle choices, and liquidity constraints. The results are used to develop a measure of current expenditures on housing services for owner-occupiers. Having such a measure is important for measuring the relative welfare of households, especially when comparing renters and owners, and for measuring inflation. This work is published in CWP04/09, Blow and Nesheim (2009).

The effect of house prices on households' cost of living has long been a subject that is both central to the measurement of household welfare in the UK and important from an interest-rate-setting perspective. The main measure of inflation in the UK does not directly incorporate house price changes. Instead it uses mortgage interest to capture the cost of owning a home. This is a useful method from many perspectives. However, from a consumer welfare perspective, mortgage interest does not capture the cost of housing services. The shadow price of housing captures the welfare cost to a household of changes in housing prices. In CWP03/09, Blow and Nesheim (2009), we create a new measure of inflation using RPI data and the shadow price of housing and investigate how replacing the mortgage interest with the shadow price of housing affects measures of the cost of living. We study the differences and analyse the implications for measuring the welfare of homeowners.

Objective 4. To construct a robust set of tools for empirical analysis of feedback effects in economic systems in order to study the impacts of large-scale changes in the economic environment

One of the most rapidly evolving areas in applied research in the last 15 years has been what is called 'new empirical industrial organisation'. This field unites models of consumer demand with models of firms and market structure and attempts to estimate the equilibrium outcomes using microdata. In this area, firm and consumer heterogeneity is an essential element and is modelled explicitly.

Key elements of these models are 'hedonic pricing equations'. These are used to describe the equilibrium relationship between the prices of products and the distributions of consumers and firms. Such equations have been in use for more than 90 years to study markets for differentiated products. However, the theoretical underpinnings of these models have never been well understood because of perceived computational complexity inherent in the feedback effects that exist between changes in the distribution of consumer taste and industrial structure.

CWP23/07 (published in *Economic Theory*, Chiappori, McCann and Nesheim, 2010) changed this by showing how to compute equilibrium in these models using quite simple computational tools. This advance allows production of tight estimates of the welfare benefits of, for example, new products, changes in the environmental quality of residential neighbourhoods or changes in workplace safety.

Two other research projects in this area resulted in a paper exploring how notions of equilibrium in games can be exploited to produce identification results, now forthcoming in the *Journal of Business and Economic Statistics*, Rosen (2010), and in a paper studying how the impact of 'sin' taxes, such as a tax on the saturated fat content in food, can vary dramatically depending on the strategic reactions of firms. Depending on the precise composition of demand and on the market structure of firms, these 'feedback' effects can result in taxes being overshifted onto consumer prices so that prices increase by much more than the tax or the reverse. The results imply that, in oligopoly markets, an excise tax is much more efficient than an *ad valorem* tax in reducing saturated fat consumption. Results from this work have been presented in a series of conference and seminar papers by Griffith, Nesheim and O'Connell.

Centre staff continued to work on equilibrium search models of the labour market, studying a number of related issues. One is the decomposition of the returns to experience into human capital accumulation and 'job ladder effects' (search frictions give firms market power and it takes time and effort for workers to climb the job ladder). Another issue is the evaluation of the feedback effects of in-work benefit reforms that favour employment and which therefore affect the wage distribution and hence employment. In continuing work, an equilibrium search model is being constructed in which the relative slackness of available positions allows employers to select their employees according to quality.

In some recent work (CWP04/10, Robin, 2010) a model is developed that delivers rich business-cycle dynamics of wage distributions and explains why both low wages and high wages are more procyclical than wages in the middle of the distribution and why wage inequality may be countercyclical, as the data seem to suggest is the case.

Objective 5. To stimulate research on microdata methods, to spread knowledge of microdata methods and to foster good practice in the analysis of microdata

The main mechanisms employed to achieve this objective are the training courses, masterclasses, workshops and conferences organised by CeMMAP and its Working Paper series and website. These are described in Sections A2 and A5 below.

A2   Knowledge Transfer and Social and Economic Impact

A2.1   Knowledge Transfer

The Centre's research addresses methodological questions, which are directly relevant to academic and non-academic researchers using survey and other data to gain understanding of economic and social behaviour and to non-academic users engaged in policy formulation and evaluation in government and in the private sector. CeMMAP places communication with these various audiences at the heart of its activities.

CeMMAP organises training courses, masterclasses, workshops, conferences and research seminars, delivers information via its website and publishes an internationally respected and widely consulted Working Paper series. These activities are considered in turn.

A2.1.1 Training Courses

Since July 1st 2007, CeMMAP has delivered 29 training courses, attended by over 550 participants. Of these, 70 were public sector participants, around 40 were private sector participants and over 145 participants were from abroad. Details are given in Section A5 below. The courses are listed in Annex 4. Here we focus on two courses that have been very popular with both academic and non-academic researchers and which highlight some of the policy-oriented impact of the Centre.

Policy Evaluation Methods. This 3½-day course is in such demand that it has been staged seven times since July 2007. It is particularly popular with government users. It addresses key questions including how one could evaluate whether a government labour market programme such as the New Deal, or a subsidy to education such as the Education Maintenance Allowance, is actually working. The course deals with the tools that have been developed to estimate the causal impact on outcomes of interest of any generic 'intervention' in the presence of selection decisions by agents. Applications studied in the course include government programmes, policies or reforms, assessing the returns to education, the impact of unionism on wages, and the effect of migration on the labour market.

Microsimulation. This course focuses on the main techniques of microsimulation, using examples from the government's own report, *Adding It Up*, to illustrate the many uses of microsimulation methods in policy analysis. The course is taught by Professor Alan Duncan, now Director of the National Centre for Social and Economic Modelling at the University of Canberra. The course is designed to show how to tackle policy questions such as the likely employment effects of new tax credit policies, how road user charges might alter patterns of transport use, and whether a change in the provision of pensions affects the decision to retire.

A2.1.2 Masterclasses

CeMMAP has staged nine masterclasses since July 2007. Details are given in Section A5 and the classes are listed in Annex 4. There are five more masterclasses scheduled for 2010–11.

Leading international contributors to a developing body of research deliver a series of lectures taking participants from the elementary foundations of a subject to the research frontier. The classes are ever popular, attracting PhD students, junior and senior faculty and professional researchers from the UK and abroad.

Here are two, rather different, examples of masterclasses staged in the review period.

Structural Non-Equilibrium Models of Strategic Thinking (5–6 March 2009). This masterclass was delivered by Vincent Crawford, then Professor at UC San Diego, and organised jointly with the ESRC research centre ELSE. It gave 43 participants insight into the rapidly growing field of behavioural game theory. Work in this area, recognising the limited ability of individuals to undertake complex strategic analysis, develops theoretical models of bounded rationality, tests them, and advances knowledge using laboratory experimental methods. A

workshop held the day before the masterclass discussed new research results in the area and was attended by many of the masterclass participants.

New Developments in Econometrics (16–18 June 2009). This masterclass was a major capacity building exercise. It was a three-day masterclass, given by Professors Guido Imbens (Harvard) and Jeffrey M. Wooldridge (Michigan State), modelled on a course taught at the National Bureau of Economic Research in the US in 2007. CeMMAP brought the course to Europe for the first time for the benefit of UK/Europe-based researchers. The course was delivered in London and covered developments in econometrics over the last decade and a half. It concentrated on methods ready for use by empirical researchers, with a focus on practical issues in implementation. The course in London proved enormously popular, with 268 participants.

A2.1.3 Workshops and Conferences

CeMMAP has organised or co-organised 30 workshops and conferences during the review period. These events serve to bring together a wide range of researchers to share ideas on a research theme and to disseminate results of ongoing research. A wide variety of topics has been covered. Some of the meetings were organised jointly with other research centres in the UK and abroad. The events are listed in Annex 4.

Here are two examples of CeMMAP's knowledge transfer activities in this area that had a distinctive interdisciplinary aspect.

Nutrition, Economics and Health: Recent Research and Public Policy Issues (21 January 2009). This conference was an interdisciplinary, policy-focused event, which brought together public health and nutrition specialists, academics and civil servants to discuss recent quantitative research and public policy issues related to nutrition, economics and health. Topics discussed included childhood obesity, food safety, consumer demand for nutrients and the impact of public policies such as tax interventions. Speakers included Robert Anderson (Department of Health), Jim Holding (DEFRA), Derrick Jones (Food Standards Agency) and Jane Wardle (Cancer Research UK and UCL).

Biomarkers in Social Science Research (30 April 2010). The purpose of this one-day conference was to exchange ideas on the utility of biomarkers in social science research and to discuss priorities for future data collection. Part of the conference focused on presentation of research results and part focused on presentations and discussions of data collection. The conference was part of the ESRC National Centre for Research Methods (NCRM) funded project 'Novel Measurement Methods for Understanding Economic Behaviour' and speakers included Melanie Bartley (Professor of Medical Sociology, UCL), Nick Buck (Director, UK Longitudinal Studies Centre), Hilary Cronin (Medical Director, Irish Longitudinal Study of Ageing, Trinity College Dublin), James Nazroo (Professor of Sociology, University of Manchester), Andrew Steptoe (BHF Professor of Psychology, UCL) and Moshe Szyf (Professor, Department of Pharmacology and Therapeutics, McGill University).

Several speakers from the public and third sectors participated in the first of these conferences. Through publicity and its lists of contacts, CeMMAP seeks to encourage participation of users at all of its conference events. In addition, to maximise impact, each year CeMMAP plans at least one conference event that directly engages public, private, or third sector researchers. At the planning stage, they are invited to participate and co-organise. These "user engagement" conferences are designed to seek a balance between academic and non-academic speakers and to encourage the sharing of ideas amongst these groups.

A2.1.4 Research Seminars

The Centre staged a research seminar series which met weekly for much of each year. Centre staff and visitors made presentations and the seminars were regularly attended by Centre staff and students and staff at IFS and UCL and other, nearby, research centres. The seminars were

widely advertised and typically attended by from 20 to 60 participants. The research seminars broadcast the results of the Centre's research often at an early stage when feedback could influence research directions. They gave participants the opportunity to hear and discuss new results from researchers external to the Centre.

A2.1.5 Dissemination of the Centre's Research

Centre staff went to great efforts to disseminate the results of the Centre's research to audiences. During the three-year review period, they made 121 seminar presentations, of which around 80 were outside the UK, and more than 64 presentations at international conferences. Centre staff published 28 papers in the Centre's Working Paper series and nearly 40 papers in international journals.

A2.2   Social and Economic Impacts

CeMMAP has offices at the Institute for Fiscal Studies (IFS)[2] and the Centre's research staff have frequent interactions with researchers and analysts in IFS and with the outside world via IFS. Microeconomic policy analysis is essential for shaping an efficient and fair public sector. It requires knowledge of consumers' preferences, firms' production possibilities and their behaviour. Improving the ability to gain knowledge about these aspects of the economy is the focus of CeMMAP's work and so the research of CeMMAP informs, stimulates and improves the research and policy analysis of IFS.

IFS has an excellent record of effective communication with non-academic users and is frequently praised for its accurate commentaries on public policy issues. CeMMAP plays an important supporting role in delivering these services.

A good example of how the Centre's research impacts on users via synergies with IFS is in the recent analysis of indirect tax reforms in IFS's flagship publication, *The Green Budget*, which has been much informed by recent CeMMAP work on consumption dynamics and demand responses – a good understanding of both of these is crucial to any sensible analysis of the appropriate timing of and likely consumer responses to fiscal tightening through indirect tax changes. *The Green Budget* is printed and distributed to members of IFS, who include policymakers, politicians, professionals, charities and public bodies, and is also freely available online.

Another example of this kind of synergy is the Mirrlees Review. This Review brought together a group of international experts and younger researchers to identify the characteristics of a good tax system for any open developed economy in the 21st century, to assess the extent to which the UK tax system conforms to these ideals and to recommend how it might realistically be reformed in that direction. The Review is being published by Oxford University Press in two volumes. CeMMAP research and researchers contributed to the Review in a number of ways – for example, by estimating a consumer demand system for the UK based on microdata and then using the results to simulate the effects of a uniform VAT system.

IFS also publishes online briefing notes, analysing topical policy issues. Again, CeMMAP research often informs these analyses. Many IFS staff members attend CeMMAP conferences, masterclasses, seminars and training courses. In addition, IFS and CeMMAP staff often collaborate on research. In the review period, 11 publications of CeMMAP staff were joint with IFS staff.

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[2] The Institute for Fiscal Studies is a company limited by guarantee and a registered charity. The aims of the Institute are to "advance education for the benefit of the public by promoting on a non-political basis the study and discussion of and the exchange and dissemination of information and knowledge concerning national economic and social effects and influences of existing taxes and proposed changes in fiscal systems".

CeMMAP staff have also provided advice, informed by their research, to a range of public and private organisations. Here are some examples.

Advice was provided to Ofcom regarding econometric analysis that was produced as evidence that Sky TV faced significant competition from free-to-view terrestrial digital television providers in the markets for its basic and premium satellite packages. The analysis was based on an instrumental variable model of household demand for TV services and choice between Sky and free-to-view providers. These models have been the subject of research at CeMMAP. The appropriateness of the instrumental variable model was questioned. It was concluded that the effects of free-to-view competition on demand for Sky's premium services were likely to be lower than claimed.[3]

Advice was provided to Ofcom on the appropriate methodology to employ when measuring broadband speeds experienced by British households and the variations in speeds across internet service providers (ISPs). A major influence on the broadband speed delivered at the household is the distance of the household from the telephone exchange. The challenge in this work was to identify the pure ISP-related differences in broadband speeds experienced by households. This was done using recently developed microdata methods. Ofcom was highly satisfied with this work.

> 'We ran over 60 million tests over the course of the research and we believe that the integrity of our hardware-based technical methodology combined with the scale of the project and the sophistication of the statistical analysis makes this research a step change from other research into broadband speeds in terms of providing a robust analysis of the variables that affect broadband speeds.'[4]

The results made headline news when they were published in July 2009. There were articles in *The Times*[5] and *The Guardian*[6] and many other press reports.

Advice was provided to EDF Energy during the Fifth Distribution Price Control Review (DPCR5) conducted by Ofgem, which terminated with Final Proposals published by Ofgem in December 2009.[7] A major element in determining the differential price controls to place on the 14 electricity district network operators (DNO) covered by the Review is the relative cost efficiency of the DNOs. Ofgem employed a variety of econometric cost efficiency measurement procedures, including stochastic frontier analysis and a number of techniques rooted in regression analysis. Ofgem's methods were found to be below best-practice standards in a number of respects. A critique of Ofgem's DPCR5 procedures has been prepared for EDF Energy. This will be published at some point in 2010. The advice given drew on CeMMAP research and its experience in conducting applied econometric research. The topic of efficiency measurement is one on which CeMMAP has run well-attended training courses for a number of years.

The Centre Director sits on the Family Food Committee, which advises DEFRA on the collection and analysis of data on household food purchases, consumption, diet and nutrition.[8] The advice given relates to methods for measuring household food consumption and nutritional intakes and to the econometric methods used to analyse the data that are obtained. This draws on CeMMAP's research and experience in the development and application of methods for measuring household experience and modelling household behaviour.

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[3] http://www.ofcom.org.uk/consult/condocs/third_paytv/responses/annex7.pdf

[4] http://www.ofcom.org.uk/research/telecoms/reports/broadband_speeds/broadband_speeds/broadbands peeds.pdf

[5] http://business.timesonline.co.uk/tol/business/industry_sectors/telecoms/article6730035.ece

[6] http://www.guardian.co.uk/uk/feedarticle/8630143

[7] http://www.ofgem.gov.uk/Networks/ElecDist/PriceCntrls/DPCR5/Documents1/FP_1_Core%20docum ent%20SS%20FINAL.pdf

[8] http://www.defra.gov.uk/evidence/statistics/foodfarm/food/familyfood/index.htm and http://www.defra.gov.uk/evidence/statistics/foodfarm/food/familyfood/documents/familyfood-2008.pdf

Centre researcher Carneiro has served on the Working Group of the Commission on Growth and Development since it was launched in April 2006. The Commission brings together leading practitioners from government, business and the policymaking arenas, mostly from the developing world. The Commission seeks to gather the best understanding there is about the policies and strategies that underlie rapid and sustained economic growth and poverty reduction. Commission members interact closely with the Working Group, which comprises 11 members. The Working Group commissions, reviews and comments on thematic papers and case studies throughout the process, and assists in drafting the final report.

Carneiro has also worked with the World Bank and governments of several developing countries in the evaluation of poverty, health and education programmes. He has participated in courses on programme evaluation organised by the World Bank for civil servants across the world. He has designed and implemented evaluations including: Chile Solidario, a poverty programme in Chile; Nadie es Perfecto, a parenting programme in Chile; alternative modes of delivering childcare services in the municipality of Rio de Janeiro, in Brazil; Juntos, a poverty programme in Colombia; a school grants programme in Senegal; programmes designed to eradicate malaria in Nigeria and in Eritrea; and conditional cash transfer programmes to encourage secondary schooling enrolment in Macedonia.

Centre Co-Director Nesheim is an Academic Panellist for the Competition Commission. He acts in an advisory capacity to Commission staff and has been invited to take part because of his particular experience and research in the area. He has also provided advice on competition policy and econometrics to the OFT, the Treasury and the DTI.

The Centre also achieves impact through its "user engagement" conferences (see Section A2.1.3). The Centre aims to hold one of these conferences each year and actively solicits participation as speakers and discussants by public, private and third sector researchers.

A3   External and International Interest in the Centre

The following are some indicators of external and international interest in the work of the Centre: (1) the people who choose to be associated with the Centre and visit the Centre to discuss research; (2) the interest in Centre events shown by distinguished lecturers and participants and the many requests Centre staff receive to attend events to deliver presentations of their work; (3) the cooperation with European research centres in the EU Research and Training Network which the Centre coordinated; and (4) the interest shown in the Centre's Working Paper series.

A3.1   People

Centre Fellows

During the period of the review, the Centre had 12 UK-based Centre Fellows. They variously attended CeMMAP meetings, collaborated with CeMMAP staff, offered advice on research issues and organised CeMMAP events. For example, Robinson (LSE) organised a workshop on Cross-Sectional Dependence in October 2009, Linton (LSE) organised a meeting on Unobserved Factor Models in November 2008 and Pudney (Essex) is organising a workshop on Survey Response Error and Statistical Modelling in April 2011.

International Fellows

During the period of the review, there were 26 International Fellows of the Centre. The International Fellows made visits to the Centre, many of them annually. In total, there were over 40 visits during the three-year review period. The Fellows variously attended and gave papers at workshops and conferences, delivered masterclasses, collaborated with CeMMAP staff, offered advice on research issues and contributed papers to the CeMMAP Working Paper series. In addition, many exploited the opportunity of visiting CeMMAP to make side

trips to other institutions throughout the UK to present seminar papers. This is an example of how the funding of the Centre produced spillover benefits reaching out to the UK social science community. The Centre's International Fellowship includes many of the leading international researchers in theoretical and applied microeconometrics. Without the efforts of CeMMAP, UK-based researchers would not have had anything approaching the exposure to this world class talent that the Fellows' visits delivered.

International Visitors

In all, the Centre hosted over 120 visits by visitors from overseas, including International Fellows, during the review period.[9] Many of these visitors stayed at the Centre for a week or more, presenting seminar papers and interacting with its staff and UK-based visitors. As with the Centre Fellows, many exploited the visit to make side trips to other UK research groups and present seminar papers. CeMMAP is valued for the quality of its research environment by longer-term visitors. In 2011, Centre Fellows Koenker (Illinois), Linton (LSE) and Manski (Northwestern) will spend sabbatical spells of between three and four months at CeMMAP.

CeMMAP junior hiring

Its international research reputation has made CeMMAP a destination of choice for some of the best candidates on the international junior job market in economics. We were successful in appointing Karthik Kalyanaraman (PhD, Harvard, 2009), Toru Kitagawa (PhD, Brown, 2009) and Adam Rosen (PhD, Northwestern, 2006) in the face of fierce competition from top-line US schools.

A3.2   Events

Masterclasses

During the review period, nine masterclasses were delivered by the following international visitors, acknowledged experts in their fields: Dale Mortensen (Northwestern), Robert Porter (Northwestern), Yacine Ait-Sahalia (Princeton), Vincent P. Crawford (UC San Diego), Charles Manski (Northwestern), James Powell (UC Berkeley), Guido Imbens (Harvard) and Jeffrey M. Wooldridge (Michigan State), Kenneth Judd (Stanford) and Joel Horowitz (Northwestern). These events attracted over 700 participants, of whom over 100 came from abroad. Section A5 gives more detail.

Jointly organised international events

Six workshops/conferences have been organised in collaboration with overseas institutions, as follows. In March 2008, a conference was held in London on Inference in Partially Identified Models joint with the Northwestern University Econometrics Research Centre. In May 2009, a workshop on Econometrics of Demand was held at Brown University, organised by CeMMAP and colleagues at Brown, MIT and UCLA – a follow-up meeting takes place at MIT in May 2011. Also in May 2009, a conference on Identification and Decisions was held at Northwestern University jointly organised with its Econometrics Research Centre. In April 2010, a conference on Matching and Sorting held in Paris was organised jointly with the French research organisation ANR.

In August 2009, CeMMAP was involved in the first of a planned series of meetings in Asia. The event was the annual International Symposium on Econometric Theory and Applications (SETA) meeting held in 2009 at Kyoto University. We followed this with a meeting in August 2010 at Peking University held directly after the 10th World Congress of the Econometric Society, which met in Shanghai. This was organised jointly with Yale University's Cowles Foundation and Peking University's Gonghua School of Management. The event was attended by the China representative of RCUK. Future events in Asia are planned at the National University of Seoul and at Tokyo University.

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[9] This figure relates to research visits and does not include participants at conferences and other events.

Invited presentations and other speaking engagements

Invited presentations given at UK and international conferences included the Walrus-Bowley Lecture at the 2009 North American Summer Meeting of the Econometric Society and the 2010 Sargan Lecture at the Annual Conference of the Royal Economic Society, both delivered by Jean-Marc Robin, the inaugural 'Econometric Theory Lecture' in Asia funded by the CUP journal *Econometric Theory*, delivered by Andrew Chesher at the 2009 SETA meeting in Kyoto, and the Keynote Address at the 10th IWH-CIREQ Macroeconometrics Workshop, Montréal, 2009, delivered by Raffaella Giacomini.

Interest in the Centre's research led to invitations to Centre staff to speak at 71 conferences and 121 research seminars during the review period.

A3.3   Research and Training Network

CeMMAP coordinated a Research and Training Network (RTN) funded by the European Commission under the EU 6th Research Framework and Marie Curie Training Actions. The objectives of the network included.

- To provide a European focus for, and engage in the development of, microdata research methods.
- To stimulate development of skills in microdata methods and practice and appreciation of their strengths and weaknesses amongst academic researchers and users in the public and private sectors.
- To provide a research environment in which researchers and users interact while addressing research and policy questions.

The project, with a value close to €2m, brought together CeMMAP and five nodes: the Centre for Applied Microeconometrics at the University of Copenhagen, CEMFI in Madrid, CNRS-EUREQua at Université Paris 1, the Tinbergen Institute at Eramus University Rotterdam, University of Amsterdam and Vrije Universiteit Amsterdam and IFAU at Uppsala University. Doctoral students were located away from their home departments at various nodes of the network and there were twice-yearly conferences attended by students and academic faculty of which the first and the last were held at CeMMAP in London. The project ended in 2009.

A3.4   Working Papers

CeMMAP's Working Paper series is internationally respected, frequently consulted and highly cited. It is the series of choice for many of CeMMAP's international fellows, who are responsible for around 70% of the papers appearing in the series. During the review period, 104 papers have been added to the series. Many of these papers are part way through the publication process and 28 have already appeared in scholarly journals. Annex 9 gives some download statistics.

A4   Key Performance Indicators (KPIs)

Measuring its output against the Key Performance Indicators agreed with ESRC, the Centre has performed well during the three-year review period.

There are five groups of KPIs, as follows:

1. Scientific outputs
2. International and interdisciplinary collaboration
3. Engagement with non-academic stakeholders
4. Capacity building
5. Cofunding and organisational effectiveness

These are addressed in turn below where targets are stated and achievements recorded. The targets equal three times the agreed annual target unless otherwise noted. There is a brief explanation following each group of KPIs but most of the detail can be found in Sections A1, A2, A3 and A5.

A4.1 Scientific Outputs

- Refereed journal articles published: target: 12 – achieved: 38
- Working papers published in total: target: 60 – achieved: 104
- Working papers published by CeMMAP staff: target: 30 – achieved: 32
- Invited addresses at conferences: target: 6 – achieved: 8
- Conference papers presented: target: 24 – achieved: 64
- Seminars presented: target: 120 – achieved: 121
- Seminars organised: target: 36 – achieved: 79
- Masterclasses organised: target: 9 – achieved: 9
- Conferences organised: target: 9 – achieved: 30

Of the 38 refereed journal articles published by Centre staff during the period, 10 appeared in the *Journal of Econometrics*, 6 in *Econometrica*, 5 in the *Review of Economic Studies* and 3 in the *American Economic Review*. In addition, five book chapters and a book were published by Centre staff. Details are given in Annex 2.

A4.2 International and Interdisciplinary Collaboration

- Conference presentations outside the UK: target: 45– achieved: 45
- International visitors hosted: target: 105 – achieved: 120+
- International participants at events: target: 120 – achieved: 480+
- Coordinate EU Research and Training Network – completed
- Interdisciplinary events: target: 3 – achieved: 4

The Centre coordinated the EU RTN on microdata methods and practice with six main partners and seven associate partners. The final conference of the network was organised by the Centre and held in March 2009.

The Centre's launch conference 'Measurement Matters', held 28-30 June 2007, cofunded by the Leverhulme Trust and attended by 135 participants, featured papers delivered by the world's leading researchers in econometrics and empirical economics. A conference on 'Auctions: Theory and Empirics', held in March 2008, brought together theorists and practitioners from the USA, France and the UK. A conference on 'Novel Measurement Methods for Understanding Economic Behaviour', held in July 2008, brought speakers from RAND, the Danish Rockwool Foundation, the Geary Institute UCD, Munich, Cambridge and UCL.

An interdisciplinary conference took place in January 2009 on 'Nutrition, Economics and Health: Recent Research and Public Policy Issues'. This conference brought together public health and nutrition specialists, academics and civil servants. In April 2010, CeMMAP organised an interdisciplinary conference on 'Biomarkers in Social Science Research', which brought together data collectors, geneticists, demographers, economists, statisticians and econometricians.

The Centre has co-organised high-profile international meetings. For example at Northwestern University, Kyoto University and the Gonghua School of Management of Peking University

A4.3 Engagement with Non-academic Stakeholders

- Training courses (TC) organised: target: 21 – achieved: 29
- TC public sector attendees: target: 210 – achieved: 76

- TC private sector participants: target: 30 – achieved: 38
- TC international participants: target: 120 – achieved: 145
- Website visitors: target: 2,000 per month – achieved: 8,500 per month[10]
- Website resources: target: at least 25 entries in total – achieved: 25

Over the period of the review, it has become increasingly difficult to attract public and private sector participants as budgets have been cut on entering the period of the financial crisis. The Centre planned to organise bespoke courses which would have boosted non-HE numbers amongst participants but the market has been difficult.

Website usage has increased greatly during the period, with an average of over 15,000 visitors per month in mid-2010.

A4.4   Capacity Building

- Masterclasses organised: target: 9 – achieved: 9
- Conferences organised: target: 9 – achieved: 30
- Conference participants from HE sector: target: 750 – achieved: 1900+
- Conference participants from abroad: target: 120 – achieved: 200+
- Conferences: non-HE participants: target: 75 – achieved: 200+
- PhD students supervised: target: 4 – achieved: 4
- Postdoctoral researchers in place: target: 1 – achieved: 1
- Website resources: target: at least 25 entries in total – achieved: 25

The Centre coordinated an EU-funded Research and Training Network which brought additional PhD students to the Centre, not included in the numbers above. Centre staff supervised additional UCL PhD students who contributed to the research life of the Centre but were not funded by it.

A4.5   Co-funding and Organisational Effectiveness

- Additional research funds sought: target: £470,000 – achieved: yes.
- Staff turnover: target: minimal – achieved: 3 research staff departed.
- Advisory Board: target: 2 meetings – achieved: 2 meetings.
- Financial management: target: quarterly monitoring against cash limit – achieved: yes.

Details of cofunding are given in Annex 1. The EU RTN generated a large income of which a substantial proportion was distributed amongst network partners to pay student and faculty costs. The amount stated above reflects this.

The Advisory Board was not constituted until 18 months into the project. It now meets annually.

A5   Capacity Building, Training and Development Activities

The Centre has carried out an extensive programme of training and development activities which has benefitted a large number of academic and non-academic users. CeMMAP's website provides an expanding collection of resources for the community of academic users and for public, private and voluntary sector researchers and practitioners. Staff development at the Centre develops skills that will be valuable throughout our researchers' careers.

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[10] In the past year, the website averaged 15,000 visitors per month. The number in the text is the average over the three year period.

A5.1   Training and Instruction

During the review period, the Centre has offered 29 training courses, 9 masterclasses and 30 workshops and conferences. Details of these events and attendance numbers are given in Annex 4. More information about the content of courses and other events is available in Annex 4 and at the Centre's website, www.cemmap.ac.uk.

The two- to three-day training courses are aimed at practising social scientists and economists. Courses comprise a blend of theory and practice with hands-on computing instruction. Applications to real substantive problems, on issues such as policy evaluation and design, inequality and poverty measurement, and consumer demand, are to the fore. As a result of restrictions on budgets, currently about 20% of the participants come from non-HE sectors, particularly the government and other public sectors. All training courses are assessed, using feedback from delegates, and revised every year. In the past three years, 98% of completed course evaluations reported that the course was good or excellent. New courses have been introduced where there is felt to be a significant gap in skills. Some courses have been specifically designed to attract private sector participants (for example, 'Discrete Choice Modelling' and 'Econometric Estimation of Frontier Functions and Economic Efficiency').

The two-day masterclasses of six to eight lectures were delivered by international authorities on fast developing topics. Classes have been very popular, with audiences of from around 40 to nearly 270 junior and senior researchers from across Europe and further afield.

A further 11 training courses will be delivered during 2010–11 – details can be found on the Centre's website. Masterclasses already organised for 2010–11 are as follows: 'Non-Parametric Likelihood: Methods and Applications in Econometrics' to be given by Yuichi Kitamura (Yale), 'Social Interactions' by Charles Manski (Northwestern), 'Matching Models of the Marriage Market' by Pierre-André Chiappori (Columbia), 'High-Dimensional Econometric Modelling' by Victor Chernozhukov (MIT) and 'Market Microstructure and Asset Pricing' (a CeMMAP/ELSE masterclass) to be given by David Easley (Cornell) and Maureen O'Hara (Cornell).

A5.2   Workshops, Conferences and Seminars

The Centre has organised around 10 one- or two-day conferences a year on developing research areas, covering both theory and applications. Some of these meetings have been constructed around themes that are both directly relevant to practising economists and social scientists and challenging to our research community, encouraging a dialogue across traditional boundaries. Examples include a conference on nutrition, economics and health in January 2009, a conference on measuring school effectiveness at the 2010 Research Methods Festival and a conference on biomarkers in social science research in April 2010. Over 2,000 people from diverse backgrounds have participated in CeMMAP conferences and workshops over the period of this review.

The Centre organises a research seminar series that has staged 79 seminars during the review period, attended by from 20 to 60 participants including students and visitors. Speakers are listed in Annex 4.

A5.3   Website

The website (http://www.cemmap.ac.uk) gives information about the Centre's training events and conferences. Importantly, it holds resources associated with these events and gives access to CeMMAP publications. The website was redesigned in 2007 to make it more attractive and accessible to visitors.

During the period of the review, CeMMAP hosted a website for the EU-funded Microdata Methods and Practice Research and Training Network (RTN). The website holds information and papers from the various conferences and training events organised by the network, of which CeMMAP was the coordinating partner.

In 2007, there were approximately 3,500 visitors to the website per month. By 2010, this had risen to 15,000 visitors to the website per month.

A5.4   Working Papers

The CeMMAP Working Paper series has expanded to include over 30 new papers each year since 2007, many of which were submitted by the Centre's network of Fellows and have gone on to be published in leading international journals (see Annex 2 for full details). The papers provide an important resource by bringing together high quality research on microdata methods. The papers are available on the Centre's website and via RePEc, where they have received over 14,000 downloads and over 37,000 abstract views since July 2007. We estimate that the top 20 Working Papers over the last year have been downloaded over 40,000 times.[11] In 2010, syndication via RSS and Atom feeds has been introduced.

A5.5   International Community

The Centre has a team of 26 leading international researchers, the International Fellows, who spend up to three weeks a year working at its London office. The Fellow's annual visits have been the focus for workshops and other events. The visits are trailed in advance on the Centre's website enabling those who are interested to make arrangements to meet and discuss research. Through their visits and associated activities, the Centre's International Fellows give UK-based researchers access to cutting-edge international research.

During part of the review period, the Centre coordinated the EU Microdata Research and Training Network of six partners and seven affiliates who conducted research and provided doctoral and postdoctoral training in microdata methods and practice. Details of the RTN are available at http://www.microdata-rtn.net/index.php.

A5.6   Staff Development

Training for Centre staff is achieved by a combination of formal programmes and learning-by-doing in research interactions with senior staff. Junior researchers are given the opportunity to work on all aspects of projects as part of a team with more senior researchers and are expected to be involved in planning and writing up research findings. They are expected to take an active part in the dissemination of findings to academic and policy audiences, through informal meetings, presentations at conferences and briefings, and direct contact with journalists, where appropriate.

A5.7   Students and Diaspora

The Centre has funded four PhD scholars, supervised by senior Centre staff, and hosted long-term visits from students of the EU-funded RTN. This has proved a particularly successful capacity building activity, allowing us to attract excellent PhD students to study in the UK at a time when many universities have found PhD recruitment difficult. In turn, these students benefit both from formal university graduate training at UCL and from the frequent interaction with the network of CeMMAP researchers and fellows.

PhD scholars proceed to good positions in the UK and abroad. For example, during the period of this review: Le-Yu Chen joined Academia Sinica in Taiwan; Nithin Umapathi joined the World Bank, Washington; Nicolas Roys (RTN) took an appointment as an Assistant Professor of Economics at the University of Wisconsin-Madison; and Michaël Bégorre Bret (RTN) took a post at the OECD. Other CeMMAP staff who have moved on include Jérôme Adda, who has been appointed to a Chair at the European University Institute, and Simon Lee, who has been appointed to a Chair at the National University of Seoul while retaining a visiting position at the Institute for Fiscal Studies.

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[11] The REPEC figure is lower because many people access the Centre's publications directly or following Google Scholar searches which do not direct people to REPEC.

A6 Relationships with Funders, Users and Beneficiaries

A6.1 Relationship with the ESRC and ESRC Investments

Close contact is maintained with the ESRC at regular Troika meetings. ESRC representatives attend the Centre's annual Advisory Board meetings (for membership, see Annex 8). The Centre submits an Annual Report to the ESRC, which is first discussed in draft form at the Advisory Board meeting.

CeMMAP cooperates closely with the National Centre for Research Methods (NCRM) and is a member of the NCRM Associate Organisations. CeMMAP's Director sits on the Advisory Board of the NCRM and the Advisory Board of Understanding Society.

CeMMAP organised half-day sessions at the biannual Research Methods Festivals held in 2008 and 2010. At the 2010 meeting, CeMMAP joined with two NCRM nodes to organise a pre-Festival one-day conference on the theme 'Measuring School Effectiveness'.

CeMMAP has been associated with the organisation of workshops funded by the NCRM on the topic 'Integrating Novel Measurement in Economics', on which Thomas Crossley is Principal Investigator. CeMMAP is one element in a group of organisations bidding for a NCRM node under the heading 'Programme Evaluation for Policy Analysis'.

A6.2 Relationship with the Host Institutions: IFS and UCL

CeMMAP has offices at the Institute for Fiscal Studies (IFS), where many of its events are held. IFS aims to promote effective economic and social policies through rigorous analysis of their impact on individuals, families, firms and the public finances. The Centre provides a core of expertise in model construction, identification, estimation and inference that aids IFS in the effective pursuit of these aims. IFS staff attend CeMMAP masterclasses, training courses, seminar and conferences. IFS and CeMMAP staff discuss research issues on a regular basis and often collaborate on joint research. Centre staff produced 11 publications joint with IFS staff in the review period. The Centre gains greatly from contact with applied economic and social research conducted at IFS and from its contacts with policymakers in the public and private sectors. IFS, voted by Prospect Magazine 'Think Tank of the Year 2009', offers the closest possible engagement with economic and social policymaking in the UK.

CeMMAP also has offices at University College London (UCL) and many of its researchers hold academic positions there. UCL, its Faculty of Social and Historical Sciences and its 5* RAE rated Department of Economics are committed to innovation and excellence in research at the highest international level. The Department of Economics aims to be the leading economics department in Europe and a significant player on the world economics research stage and to provide the highest quality training to professional and academic economists. The Department, Faculty and College gain great benefit from the research work of CeMMAP and from the international profile that CeMMAP brings. CeMMAP benefits greatly from contact with researchers in the Department, Faculty and College. CeMMAP's training courses are staged in the Experimental Game Theory and Microeconometrics Laboratory located at the Department of Economics of UCL.

IFS and the Department of Economics at UCL together house major research centres and integrate their work into teaching and research life. Centres currently operating include: the ESRC Centre for Economic Learning and Social Evolution, the ESRC Centre for Microeconomic Analysis of Public Policy, the Centre for the Economics of Education, the Centre for the Evaluation of Development Policies, the Centre for Economic Research on Ageing and the Centre for Research and Analysis of Migration. CeMMAP has played a central role in the research effort of the Institute and of the Department of Economics, working with these centres and bringing essential expertise in microdata methods and practice. The Centre has gained from contact with the theoretical and applied economists and

econometricians and the staff from many other disciplines who work in the research centres, including social policy researchers, epidemiologists and psychologists.

A6.3   Relationships with Other Bodies

CeMMAP has close relations with the European Commission. CeMMAP coordinated the Microdata Research and Training Network (RTN) which involved close liaison with EC officers and with staff at the five other nodes of the network. Details of the RTN are given in Section A3. CeMMAP staff have been successful in attracting a major European Research Council grant and CeMMAP works closely with the ERC in the execution of this project.

There is a close relationship with Northwestern University's (NWU) Econometrics Center with which CeMMAP organises conferences each year. CeMMAP International Fellows Horowitz, Manski, Porter and Tamer are located at NWU. A meeting at Northwestern on 'Shape Restrictions in Econometrics' is planned for November 2010 and a meeting is planned for London in June 2011.

CeMMAP is building a close relationship with Yale University's Cowles Foundation. CeMMAP Fellows Chen and Phillips are located at Cowles. CeMMAP staff have addressed their Summer Conferences, Lee visited for 2010 as a Cowles Fellow, Chesher delivered a series of invited lectures at the Cowles Foundation in 2008 and in August 2010 CeMMAP joined with the Cowles Foundation and Peking University's Gonghua School of Management to stage a major international conference in Beijing.

CeMMAP has been building a relationship with researchers at Brown University, MIT and UCLA where there are common interests in modelling household and individual behaviour. This has led to a joint meeting at Brown in May 2009, with another planned at MIT in May 2011. Chesher delivers a series of invited lectures at UCLA in February 2011.

A6.4   Links with Users

The Centre provides resources for and engages with a wide variety of users. Important user communities include academics and practising economists and social scientists in the public, private and voluntary sectors. These are represented by a mix of academic and non-academic users on the Centre's Advisory Board.

Academic researchers, teachers and students

This group is kept informed of CeMMAP's activities via contacts in a database, which has been expanded over the past few years to include over 3,000 academics in the UK and Europe. The Centre has cooperated with the NCRM in expanding and diversifying this list. It has publicised its work through these contacts, at major conferences, through publications in leading journals and through contributions to newsletters of professional organisations and learned societies.

Public, private and voluntary sector researchers and practitioners

A major resource that the Centre has offered to this group of users has been its programme of training courses described in Section A5.

As discussed earlier, the Centre also stages at least one "user engagement" conference each year with active participation by public, private and voluntary sector researchers. Participants are sought out from CeMMAP's and IFS's network of contacts, from contacting users directly and soliciting participants and from responding to user enquiries.

More generally, a wide circle of stakeholders was invited to all CeMMAP events and informed of the Centre's activities via IFS's database of more than 12,000 individuals and organisations. The contacts in this database are split approximately 2:1:1 between the public, private and voluntary sectors. The new Centre has used its cooperation with the NCRM to expand this list and to extend advertising of both CeMMAP and NCRM events.

The Centre offers advice to public and private sector organisations as set out in Section A2.2 and has developed long-term relationships with some of its clients. There are frequent contacts developed at IFS where CeMMAP is located.

The Centre has also formed research collaborations with several public and private sector groups. CeMMAP staff are currently working with a major UK online automobile firm on the design and operation of used car auctions. They are also working with Kantar, a market research firm, to analyse data on consumer purchases, and with researchers at the Competition Commission and the European Commission, Directorate General for Competition to analyse data from the National Transport Survey.

A7   Direction and Management

The Centre currently has 11 research staff (all part funded) and four administrative staff (two part funded). At 30 June 2010, the research staff comprised three Professors, three Readers, four Lecturers and one junior Research Economist; the administrative staff comprised the IFS Events and Conference Officer, the IFS External Relations Manager, a UCL administrator and the IFS Executive Administrator.[12] The administrative staff also have other duties variously at IFS and UCL. Details of time commitments to the Centre of funded staff are given in Annex 6. The Centre received information technology, audio-visual and additional administrative support from IFS and the Department of Economics at UCL.

The Centre's courses were taught by six external tutors (listed in Annex 4) assisted by a team of UCL PhD students. The Centre's research and knowledge transfer activities were assisted by a network of 12 UK Fellows and 26 International Fellows, listed in Annex 5.

The Centre Director is Professor Andrew Chesher. He is responsible for providing leadership and ensuring coordinated efforts continue to lead to the important breakthroughs envisaged for the core of the Centre's research programme. Chesher also coordinates the Centre's networking activities including networking with the Centre's national and international Fellows and with the public, private and voluntary sectors. Together with the Centre's Co-Directors, he manages the Centre's overall programme and coordinates the activities of Centre Research Staff.

The Centre Co-Directors are Dr Raffaella Giacomini and Dr Lars Nesheim. The Director and Co-Directors manage the Centre's overall programme and coordinate the activities of research staff. Giacomini coordinates the Centre's capacity building and user engagement and manages staff involved in each of these activities. Nesheim is responsible for the day-to-day management of the Centre. He also manages the computational resources of the Centre.

The research staff as a group are responsible for ensuring that the Centre's programme of research, training courses, masterclasses, workshops and conferences, seminars, publications, visitors and website continue to meet the objectives set out in the Centre's initial contract. They are also responsible for ensuring that the Centre maximises the positive impact of its activities. To this end, the research staff regularly meet to review the current programme of activities and assign management responsibility for individual events. In term time, research staff meet once per week after the Research Seminar.

Each Centre event is overseen, in its development and as it happens, by one designated member of staff responsible for ensuring that the activity meets the Centre's standards of excellence. In practice, there is a lot of team working. The scientific programmes of some of the conferences are managed by Centre Fellows. Participants at events are invited to complete evaluations which are reviewed, with results fed back into the management process.

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[12] The UCL administrator and the IFS Executive Administrator were not funded by the Centre but were funded by UCL and IFS respectively.

There are management meetings several times per term at which plans for upcoming events are put in place and ideas for future masterclasses, workshops and visitors are discussed. Promising ideas are assigned to individual staff members for further development. The menu of training courses is reviewed each year at one of these meetings.

The Events and Conference Officer is responsible for event publicity, bookings, logistical arrangements, and evaluations and feedback. She meets with the Centre Director weekly to review progress. Day-to-day management of the training courses and accommodation and office arrangements for visitors is delegated to the UCL-based administrator. The External Relations Officer manages the website and the IFS IT services. The Executive Administrator manages the budget, supports the Advisory Board and Troika, and provides HR and accommodation support, coordinating with the Centre Director at bi-weekly meetings. Responsibility for particular aspects of the Centre's work – for example, management of the Working Paper series – is delegated to particular members of the research staff. Details are provided in Annex 5.

PhD studentships are advertised and filled jointly with IFS, which makes annual appointments to PhD studentships. A committee reviews the applications and selects a shortlist of promising applicants to be interviewed. PhD students are selected through a competitive interview process conducted by a joint committee of IFS and CeMMAP staff. PhD students are actively involved in the Centre's activities, attending seminars and research lunches, working closely with research staff, and attending masterclasses and workshops.

Brief CVs of research staff currently employed at the Centre are provided in Attachment 2.19.4. Research staff span the range from junior lecturer to senior professor and have all been trained at leading international institutions. Among them are PhD graduates of some top US graduate schools: Brown, Chicago, Harvard, Iowa, Northwestern and UC San Diego. The CVs and the publications listed in Annex 2 demonstrate that the Centre staff are actively working on research in the various areas set out in the Centre's objectives and publishing in the world's leading journals.

The Centre reports to an Advisory Board which meets annually to appraise the Centre's performance and to advise on new directions for the Centre's work and on new opportunities for funding and user engagement. The Advisory Board reviews the Centre's Annual Report before it is submitted to ESRC and provides feedback. The membership of the Advisory Board is listed in Annex 8. The Centre Director, a Co-Director and the Executive Administrator meet with ESRC representatives biannually at Troika meetings.

The Centre subscribes to the human resources development process operated by IFS. This encourages every staff member to develop their skills to the best of their ability at all stages of their career. To achieve this, staff receive detailed regular feedback from senior and junior colleagues. The Centre aims to foster a cooperative, open environment where colleagues discuss research questions formally and informally. All members of research staff are consulted about strategic research issues.

The Centre subscribes to the Equal Opportunities Policies of IFS and UCL. No discrimination, direct or indirect, is permitted. The Centre ensures that the Equal Opportunities Policies are observed in both spirit and letter. CeMMAP takes reasonable steps to ensure that staff openings are advertised widely, that recruiting efforts and employment decisions do not discriminate and that, for each post, the Centre identifies and hires the best possible person based on a fair assessment of qualifications, experience and abilities necessary for the successful performance of the post.

The Centre has worked towards its present position since 2000 when it started under the auspices of the Leverhulme Trust. The present organisational structure has evolved to meet the Centre's needs and our experience is that the current structure works well. The Centre delivers the highest quality research in substantial volumes which is published in the world's

leading journals. It mounts an annual programme packed with events for which there is strong demand.

With very few exceptions, CeMMAP events proceed smoothly without hindrance. The volcanic dust cloud caused by the eruption beneath the Eyjafjallajökull ice cap in 2010 caused the last minute postponement of one masterclass because the instructor (Susanne Schennach, University of Chicago) was unable to travel. One of our instructors had to cancel a course at the last minute due to a family emergency. In both cases, we offered participants refunds of expenses already incurred. Apart from this, the Centre's events have taken place as planned and without problems and they have received overwhelmingly good evaluations.

Mounting such an array of events is a complex organisational task, well served by the structure we employ. This said, the excellent and professional work done by our administrative staff and the team efforts of our research staff and students cannot be overstated.

A8   Summary Financial Tables

Detailed financial tables for the Centre's activities for the period 1 July 2007 to 30 June 30 2010 are presented in the Appendix to this document. The tables contain details of the agreed budget in the Centre's contract, the actual expenditure made (at full cost) and the amounts received from ESRC.

Here is a summary of budget and expenditures from 1 July 2007 to 30 June 2010.

	Summary to 30 June 2010 (36 months)		
	Budget	**Actual Expenditure (at full cost)**	**ESRC Contribution**
2007/8 (9 months)	495,279	436,238	375,165
2008/9	599,955	617,370	530,938
2009/10	616,454	782,357	672,827
2010/11 (3 months)	158,352	216,252	185,977
Total	1,870,040	2,052,217	1,764,907

For the first 36 months the Centre has underspent its budget by about 5.5% when comparing the actual ESRC contribution to the original budget. Most of this underspend has been on DI salaries but with new appointments made in the autumn of 2009 it is expected that the final expenditure will be in line with the budget.

Section B: Future Plans

B1 Introduction

The Centre for Microdata Methods and Practice (CeMMAP) is a world centre for research into the methods that reveal the nature of human decision processes using observational data. Its work is widely read, highly respected and influential amongst practitioners.

Faced with limited resources in an uncertain world, societies need guidance to attain good outcomes in the future. Governments need to know what works and what does not. Firms need to know the most effective strategies for succeeding in a dynamic marketplace. Individuals need to know what risks they face, what opportunities exist. Social and economic policy, and indeed individual decisions, cannot be undertaken successfully without high quality information and robust reliable analysis.

The Centre's work will raise the quality of information on which such decisions will be based and help produce better outcomes.

The microdata research already carried out by CeMMAP has had significant impact on the international social science community and on users and beneficiaries throughout the world. The evidence is in Section A.

In the next seven years, the Centre will expand its programme of cutting-edge research and enhance its reputation as a leading international research centre by focusing on strategically important microdata methods and applications. The Centre's mission is to match state-of-the-art statistical methods and data analysis with in-depth analysis of the implications of theoretical social science models. The Centre's work is geared toward understanding the most important social and behavioural issues of the day.

This is Section B of the Case for Support for the second phase of CeMMAP funding. It sets out the Centre's plans for Phase II of the Centre including the Scientific Programme, plans for Engagement with Users and Beneficiaries, the Relationship of Cemmap's activities to the ESRC mission, a Work Plan for 2012-17 and suggested Key Performance Indicators.

Section B2 below sets out the research agenda for Phase II of CeMMAP funding, 2012-17. This details some of the research that the Centre will do and describes the importance of this research.

All the research done by CeMMAP is for naught if user practice is not influenced and improved. So CeMMAP places user interaction and knowledge transfer very high on its agenda.

Accordingly, the Centre will deliver training courses at elementary levels and masterclasses at advanced levels, and workshops and conferences aimed at different important user communities. The Centre has a wealth of experience in this endeavour, as set out in Section A, and will aim to continue and enhance its offerings in this area, as set out in Section B3.

The Centre's work is closely aligned with the mission of ESRC and with its objectives, and the Centre's work will contribute to achievement of the strategic challenges of ESRC, as explained in Section B4.

Section B5 sets out CeMMAP's Phase II work plan, including details of new personnel, research, masterclasses, training courses, conferences, seminars and visitors.

Section B6 concludes with some suggested Key Performance Indicators for Phase II.

B2 Scientific Programme

The Centre's Phase II research programme will focus on five strands of research on **Methods** and three strands of research on **Practice**.

Research on methods will focus on:

1) Identification
2) Estimation, Inference and Testing
3) Longitudinal Data Methods
4) Computation
5) Measurement

Research on practice will focus on:

1) Understanding Individual Behaviour
2) Dynamics and Complexity
3) Networks, Interactions, and Equilibrium

Each of these areas is now addressed in turn, with attention first to the strategic importance of research in the area and then to the priorities for research as we see them at this time. Our assessment of priorities is determined by consideration of (i) the importance of obtaining solutions to the various problems in the area and (ii) the likelihood of making progress given the state of relevant knowledge, tools and techniques. Of course, that may change.

As was demonstrated in Section A, the CeMMAP Fellows are an integral part of the Centre's research and other activities. We expect them to continue to contribute to the research agenda through regular visits, discussions and collaborations. In each section below, we indicate the Fellows who are currently expected to help advance the Centre's research.

B2.1   Methods

B2.1.1 Identification

Strategic Importance of Research in this Area

Research on identification underpins all social science research and lies at the basis of all of CeMMAP's endeavours. Analysis of identification provides guidance on what is knowable given current data resources and on what types of new measurements and experiments can expand the frontier of knowledge. It informs researchers about the relative power of restrictions on models implied by social science theory and restrictions imposed for statistical convenience. It informs researchers about their ability to distinguish between different theoretical models and the ability to falsify models.

Identification research gives information about the robustness of conclusions of empirical studies to variations in models' restrictions. It is well known that predictions and estimates obtained using economic models often fail to exhibit the accuracy that conventional statistical calculations predict. It is crucially important to understand this. A common cause is overly restrictive model specification, which results in the model speaking louder than the data.

Recent research on partial identification determines what bounds data can place on the magnitudes determining economic and social processes when weakly restrictive models employing only credible restrictions are used. The Centre's research will study the identifying power of a variety of models, including those for discrete ordered and non-ordered outcomes, for sequences of observations obtained from panels of individuals and for problems in which there are essential multiple sources of heterogeneity such as arise when studying returns to education, where skill endowments and acquisitions of a variety of types are important considerations.

Instrumental variable (IV) models are widely used in economics and other social sciences. They are also used in epidemiology under the heading 'Mendelian Randomisation'. IV models were historically confined to problems with continuous outcomes and single sources

of heterogeneity. We have shown in Chesher (2010) how discrete outcomes can be accommodated once partial identification is entertained. The next step is to extend IV methods to problems with multiple sources of heterogeneity, initially studying models of optimising individuals making discrete choices from unordered alternatives each characterised by observed and unobserved characteristics. This is one of a number of research areas focused on incomplete models which leave aspects of the processes under study unspecified.

Strategic Priorities for Research in this Area

Identification analysis underpins all of CeMMAP's research, as explained above. The partially identifying power of relatively weakly restrictive, credible models is a major but not the sole focus. Topics to be researched include the following:

- *Incomplete models.* What is the identifying power of incomplete models in which aspects of the process generating some of the variables determined by a process are left unspecified or loosely specified? See e.g. Chesher (2010) and Tamer (2003). Attention will focus on particular policy- or theory-relevant structural features.

- *Selection and product characteristics.* Identification of the relative valuations of observed characteristics of goods or choices when individuals self-select so that unobserved preferences and observed characteristics may be correlated. This work will deliver an instrumental variables extension of McFadden's (1974) model of multiple discrete choice in which explanatory variables will be allowed to be endogenous.

- *Multiple sources of heterogeneity.* Identification of structural features in models for single and many discrete or continuous outcomes in which there are multiple sources of heterogeneity, e.g. skills of different types in an education setting or political attitudes on economic and cultural scales in the analysis of voting. Cunha et al. (2010) is an example of one type of model to be considered. Applications of this work will be developed in Section B2.2.2.

- *Shape restrictions.* Identification of the power of qualitative 'shape' restrictions is another topic of interest in many social science disciplines. Examples of this include restrictions requiring functions to be monotone or concave, and restrictions requiring distributions of unobservables to be single-peaked or to exhibit stochastic dominance when there is conditioning on unobservables. We expect several applications in Section B2.2 to make use of this research.

- *Panel data.* Identification of structural features in problems where a sequence of observations on a panel of individuals is obtained. In such settings, there may be multiple unobserved sources of heterogeneity constant through time but varying across individuals. We aim to extend results due to Altonji and Matzkin (2005) allowing for discrete outcomes and results in Newey (2010) for discrete outcomes. Also important are the papers cited in Section B2.1.3 (Chernozhukov et al., 2009, Hoderlein and White, 2009, and Bonhomme, 2010). This work feeds into the research described in Sections B2.1.3 and B2.2.2.

- *Household bargaining.* Following analysis such as that in Chiappori and Ekeland (2009), we will study what can be known of aspects of intrahousehold bargaining, conflict and allocations from various types of data available at the household and within-household level.

CeMMAP Fellows including Blundell, Heckman, Ichimura, Lee, Manski, Matzkin, Robinson, Schennach, Stoker and Tamer are expected to help advance CeMMAP's research in this area.

B2.1.2 Estimation, Inference, and Testing

Strategic Importance of Research in this Area

While the study of identification is about what can be learned from economic models when applied to data, the study of estimation, inference and testing is concerned with, inter alia: the

measurement of identified quantities using real data; summarising the precision of estimates; quantifying how well the data support particular hypotheses of interest; and quantifying the degree of support that the data give to the restrictions imposed by the model being employed.

The methods of estimation, inference and testing enable application of models to real-world datasets in an attempt to assess key features of interest in the population from which their data are taken. These are the methods that produce the magnitudes used in policy evaluation, and measures of their accuracy, and that allow an assessment of their robustness to changes in a model's assumptions.

New types of data, new models and interest in new aspects of behaviour require development of new methods of estimation and new inferential and testing procedures. Considerations of efficiency and robustness drive the search for improvements to existing methods of estimation, testing and inference.

Developments in computer power and computational methods will lead to the development of new estimation, inference and testing procedures.

The result will be new knowledge of individuals' behaviour and the influences on it, better understanding of the likely impact of policy and improved decision making. The Centre's research will contribute to the international research efforts in this area, focusing on methods designed for analysis of microdata. Here are some of the topics on which we plan to work.

Strategic Priorities for Research in this Area

Topics to be researched include the following:

- *Methods for partially identifying models.* Weakly restrictive models that embody only plausible restrictions and dispense with strong functional and distributional form restrictions may only allow values of parameters to be located within sets, e.g. intervals in the case of scalar valued parameters. There are many unsolved research questions concerning estimation, inference and testing when dealing with set-identified parameters. In our recent poll of Centre Fellows, Charles Manski suggested that a big challenge for the next seven years is to bring partial identification methods into applied statistical practice. The Centre's research in this area is aimed towards this goal. Some of the topics to be addressed under this heading include: the properties of estimates of parameters identified by intersection bounds following work initiated in Andrews and Shi (2010) and Chernozhukov et al. (2009); the detection of misspecification in partially identified models; Bayesian allocation (Moon and Schorfheide, 2010; Liao and Jiang, 2010); the relationship with decision theory (Manski, 2008); meta-analysis of results (Chetty, 2009b); and implementation in a number of contexts, including treatment effect models with non-randomised experiments (Manski, 1990; Balke and Pearl, 1997), estimation of strategic interactions in oligopoly models (Tamer, 2003), non-linear and dynamic panel data models (Honoré and Tamer, 2006) and estimation of consumer demand based on revealed preference (Blundell et al., 2008). Applications include several discussed in Section B2.2.
- *High-dimensional modelling.* Recent advances have also been made in methods for high-dimensional modelling: see e.g. Huang et al. (2009) and Belloni and Chernozhukov (2010). These have so far made little impression on empirical practice in social science. However, there is now access to vast new data sources on social and economic behaviour that naturally lend themselves to the application of such methods. Such sources include scanner data recording millions of supermarket transactions per year and rich survey data from ELSA, BHPS and other longitudinal surveys that contain an enormous number of variables. We will explore how model

selection tools such as LASSO[13] can be meshed with economic theory to analyse these. This research will feed into work described in Section B2.2.1.

- *Bayesian methods.* These provide a clear route to introducing prior information into empirical analysis, which can be valuable when important decisions rest on empirical results. Bringing non-parametric Bayesian methods into applied social science practice is a challenge highlighted by Guido Imbens in our poll of Centre Fellows. Many methods rely on strong parametric restrictions. We plan to study methods for conducting Bayesian analysis in the absence of parametric restrictions using tools from non-parametric likelihood analysis, see e.g. Schennach (2005). We will study Bayesian methods in partially identifying models (Moon and Schorfheide, 2010; Liao and Jiang, 2010) and a new approach to robust Bayesian analysis in this context using tools of random set theory (Molchanov, 2005) and belief function analysis (Shafer, 1976; Liu et al., 2006).

CeMMAP Fellows including Arellano, Chen, Chernozhukov, Hillier, Horowitz, Ichimura, Imbens, Lancaster, Manski, Newey, Pakes, Phillips, Powell, Ridder, Robinson, Schennach, Smith and Tamer are expected to contribute in this area.

B2.1.3 Longitudinal Data Methods

Strategic Importance of Research in this Area

Understanding individuals' responses to changes in environment and to changes in risk and uncertainty requires structural analysis of sequences of individuals' decisions and outcomes. Models currently used for analysis of longitudinal data employ such strong restrictions that our understanding of important aspects of behaviour is very limited. Research is needed to enable analysis using models with essential non-linearities, models with multiple sources of heterogeneity and models suitable for application in complex dynamic decision environments where people's computational capabilities may be limited.

Research on longitudinal methods is needed to deliver tools that will maximise the returns from investment in the growing stock of high quality UK longitudinal data sources including the BHPS, ELSA, the British and Millennium Cohort Studies and Understanding Society. Valuable longitudinal data from commercial sources, such as panel data on auctions (from an anonymous online UK automobile auction firm) and panel data on consumer expenditures (Kantar World Panel) are becoming available.[14]

Strategic Priorities for Research in this Area

Topics to be researched include the following:

- *Non-separable errors in panel data models.* Building on recent research, for example Chesher (2010), Chernozhukov et al. (2009), Hoderlein and White (2009), Bonhomme (2010), and on the identification research in Section B2.1.1, the Centre will explore alternative restrictions in non-separable errors models, examine problems with discrete outcomes and study how restrictions implied by social science theory can be exploited in these models. We will apply these methods in several applications described in Section B2.2.2.
- *Bounded rationality in dynamic models.* Analysing models of behaviour in complex environments can require several hours of computation on a supercomputer. Clearly, individuals and households cannot perform these computations and we need more plausible models. The Centre will build on Baak (1999) and Hoderlein et al. (2010), extending dynamic models to allow for costs of computation and for decision rules other than fully optimising, e.g. using rules of thumb, habits or adherence to social

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[13] LASSO stands for the 'least absolute shrinkage and selection operator'.

[14] The Centre is currently using these data sources in a number of projects. Exploitation of the panel dimension of these data sources requires advances in panel data methods for extremely large data sources.

norms. We will develop methods that can discriminate between alternative models. We will exploit information in ELSA linking measures of cognitive ability to saving behaviour. This work will inform work in Section B2.2.2.

- *Semi-parametric dynamic models.* The aim here is to develop low-dimensional approximations to decision rules in complex environments and develop methods to test their reliability as approximations of behaviour. We will investigate methods to relax some of the identification assumptions in Magnac and Thesmar (2002) and Bajari et al. (2007) to provide bounds on structural features of dynamic decision processes. This will increase the scope of applicability of dynamic discrete choice models as well as the credibility of estimated parameters and policy prescriptions.

- *Econometrics of non-linear DSGE models.* This research will develop methods to (i) estimate the structural parameters of realistic non-linear dynamic stochastic general equilibrium (DSGE) models directly, without resorting to approximations around a steady state (e.g. Fernandez-Villaverde and Rubio-Ramirez, 2007; An and Schorfheide, 2007), (ii) test hypotheses and evaluate model fit, (iii) compare competing models and (iv) develop methods that are robust to weak identification (e.g. Kleibergen, 2005). One approach is to consider the exact non-linear model and construct approximate likelihoods based on projection methods (e.g. Kim, 2002; Chernozhukov and Hong, 2003). The theoretical challenge is to show that such techniques can be adapted to a setting with latent dynamic variables. Applications of this research will be developed in research in Section B2.2.3.

- *Forecasting inflation using prices of tens of thousands of items.* Factor models have been developed to estimate the dynamics of large-dimensional data sets; see e.g. Stock and Watson (2006). These models have yet to be incorporated into structural dynamic models of behaviour. We will develop models to study questions that include: How do firms decide on prices and inventories when choosing prices of thousands of items? How do consumers forecast prices of a basket of groceries? How do stores and consumers respond to each other in this environment? What are the implications for food safety regulation, for energy efficiency choices, for tax policy?

- *Attrition and missing data in panels.* We will study methods for analysis of data from panel surveys in which some questions are not asked at relevant periods or a panel is unbalanced, examining parametric and non-parametric latent variable methods and the use of the EM algorithm (Moffitt and Ridder, 2007; Stock and Watson, 2002). There will be applications to modelling the dynamics of grocery prices and grocery purchases using high-frequency unbalanced panels with missing data on store- and household-level inventories.

Centre Fellows including Arellano, Browning, Chen, Chernozhukov, Magnac, Meghir, Newey, Ridder and Tamer are expected to contribute to this area.

B2.1.4 Computation

Strategic Importance of Research in this Area

Computational obstacles remain a great barrier to progress in a range of microdata research areas, including the analysis of semi-parametric structural models, research involving very large datasets, the analysis of models with dynamics and complexity, and the analysis of networks, interactions and equilibrium. One result is that researchers resort to restrictive and misspecified parametric models to get around computational difficulties. While this produces valuable information in many cases, it severely limits the information that can be extracted from data about economic and social processes and often prohibits consideration of important phenomena. Analysis of models involving essential non-linearities and rich forms of heterogeneity requires advances in computational methods.

This strand of the Centre's research will focus on advancing computational social science. Computational tools will be developed for estimation and testing, for understanding longitudinal data and dynamic models, and for analysing models of networks, of interactions

and of equilibrium. Applications will use the most sophisticated computational tools available to expand the frontier of applied microdata research.

Areas of computation to be studied include numerical integration, approximation theory, optimisation methods, massively parallel computation, and methods for solving non-linear equation systems. Many of these methods are important for estimation problems discussed in Section B2.1.2. All are areas that are important in microdata applications and in which numerical analysts are making rapid advances which can be exploited in microdata analysis.

Strategic Priorities for Research in this Area

Some of the Centre's priorities for research in computational methods will be:

- *Methods for high-dimensional estimation.* This includes Bayesian estimation and penalisation including LASSO.[15] These methods will be used in applications with large datasets and in estimating dynamic models in Section B2.2.2 and strategic interactions in Section B2.2.3.

- *Methods for dynamic models with complexity.* Key computational problems to be addressed include numerical integration, approximation, and solution of operator equations inside estimation problems. We will build on Heiss and Winschel (2008) and Krätzig and Winschel (2010) and make use of alternative approximation methods such as radial basis functions discussed in Buhmann (2003).

- *Estimation of structural models using the method of Mathematical Programming with Equilibrium Constraints.* This follows on from work by Judd and Su (2008). The Centre will use this method in a range of applications that require large-scale computations nested within estimation problems. The method allows researchers to avoid costly computations by replacing them with a large number of low-cost constraints, significantly increasing the range of models that can be computed.

- *Matching and sorting in higher dimensions.* We will extend work of Lise et al. (2010) and Chiappori et al. (2010) by reformulating equilibrium conditions first as large-scale linear programs and then as lower-dimensional non-linear programs. The latter step is similar to Lagrangian relaxation techniques, which have been used to make previously intractable combinatorial optimisation problems tractable. These methods will be used in the applications described in Section B2.2.3.

- *Structural estimation in industrial organisation.* The Centre will develop several computational methods for use in estimation of structural industrial organisation models, including homotopy methods to find solutions to equilibrium conditions, numerical integration methods (Heiss and Winschel, 2008; Judd and Skrainka, 2010) and integer programming methods to compute equilibria in location choice models (Nemhauser and Wolsey, 1999). These methods will be used in research discussed in Section B2.2.3.

CeMMAP Fellows including Adda, Chen, Chernozhukov, Hausman, Horowitz, Koenker and Lee are likely to contribute to this line of research.

B2.1.5 Measurement

Strategic Importance of Research in this Area

The knowledge that can be obtained from empirical research in social science ultimately rests on the quantity and quality of measurements of social and economic phenomena. Our research on measurement is complementary to our research on identification. Analysis of identification provides guidance on what is knowable given current data. This stimulates research on measurement methods to improve the information content of data, and thereby expand what is knowable. Our research on identification will identify what types of

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[15] LASSO stands for the 'least absolute shrinkage and selection operator'.

measurements can expand the frontier of knowledge; our research on measurement focuses on improving methods to obtain those measurements.

Economic and social science models typically involve many theoretical constructs whose measurement is problematic. Some, such as income or expenditure, are quite concrete. Others, such as preferences or expectations, are more abstract. Historically, economists have attempted to measure only some of these items: for example, income or wealth, prices, and expenditures or amounts purchased. Other constructs are not measured: for example, expectations or beliefs, preferences, wellbeing, or the form of the contract that governs the purchase of or flow of services from durables or housing.

There are two types of problem to be tackled. First, items that are measured are often very poorly measured. What impact does this have in microdata analysis and what can be done to reduce resulting problems? Household consumption and expenditure are examples (see Browning et al., 2003 and Crossley, 2009). Second, items that are not measured must either be assigned values based on assumptions (e.g. in the absence of data on expectations, we might assume that consumers have rational expectations) or be inferred given the data and model at hand (e.g. we might attempt to estimate preferences given an assumption about expectations and observed purchases, prices and wealth). How reliable is analysis based on such 'measures'? Can researchers do better by measuring the unmeasured items? These are the questions that will be addressed.

Strategic Priorities for Research in this Area

The Centre will work to address both sets of problems, seeking new ways to obtain better measures of objects that social scientists have traditionally measured and developing methods for the measurement of quantities that have typically not been measured directly.

- *Measurement of expectations, preferences and other quantities.* The Centre will build on Manski (2004) and Attanasio (2009) to develop methods to collect better data on expectations or beliefs. The Centre will also work to incorporate this information into estimation methods discussed in Sections B2.1.3 and B2.2.2. The Centre will continue to develop measurements based on work by Barsky et al. (1997), Choi et al. (2007) and Crawford (2010) to measure risk and time preferences and will extend these methods to deal with non-rational choice models.

- *Measurement of aspects of contracts.* There is very little quantitative evidence on the nature and performance of contracts other than experimental studies (Fehr et al., 2010). However, there are rich possible sources of data on contracts, including online databases of government procurement contracts (e.g. Bandiera et al., 2010), construction management contracts and building permits. It is possible to match these to data on various outcomes. The Centre will develop methods for measuring and summarising the important features of contracts, first using data mining in conjunction with contract theory to quantify legal terms, phrases and words, making it possible to quantitatively study the effect of contract features and contract complexity on performance and other outcomes.

- *Use of biomarkers.* A rapidly emerging area is the use of biomarker data, either as outcomes (Adda and Cornaglia, 2010) or as source of variation in causes (von Hinke Kessler Scholder et al., 2010). The Centre will continue to work in this area exploiting access to data sources including ELSA and Understanding Society.

- *New methods for collecting traditional data.* As suggested by Browning and Crossley (2009), the Centre will experiment with methods to collect data on consumption and expenditure that generate measurements with known measurement error structures to replace existing measurements with unknown measurement error structures. With known error structures, statistical methods (Hu and Schennach, 2008) can be used to correct the bias induced by measurement error.

The Centre has had, and will continue to have, significant interactions with major data collectors. Centre staff contributed experiments (on the measurement of household

consumption) to the innovation panel of the Understanding Society project, and anticipate contributing further experiments in the future. Team members recently developed risk and time preference measures (building on the methods of Choi et al. (2007)) for the English Longitudinal Study of Ageing and expect continued interaction with the ELSA team. The Centre will also develop its relationship with CentERdata at Tilburg University, which specialises in internet-based panel data collection. Team members' work on measuring consumption will feed through the current redesign of the Consumer Expenditure Survey in the USA by the Bureau of Labor Statistics.

In the private sector, Centre staff are currently working with a major UK online automobile auction firm to determine how features of auction and web design affect customers, sales, revenues and other auction outcomes. The Centre plans to continue to work to determine how best to measure the features of the web environment and the search behaviour of customers on the website.

CeMMAP Fellows including Adda, Browning, Manski, McFadden, Pudney, Ridder, Skinner and Spady are expected to contribute to CeMMAP's research in this area.

B2.2   Practice

B2.2.1 Understanding Individual Behaviour

Strategic Importance of Research in this Area

Models of individual choice remain the principal focus of research in microeconomics (and increasingly macroeconomics too given the importance of micro-foundations and distributional issues in modern macroeconomics). The ability to rationalise and predict individual choices and how they adjust in response to changes in the economic, social and policy environment is at the heart of many applied questions from education policy to welfare reform to the measurement of social progress. Indeed, this is an essential component of the general research programme of *ex ante* policy evaluation identified by James Heckman, 2000 joint Nobel Laureate, in our poll of CeMMAP Fellows' priorities for the future. Our work under this theme will provide answers to important empirical questions regarding individual behaviour based on application of robust methods developed in the Methods strand of the Centre's research. It will also provide inspiration for further methodological innovation shedding light on what works and what does not in practice and generating unforeseen improvements in methods. This work will also provide prototypes for other researchers on how to use frontier research methods to improve understanding of individual behaviour.

Strategic Priorities for Research in this Area

Topics to be researched include the following:

- *Estimating demand for the entire basket of retail grocery store purchases.* A typical supermarket stocks several thousand distinct items. Yet, over the course of a year, a single household may purchase at most a few hundred distinct items. Most households have zero demand for most products. The demand system is 'sparse'. Analysing demand in this context is extremely challenging. The Centre will build on Smith (2004), Beckert et al. (2009) and Briesch et al. (2009) to estimate models of demand that can capture this 'sparsity' and so increase understanding of the welfare effects of store location choices, product choices and pricing policies. The Centre will also use detailed nutrition information and monthly advertising data from the *AC Nielsen Digest of UK Advertising Expenditure* to estimate how prices and information affect consumers' nutrition choices. This research will use methods developed in research described in Section B2.1.2.
- *Testing for the stochastic dominance efficiency of a given portfolio.* The portfolio choice problem is one of the fundamental problems in finance. There are two main approaches to its solution, the mean variance approach (Markowitz, 1952) and the stochastic dominance (SD) approach (Levy, 2006). The SD approach makes much weaker assumptions about

the distribution of returns and/or preferences, but the practical implications of SD analysis have proven to be more difficult because one has to consider infinitely many portfolios, while the standard SD rules rely on pairwise comparison of the individual alternatives. We will investigate a test of whether a given portfolio is efficient with respect to the stochastic dominance criterion in comparison with a set of portfolios formed from a given finite set of assets and use a modification of the Kolmogorov–Smirnov test statistic of McFadden (1989).

- *Estimation and inference for a generalised competing risk.* Athey and Haile (2002) were among the first to notice the connection between second-price auctions and generalised competing risks models. The issue is to estimate the distribution of bidders' private values given information on the auction winner. The distributions of private values satisfy a system of non-linear integral equations depending on the observed distribution of winning price. Komarova (2008) has established identification of the private value distributions and proposed an estimation method based on sieves. We will explore an alternative method which linearises the non-linear equation to express the estimation error as a type 2 linear integral equation which can be solved to obtain the limiting distributions of a transform of the objects of interest.

- *Non-parametric methods for behavioural models.* Recently, there has been renewed interest in approaches to economics that move somewhat away from the neoclassical tradition of treating people as always-rational decision-makers. These approaches focus on models that have more plausible sociological and psychological foundations in which people are influenced by others, may make mistakes and may come to regret their choices. However, an important question needs to be addressed: Whilst traditional economic models are, for all their shortcomings, falsifiable, is the same true of these 'behavioural' models? In other words, can observational data tell us when behavioural models are wrong? We plan to study this question in relation to several prominent behavioural models, including reference point models (Tversky and Kahneman, 1991) and models of quasi-hyperbolic discounting (Thaler and Shefrin, 1981). This work will develop our recent revealed preference research on the falsifiability conditions for rational choice models to explore whether these non-rational models might be tested in the same way. This work is closely related to work described in Section B2.1.1.

- *Aggregation and heterogeneity.* Unobserved heterogeneity is a central concern in modelling microdata – the researcher can never observe *all* the relevant variables. In applied work, the standard approach has been to pool data and to model the behaviour of single agents as a combination of a common component and an idiosyncratic component that reflects unobserved heterogeneity. Such an approach typically requires a combination of assumptions on the functional form of the statistical model and the distribution of unobservable heterogeneity (e.g. McElroy, 1987; Brown and Walker, 1989; Lewbel, 2001; Lewbel and Pendakur, 2009). We will look at this question using non-parametric revealed preference methods in order to determine the minimal partition of the data such that there is no need to rely on unobserved heterogeneity in order to model the data. In related work, we will investigate the non-parametric counterparts to the Gorman (1953) aggregation theorems and try to characterise the properties of microdata such that there exists a representative agent.

CeMMAP Fellows including Browning, Hausman, Matzkin, McFadden, Pakes, Pudney and Windmeijer are expected to help advance research in this area.

B2.2.2 Dynamics and Complexity

Strategic Importance of Research in this Area

Almost all important decisions in an individual's life are dynamic in nature: decisions about education, marriage and cohabitation, childbearing, health and nutrition, savings and investment, retirement planning, house purchase and the labour market – all have consequences in both the present and the possibly distant future. For many of these decisions,

individuals face enormous uncertainty. The financial crisis beginning in 2007 reminds us of this fact. There are complex interrelationships, decisions in one area having effects on outcomes in others.

Further empirical work is essential to understand how individuals behave in a dynamic complex environment. Knowledge is very limited at present and government cannot act in the best interests of the populace without this knowledge.

There are new rich longitudinal data sources which, with the application of rising computational power and new microdata methods, can bring insights into the decision processes of individuals in complex settings.

Strategic Priorities for Research in this Area

Topics to be researched include the following:

- *Investments in skill development.* We will build on Cunha et al. (2010) to study the educational lifecycle of children in both developed economies and developing economies. Data to be exploited include the UK Birth Cohort Studies, the US National Longitudinal Survey of Youth, and Understanding Society. The methodological developments from Section B2.1.3 will allow us to account for heterogeneity in cognitive skills and various types of non-cognitive skills. They will allow account to be taken of the complex dynamic process through which multiple types of investments (parental time and money, formal and informal day care, formal and informal schooling) taking place at different ages interact to produce social and educational outcomes. They will allow us to disentangle whether different investments are substitutes for one another or rather are complementary, and what are the most cost-effective forms of public investment.

- *The importance of heterogeneous preferences.* We will use methods described in Section B2.1.3 to study how unobserved heterogeneity drives outcomes in applications including saving behaviour (Alan and Browning, 2010; Attanasio et al., 2010; Lewbel and Linton, 2010), housing market behaviour (Bajari et al., 2010; Michelangeli, 2010) and labour market behaviour (Schroeder, 2010). Key questions to be explored concern the nature of the policy conclusions that can be drawn from the analysis and the relative importance of preferences, risk aversion, patience, beliefs about future housing prices and interest rates, information about future prices and income, and income shocks.

- *Semi-parametric dynamic discrete choice applications.* We will apply the results of Linton and Srisuma (2010) in specific settings to see how a semi-parametric approach affects the analysis of inventory restocking models.

- *Dynamic factor models.* We will investigate how the dynamic factor models discussed in Section B2.1.3 perform in data obtained from the Kantar World Panel. We will compare inflation forecasts with those obtained from aggregate data. We will apply these models to improve empirical understanding of behaviour in retail markets such as the retail grocery sector.

- *Non-parametric Euler equation identification and estimation.* We will study non-parametric identification and estimation of consumption-based asset pricing Euler equations. The standard way of writing these Euler pricing equations yields Fredholm integral equations of the first kind, resulting in the ill-posed inverse problem. However, these equations can be written in a form that equals (or, with habits, resembles) Fredholm integral equations of the second kind, having well-posed rather than ill-posed inverses. This framework can also allow durables, habits or both to affect utility.

CeMMAP Fellows including Adda, Blundell, Browning, Heckman, Magnac, Meghir, Pakes, Schennach and van den Berg are expected to contribute to this area.

B2.2.3 Networks, Interactions and Equilibrium

Strategic Importance of Research in this Area

In the past 20 years, research on social networks has exploded in a range of fields, including computer science, economics, sociology, physics and mathematics; see e.g. Carrington et al. (2005), Newman et al. (2006), Borgatti et al. (2009) and Jackson (2009).

Interactions in social networks affect an array of social and economic outcomes. For example, peer effects affect educational outcomes and choices to engage in behaviours such as smoking and crime. Social contacts affect job-finding probabilities in labour markets. Strategic interactions among firms affect pricing and store location decisions. At the economy-wide level, interactions determine prices, the matching of buyers to sellers and the matching of firms to workers.

It is clear that social networks, the interactions that occur within these networks and the global equilibrium outcomes that result from these structures have profound implications for understanding of a wide range of social and economic phenomena.

Moreover, new cross-sectional and longitudinal data sources increasingly have information not only on social outcomes but also on network structure and membership. For example, Understanding Society will contain a module with information on social networks and interactions. As a result, there is an opportunity to bring new data to bear to analyse the sophisticated theoretical work that has been done in the past two decades and to enrich it with models of heterogeneity developed by the Centre's research.

Strategic Priorities for Research in this Area

Networks

Topics to be researched include:

- *Detecting network structure.* The Centre will develop and apply methods to detect who is related with whom in social networks. The Centre will build on Newman et al. (2006) and adapt methods for detecting spatial dependence from the spatial statistics literature (Pinkse and Slade, 2010; Conley and Topa, 2007). Applications include networks of friends, job-finding networks and networks of CEOs in an industry.
- *Strategic network formation.* Social networks do not form at random; people choose to be a part of a network. The Centre will study what determines the strategic formation of networks. The work will extend that of Christakis et al. (2010) to allow strategic foresight and to consider the interaction of network formation and education and labour market policy. It will also extend Nesheim (2002) to study parents' choice of school for their children when both school quality and other characteristics of the location matter.
- *Social interactions in networks.* Using methods developed in Brock and Durlauf (2007) and Bisin et al. (2009), the Centre will exploit a range of data sources to study the importance of social interactions in determining educational outcomes, behaviour including smoking and crime, and job-search behaviour. This work will make use of the Centre's research on identification described in Section B2.1.1.

Strategic interactions

The Centre will conduct research on strategic interactions in industrial organisation. Topics to be studied include:

- *Retail store pricing behaviour.* Building on Smith (2004) and Beckert et al. (2009), the Centre will develop and estimate models in which retailers choose a menu of prices and models of retail location choice. The Centre will analyse these models using data from the Kantar World Panel and methods from Bajari et al. (2007) and

Holmes (2010). This work will exploit computational methods described in Section B2.1.4 to solve large integer programming problems.

- *Online auctions.* Using data from a UK online automobile auctioneer, the Centre will estimate auction models with endogenous entry, building on Bajari and Hortacsu (2004), Song (2007), Hendricks and Porter (2007) and Athey and Haile (2007).

Equilibrium

The Centre will work on three types of equilibrium models: equilibrium hedonic models, equilibrium search models and dynamic stochastic general equilibrium (DSGE) models. The three types of models allow researchers to study different aspects of individual and aggregate economic behaviour. Research on the econometrics of non-linear DSGE models is discussed in Section B2.1.3. Here we discuss research in the other areas:

- *Equilibrium hedonic models.* The Centre will apply Heckman et al. (2010) to US Census and American Housing Survey data to estimate structural equilibrium models of willingness to pay for environmental quality and job access. This will allow the Centre to estimate the welfare impacts of major changes in transport and energy policy. The Centre will work to extend the analysis to the UK using UK data sources.[16]
- *Equilibrium search models.* The Centre will continue to develop and estimate empirical equilibrium search models of the labour market. The Centre will use these models to improve understanding of rent sharing mechanisms in labour markets and to study multiple sources of productivity dynamics (e.g. human capital accumulation and idiosyncratic productivity shocks). The models will aim to fit linked employer–employee data in three dimensions: across workers, across firms and across time. The Centre will use the results for *ex ante* policy evaluation to evaluate policies including labour market reforms, government spending cuts and tax policies.
- *DSGE search models.* Building on Robin (2010), we will allow for both worker and firm heterogeneity, and study DSGE models with search and matching to deepen understanding of the welfare and inequality impacts of business-cycle fluctuations.
- *Marriage and matching.* Building on Lise et al. (2010), the Centre will develop and estimate models of marital matching and of job matching that allow for increasing amounts of heterogeneity and sorting to deepen understanding of the dynamics of sorting.

CeMMAP Fellows including Blundell, Browning, Heckman, Imbens, Manski, Matzkin, Meghir, Pakes, Porter, Robinson and Tamer are expected to contribute in this area.

B3   Engagement of Users and Beneficiaries

B3.1   Mission and Impact on Policy and Practice

The mission of the Centre is to advance knowledge in economic and social science through the development, improvement and application of tools for understanding human behaviour using microdata records of environment, circumstances, actions, decisions and outcomes.

The result of this work will be improved knowledge of the responses of people, households and firms to changes in environment, situation and prospects including those changes brought about by policy interventions. Good knowledge of responses to change has become critically important in the last two years as the world financial crisis has hit the UK and its people.

The Centre's work will improve the quality of decision-making in the public and private sectors, increasing the welfare of the populace. The Centre will advance knowledge, creating

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[16] Spatially disaggregate information including household income and detailed housing characteristics is not readily available from UK sources.

new research opportunities. Through its training and instructional activities, the Centre will improve skills and raise the quality of applied economic and social science research.

B3.2   Beneficiaries

There will be the following beneficiaries from the research and activities of the Centre, as set out in the 'Impact Summary' section of the Je-S form:

(A) Academic and professional economists, and social scientists and statisticians located in many disciplines who use non-experimental data to understand human behaviour and the influences on it.

(B) Statisticians, practitioners and theorists, and others who develop statistical procedures and research their properties.

(C) Designers of surveys and other instruments that gather information about individuals' circumstances, actions, choices and decisions and the outcomes that ensue. Designers of programme and policy evaluations. Designers and analysts of social and economic laboratory and field experiments.

(D) Policymakers and decision-makers in the public and private sectors who use evidence gathered from microdata to choose amongst alternative policies or actions and the analysts who process data to inform these decisions.

(E) The general public.

The ways in which these groups will benefit from the research and activities of the Centre are set out in the 'Impact Summary' section of the Je-S form and they are not repeated here.

B3.3   Knowledge Transfer

Knowledge transfer will take place through the Centre's publications, which are aimed at the world's leading journals, and through the conference and seminar engagements of its staff. However, the Centre places great weight on its training and instructional activities, its courses and masterclasses, on the workshops and conferences that it organises and on the international collaborations it creates and develops. These activities are now described in turn. Many of them involve a degree of user engagement; activities solely aimed at that are described in Section B3.4.

B3.3.1 Courses

Microdata methods are widely employed in applied economic and social research and there is substantial demand for elementary training in the use of these methods. To meet this demand, the Centre will mount an annual programme of 9 or 10 training courses. Each course focuses on a particular group of microdata methods, gives instruction in basic theory and works through a series of applications, showing how proprietary software can deliver results.

The courses will run for between two and four consecutive days and will be held in a purpose-built microdata laboratory at UCL's Economics Department. This is equipped with excellent audiovisual facilities, which include an interactive whiteboard that can display the image of the instructor's computer screen. Each participant's workstation also displays this image and indeed displays all materials sent to the whiteboard. In this way, participants can see precisely how software is employed when applying microdata methods. Participants will work through exercises, trying out microdata methods on real data sets. The instructor and an assistant (usually a PhD student) will pass among participants answering questions and resolving problems.

The team of instructors will include well-known figures in the field of microdata methods, e.g. Professor William Greene (NYU) and Professor Alan Duncan (Canberra). The courses will be aimed at a diverse audience including doctoral students, postdoctoral students and

junior faculty and practising researchers in the public and private sectors as well as in higher education. Some of the participants come from overseas to attend. The mix of students will vary from course to course depending on the topic covered.

The training received on the courses has direct impact on the analytic work done by those attending and a trickle-down effect through the teaching done by those attending who work in higher education.

The courses currently offered are always fully subscribed and receive good evaluations. The Centre plans to develop the programme of courses in response to changes in demand subject to it being able to source the highest quality instruction. From time to time, the Centre will poll its extensive network of contacts, which includes participants at its previous events, to determine demand for course topics. Late in 2010, the Centre will mount a course focused specifically on software. The topic is the use of STATA in microdata analysis and will be delivered by a staff member of Statcorp LP. More courses with this sort of focus and further cooperation with the software industry will be explored. New course topics under consideration include Modern Bayesian Microdata Methods, Spatial Microdata Methods and Methods of Financial Econometrics, Applied Semi- and Non-Parametric Modelling.

B3.3.2 Masterclasses

Microdata methods and practice are fast developing and there is demand for coherent concentrated overviews of dynamic subject areas. To meet this demand, the Centre will organise three or four masterclasses each year in which a leading contributor to an evolving field will take 40–100 participants from the foundations of a topic to its research frontier.

The Centre has a lot of experience in this area, having organised nine masterclasses in the three years since it became an ESRC Research Centre. Topics and instructors are listed in Annex 4. As can be seen, the instructors are indeed researchers of the highest calibre. The classes have been extremely popular with participants and instructors alike and they have received good evaluations.

Participants find attending one of these classes a very productive way of getting to grips with a new area or discovering the latest developments in an area with which they are familiar. For UK doctoral students (and indeed the many students from continental Europe who attend), the masterclasses give unrivalled opportunities for high-level instruction by the masters of the subject, people who they would not otherwise encounter in a classroom situation. Masterclasses are accompanied by extensive reading materials, much of which, subject to copyright restrictions, the Centre makes available on its website.

The audience for masterclasses is predominantly researchers in economic and social science, statistics and related disciplines. However, CeMMAP has organised classes that draw delegates from the private and public non-academic sectors. Examples are three classes in the area of empirical industrial organisation taught by Professors Jerry Hausman (MIT), Aviv Nevo (Northwestern) and Ariel Pakes (Harvard). The Centre will mount more classes with this sort of appeal.

In 2010–11, the Centre is organising masterclasses on 'Non-Parametric Likelihood: Methods and Applications in Econometrics' (Yuichi Kitamura, Cowles Foundation and Yale University), 'Social Interactions' (Charles Manski, Northwestern), 'Matching Models of the Marriage Market: Theory and Empirical Applications' (Pierre-André Chiappori, Columbia), 'High-Dimensional Econometric Modelling' (Victor Chernozhukov, MIT) and 'Market Microstructure and Asset Pricing' (David Easley and Maureen O'Hara, Cornell). These are diverse topics indeed, some directly concerned with microdata analysis and structural inference, others concerned with theory issues that guide model construction and identification. This mix reflects CeMMAP's view that effective microdata analysis requires careful consideration of the economic and social science context within which questions are posed and answers sought.

The Centre will develop its masterclass programme and expand the range of topics covered. Many of the Fellows in the Centre's network provide instruction in these classes and we seek their advice on topics to be covered. We will seek to run some cofunded and co-organised masterclasses so that we can expand the programme without additional cost to the Centre and develop classes in topics on the boundaries of the Centre's disciplinary interests. We will keep a close eye on developments in microdata methods and practice and on new talents as we create a masterclass programme which will make an extraordinary contribution to intellectual life in economic and social science both in the UK and further afield.

B3.3.3 Workshops and Conferences

The Centre will organise workshops and conferences aimed at a variety of audiences and interest groups.

For academic and professional research interests, the Centre will organise meetings adjacent to some of the masterclasses, enabling participants to hear particular presentations from the research frontier and a variety of viewpoints. The Centre will invite its UK and International Fellows to construct scientific programmes for meetings. The Centre will continue to co-organise meetings with its international collaborators. These various meetings will publicise the Centre's research, encourage feedback and bring new ideas into the Centre's research. The Centre's international meetings will help spread the word about the Centre's mission and successes, helping to put the Centre in a position where it can attract further funding post-2017.

In preparing this proposal, we polled the Centre's International Fellows, asking for their views on research issues likely to attract interest over the next seven years. The Centre will organise meetings to bring researchers and users together to discuss progress on some of these issues. Topics to be considered (and the Fellow proposing) include the following:

- Implementing boundedly rational models of choice (Hausman, Pakes)
- Progress in *ex ante* policy evaluation (Heckman)
- Non-linear panel data models (Newey)
- Identification and estimation with many sources of heterogeneity (Newey, Ridder)
- Microdata-based macroeconomic forecasting (Ichimura)
- Applied Bayesian semi- and non-parametric modelling (Imbens)
- Bringing partially identifying models into mainstream practice (Manski)
- Learning in complex decision problems (Pakes)

The Centre has deep interest in measurement and its impact on identification and inference. We will organise meetings with public and private sector data collectors to publicise the Centre's research on measurement and to allow us to assess issues requiring research. In the private sector, the Centre has a relationship with TNS Global Market Research. In the public sector, the Centre will work with the Understanding Society programme, with the English Longitudinal Study of Ageing (ELSA), with DEFRA and the Expenditure and Food Survey (EFS), and with the World Bank.

The Centre will organise meetings aimed at those with interests in policy-related issues and particular areas in which microdata analysis plays an important part in decision-making. The Centre will aim to stage at least one 'user engagement' conference per year. Following its current practice, the Centre will actively solicit participation from policymakers and private sector researchers using its network of contacts. Practitioners and policymakers will be asked to help plan the meetings, to present papers on pressing issues and to take part in panel discussions. Here are a few of the subjects on which we plan to have meetings:

- Household reaction to the crisis: savings, retirement and pension planning
- Understanding diet and nutrition choices
- Early life experiences and adult outcomes
- Measuring school performance

- Welfare, benefits and family formation

In addition, the Centre will introduce a new biennial conference at which some of the most talented PhD students in the UK and abroad working on microdata methods and applications will present their work. The scientific programme will be drawn up by Centre Fellows who will contribute to the conference as discussants. We will seek international collaborators and aim for a high international profile for this meeting.

B3.3.4 International Collaborations

The Centre will broadcast its research to the international community through its international collaborations which it will continue to develop in the future. These collaborations produce jointly organised conferences, joint research endeavours and opportunities for students to spend time studying away from their home institutions. They allow the Centre to expand its programme of conferences and the range of topics covered. The Centre will encourage its collaborators to send students on short visits.

For some time, the Centre has collaborated with the Econometrics Center at Northwestern University (NWU), organising joint conferences in 2008 in London and in 2009 and 2010 at NWU. The collaboration is planned to continue with a fourth meeting planned for London in June 2011. There is also a close collaboration with the Cowles Foundation at Yale University which we aim to develop.

In August 2010, we joined with Cowles and the Gonghua School of Management of Peking University to stage a conference in Beijing, which opened the way to further cooperation with Peking University. The Centre will develop other collaborations in Asia and Australasia, e.g. with new centres built on the CeMMAP template due to start at Tokyo University and the National University of Seoul and with the National Centre for Social and Economic Modelling at the University of Canberra.

CeMMAP will continue to develop its collaboration with CIREQ in Montreal (we mounted a joint conference with CIREQ in September 2010) and, in Europe, with: CEMFI in Madrid, the Tinbergen Institute in Amsterdam and Rotterdam, ANR in Paris, the Center for Applied Statistics and Economics at Humboldt University and IFAU at Uppsala University. Additional opportunities for collaboration will be sought.

B3.4   User Engagement

Many of the activities described above bring close engagement with users. In this section, some other aspects of user engagement are sketched.

B3.4.1 Engagement with Policymakers and Practitioners

The Centre will continue to be located at the Institute for Fiscal Studies, a respected and influential think-tank. CeMMAP staff, visitors and students will have daily contact with researchers and policy analysts at IFS and the Centre's expertise in microdata analysis will be influential in developing the data-based work of the IFS, thereby influencing the process of policy analysis. We expect IFS staff to attend CeMMAP training courses, seminars, conferences and masterclasses. Some of the work done at IFS is policy evaluation executed under contract from government departments and CeMMAP's expertise will find application here too.

CeMMAP staff will continue to engage with and respond to users in the public and private sector. For example, there are expected to be continuing relationships with DEFRA and the Expenditure and Food Survey (the merged FES and NFS), with the Competition Commission, with EDF Energy, with a major UK vehicle auction firm and with TNS Global Market Research. The Chief Executive and Director General of ONS sits on CeMMAP's Advisory Board.

A new opportunity ripe for development lies in the development of joint events with Public Economics UK (PEUK). PEUK is an academic group sponsored by HMRC and the Treasury which holds an annual conference and workshops at which both academics and HMRC and Treasury officials discuss research and research priorities. While PEUK's main expertise lies in the economic theory relating to tax and public finance, it is clear that HMRC the Treasury's research priorities also extend to empirical questions that fall within CeMMAP's area of expertise: the estimation of demand systems and the creation of tax simulation models using microdata are but two examples. Cooperation with PEUK provides an excellent chance to respond to these needs and CeMMAP intends to develop this in Phase II.

The Centre will seek to develop relationships with users of the results of microdata research. We anticipate developing a working relationship with the newly created Office for Budget Responsibility. We intend to develop working relationships with the International Bank for Reconstruction and Development, whose lending policies are supported by much microdata collection and analysis. The Centre will seek to develop other new relationships.

B3.4.2 Engagement with Media and the General Public

The Centre has full access to the IFS database of media contacts and facilities, such as an ISDN line when interviews are requested. The External Relations team at CeMMAP is very experienced in handling media enquiries and writing press releases in a simple and accessible style. We will draw on this resource where appropriate. In addition, our presence at large national and international conferences helps to disseminate our research to the media.

Our joint ventures with other organisations, such as IFS, ADMIN (at the Institute of Education) and LEMMA (at Bristol), ensure that we cover topics such as 'Measuring School Effectiveness', which has a broad appeal and is of interest to people from a variety of disciplines as well as the general public and media. We will continue to work in partnership with these organisations and will use the expertise of the External Relations team to communicate in a way that is accessible.

B3.4.3 Engagement with ESRC Investments

The Centre will continue to cooperate with ESRC investments. It will work closely with ESRC's National Centre for Research Methods (NCRM) and will remain one of the NCRM Associate Organisations. CeMMAP will continue to contribute to the Research Methods Festival. The Centre has joined a group based at the Institute for Education and IFS to create a NCRM node under the heading of 'Programme Evaluation for Policy Analysis' and will seek further funding which complements the activities of the NCRM. The Centre will work with the Understanding Society programme to maximise the outputs from the investment in the UK Household Longitudinal Study. The Centre Director sits on the Scientific Advisory Committee of Understanding Society. Stephen Jenkins, a Co-I on the Understanding Society programme, sits on CeMMAP's Advisory Board.

B3.4.4 Publicity and Website

The Centre benefits from the services of the External Relations team at IFS, which is responsible for dissemination of research findings to academics, policymakers, the private sector and the general public. This includes managing the marketing and design of CeMMAP publications, the website and all promotional materials.

Details of Centre events will be circulated to over 2,000 targeted contacts via email and will also be listed on the Government Economic Service (GES) website so that all economists within the civil service are aware of our activities. We will also send details of forthcoming events to the NCRM, ESRC and other relevant and influential organisations, which will feature them in newsletters and on their websites. In this way, we can ensure the widest possible dissemination to a diverse range of stakeholders.

As well as electronic marketing, the Centre produces fliers and posters listing forthcoming conferences, workshops and training courses and drawing attention to the CeMMAP website. These fliers and posters are sent to our extensive network of Fellows and International Fellows, the heads of most economics departments within UK universities, a number of national and international consultancies and banks and the Government Economic Service. In addition, we ensure that our fliers appear in delegate packs at a number of national and international conferences. These conferences are organised by organisations such as the Royal Economic Society and the Econometric Society and enable us to market the Centre to an additional 3,000 individuals each year.

The Centre will further develop its website, which carries the Working Paper series and information about CeMMAP news, events and visitors, and attracts over 15,000 visitors a month.

B4   Relationship to the ESRC Mission

B4.1   ESRC Mission

The Centre for Microdata Methods and Practice will contribute to the three elements of the **Mission of the ESRC** as follows.

ESRC Mission 1. To promote and support, by any means, high quality basic, strategic and applied research and related postgraduate training in the social sciences.

The Centre will pursue an agenda of top-quality basic research. It will create new research tools and develop, refine and improve understanding of the performance of existing research tools. This will add to the armoury of methods used by researchers and practitioners who employ observational data to draw inferences about the determinants of behaviour and the effects on outcomes of changes in circumstances.

The Centre will conduct high quality applied research contributing to the economic and social science knowledge base while guiding the development of tools and demonstrating their use. The methodological development work of the Centre will be driven by research questions and measurement issues arising in its applied research.

The courses, masterclasses and conferences offered by the Centre will contribute to postgraduate learning. These training activities will continue to be an invaluable complement to training available to postgraduate students at their home institutions. In particular, these courses will provide UK postgraduate students with unique access to leading international researchers, masterclasses and conferences, and with training in frontier methods of a breadth and level of specialisation that no single educational institution could replicate.

ESRC Mission 2. To advance knowledge and provide trained social scientists who meet the needs of users and beneficiaries, thereby contributing to the economic competitiveness of the United Kingdom, the effectiveness of public services and policy, and the quality of life.

The Centre will provide training in the use of microdata methods at basic and advanced levels. It will seek opportunities to develop bespoke courses tailored to the needs of particular organisations. The Centre's courses will advance the knowledge and skills of academic researchers and of economic and social scientists working in the public, private and voluntary sectors.

The Centre's research and its training work will improve the quality of decision-making, much of which is based on information gained from microdata, thereby contributing to the economic competitiveness of the United Kingdom, the effectiveness of public services and policy, and the quality of life.

ESRC Mission 3. To provide advice on, and disseminate, knowledge; and promote public understanding of the social sciences.

The Centre's programmes of workshops, conferences and masterclasses will disseminate knowledge of its research and of microdata methods and practice in general. The Centre's network of visiting international researchers will give UK academic and professional economic and social scientists access and exposure to microdata methods research at the highest level.

The microdata methods that the Centre studies are developing fast and researchers and practitioners need to regularly refresh their knowledge. The Centre will create and update web-based resources giving information about particular methods and best-practice applications.

The Centre will provide a UK-based centre of expertise which practitioners and researchers can consult and it will develop its advisory work to private and public organisations.

During its first three years under the auspices of the ESRC, the Centre has shown, as documented in Section A of the Case for Support, that it can make substantial contributions to ESRC's mission in all three aspects.

B4.2   Strategic Objectives of the ESRC

The Centre for Microdata Methods and Practice will contribute to the *five strategic objectives of the ESRC* as follows:

- *Impact through World-Class Research.* The Centre will conduct innovative research at the world frontier, develop new methods and apply them to substantive applied problems demonstrating best practice, publish its research in the world's leading journals and maintain an international hub of research excellence.
- *Impact through Skilled People.* The Centre's programme of courses, masterclasses, workshops and conferences will deliver training to early- and mid-career researchers and practitioners.
- *Impact through Infrastructure.* The Centre will develop leading-edge research methods and conduct research into measurement, contributing to the development and exploitation of a world-class data infrastructure for the UK. The Centre's work will add value to ESRC and other investments in data resources.
- *Impact through International Leadership.* The Centre will develop its extensive international collaborations with research centres in the USA and Europe and forge new relationships in Asia and Australasia.
- *Impact through Partnerships.* The Centre will expand and develop new relationships with government departments, regulatory bodies and private sector organisations.

B4.3   ESRC Strategic Challenges

The mission of the Centre for Microdata Methods and Practice is to advance knowledge in economic and social science through the *development, improvement and application of tools for understanding human behaviour* using microdata records of environment, circumstances, actions, decisions and outcomes. The work done to this end contributes to *all of the ESRC's strategic challenges*. The Centre's work will improve the quality of policy formation and evaluation. The training and instruction the Centre will deliver help to give researchers the skills required to meet the challenges. The Centre will also make specific contributions, including the following:

- *Global Economic Performance, Policy and Management.* The Centre's work on methods and measurement will aid exploitation of longitudinal data resources and improve understanding of responses to change. Understanding the response of households and firms to economy-wide developments and changes in uncertainty

(such as the financial crisis) is critical to economic policy and management. The Centre's work on DSGE models (see Section B2.1.3) will provide tools to inform policymakers on the forces driving the dynamics of the economy. Its work on housing market models (B2.2.2) will increase understanding of how households react to income shocks, interest rate shocks and changes in the mortgage market. Its work on unemployment, wage inequality and the business cycle (B2.2.3) will explain the interactions of business cycles with wage dynamics.

- *Health and Wellbeing.* The Centre's work on tools for studying rich panel data sources will be instrumental for using longitudinal data, including Understanding Society and ELSA, to analyse changes in health and wellbeing. Specific projects will look at health and nutrition using panel data on retail supermarket purchases (B2.2.1), study saving, pensions, ageing and health using methods that are robust to unobserved heterogeneity (B2.2.2) and develop methods to integrate new data on biomarkers (B2.1.5) into economic analysis.

- *Understanding Individual Behaviour.* The Centre's research is geared toward understanding individual behaviour using the most robust analysis feasible. All the applications of the Centre's methods detailed in Section B2.2.1 are aimed at understanding individual behaviour. In addition, the Centre will seek to improve understanding of the importance of bounded rationality in understanding individual behaviour (B2.2.1 and B2.1.3). The Centre will also seek to improve understanding of the role of networks, social interactions and equilibrium phenomena in influencing individual behaviour (B2.2.3).

- *New Technologies, Innovation and Skills.* Education and skill formation is one of the primary areas of the Centre's applied research (B2.2.1, B2.2.2 and B2.2.3). In addition, the Centre will develop computational and statistical methods to analyse high-dimensional datasets from both public and private sector sources (B2.1.2 and B2.1.4). The Centre will continue to work with private sector companies to develop new technologies to analyse market research data on consumption patterns and data on online auctions (B2.1.3 and B2.2.1). We will also research and advise on ways to make best use of the data that new digital technologies naturally generate.

- *Social Diversity and Population Dynamics.* The Centre will conduct research on intergenerational mobility as part of its work on the educational lifecycle of children (B2.2.2). The Centre will also conduct research on family bargaining and marital matching (B2.1.1 and B2.2.3). Finally, the Centre's work on networks and social interactions will increase understanding of how the structure and strength of social networks determine social outcomes (B2.2.3).

B5   Work Plan

Personnel

For Phase II, Professor Oliver Linton (LSE and CeMMAP Fellow) joins the team as Co-Investigator. As described in Attachment 2.19.2, he will work with the other Investigators to set the research agenda of the Centre. His skills and experience in statistical and econometric theory will be invaluable for much of the research programme described below. Professor Simon Lee, Co-Investigator up to July 2010, has left the Centre for a position at the National University of Seoul. He will continue with the Centre as a Fellow, retaining a visiting position at the Institute for Fiscal Studies. Dr Thomas Crossley (Cambridge and IFS) joins the team as a named researcher. His broad research interests and skills complement the skills of the continuing research team. He will lead several of the research projects described in Section B2. The balance of seniority on the team is excellent, with three professors, three readers and five lecturers. We expect promotions in time and some turnover and will endeavour to maintain a good junior–senior balance.

Research

The research of the Centre will evolve over the period 2012–17 in several strands as set out in Section B2. Each of the strands will be addressed throughout the period by one or more of the Centre's research staff. There is a natural cycle of theoretical development, followed by study of computational issues and then implementation in practice. Results in one strand (e.g. identification) are likely to stimulate research in others (e.g. estimation, inference and testing). Experience in application is likely to prompt further theoretical development. The process will be monitored, and, where necessary, efforts redirected and new resources sought.

Conferences and Workshops

The Centre will host a re-launch conference in the second half of 2012. This will feature Centre Fellows and other leading international researchers presenting papers that provide an in-depth overview of one facet of the frontier of microdata methods and practice in 2012. The conference will serve to update the details of the research agenda and bring to light new discoveries and new promising areas of research that emerge in 2010–12.

Each year from 2012 to 2017, the Centre will host at least four conferences or workshops. These will be scheduled 12–18 months in advance and will be planned to contribute to and disseminate results of the Centre's research. For topics that naturally have both an academic and a non-academic audience, the Centre will publicise and seek input from non-academic contacts and networks. In addition, at least one of the workshops each year will actively solicit non-academic users as co-organisers and participants in order to maximise interactions between academic and non-academic users of the Centre's research.

In each of 2013, 2015 and 2017, the Centre will organise an international conference at which the most talented PhD students in the UK and abroad working on microdata methods and applications will present their work.

Each year, additional workshops will be planned around visits of Fellows and around masterclasses and other Centre activities. We will continue to seek collaborators and cofunders so that the Centre's programme of conferences can expand and cover wider ranges of topics within the limits imposed on Phase II funding.

Masterclasses

Each year from 2012 to 2017, the Centre will aim to host at least three masterclasses. These will be planned one to two years in advance, beginning in 2011–12. Masterclasses are in place for 2011–12 and are in the advanced planning stage for 2012–13. Specific topics and tutors will be chosen based on assessment of the most important topics and talented speakers in the fields of microdata methods and based on relevance to the Centre's research programme. The Centre will seek a balance of speakers that appeal to both general social science researchers in the public, private and tertiary sectors who use microdata methods and to academic researchers seeking an in-depth overview of the frontier of a field of research.

Training Courses

Each year from 2012 to 2017, the Centre will aim to host nine training courses targeted at social science researchers in the public, private, tertiary and academic sectors. These courses will offer a hands-on training experience in how to analyse microdata in practice. Beginning in 2011–12, the programme of courses will be planned a year in advance. Each year, the Centre will solicit feedback from students on its existing courses and from public, private and third sector organisations to gauge what training courses are in high demand so that the Centre can adjust its programme of offerings. In this way, the programme of courses will be adjusted to maximise its impact on users and beneficiaries of the Centre's activities.

Seminars

The Centre will host a weekly seminar series during academic term periods supplemented by additional seminars presented by visitors, UK Fellows and International Fellows. The seminar

series will be planned 6–12 months in advance. Speakers and topics will be chosen to exploit visitors and to coordinate with the research activities of the Centre. The Centre will schedule meetings between Centre staff and students and seminar speakers and visitors to exchange ideas and to discuss research problems.

Visitors

The Centre will schedule visitors on a continual basis throughout the term of the grant. Visitors contribute to the seminar series, to the masterclasses, to the workshops and conferences and to the research agenda of the Centre.

Website

The Centre will maintain its website as an archive of its activities and findings from 2001 to the present, as a resource for users of microdata methods and as an active interactive tool for participating in the Centre's activities. In 2011, the Centre will assess the current website and compare it with other websites throughout all sectors to assess whether significant changes are needed.

PhD Scholars

In 2011–12, the Centre will aim to recruit one or two PhD scholars to start in Autumn 2012. In 2012–13, the Centre will aim to recruit one or two PhD scholars to start in Autumn 2013. The total number of scholars will be three.

Each scholar will be assigned a primary and a secondary supervisor to oversee their PhD research. In addition to enrolling in the PhD programme at UCL, the scholars will attend seminars, masterclasses and workshops offered by the Centre. They will work closely with Centre staff working in their areas of research. They will be expected to complete their PhDs in 2015 and 2016 respectively.

Management

In 2011, provision of high-performance computing equipment will be put out to tender for purchase and installation in 2012.

In 2012, the Advisory Board will be asked to review its membership and any new appointments will be made.

Future Funding

Throughout the second phase of ESRC Centre funding, additional research funding will be sought as opportunities arise from sources such as the Leverhulme Trust, the British Academy, the Nuffield Foundation and the European Research Council. The Centre will respond to ESRC calls for research that are within its expertise. The Centre will also respond to calls for research proposals put out by government departments and seek to develop funded collaborations with private sector organisations that benefit the research of the Centre while delivering useful results to the clients.

The Centre will continue to expand its international research interests through collaborations with international partners and will seek to expand its training programme by offering its services to international agencies such as the World Bank.

With a high international profile and these diverse interests, we expect to be able to attract funding to take the Centre onward past 2017. The Institute for New Economic Thinking funded by a $50m pledge from George Soros, is an example of the type of funder that may be interested in supporting developments, such as those studied by the Centre, that bring fresh thinking to the modelling and understanding of human behaviour and thereby lead to higher-quality economic and social decision-making.

B6 Suggested Key Performance Indicators (KPIs)

Based on the work plan and scientific programme and having regard to the funding available for Phase II, the Centre proposes the following Key Performance Indicators and targets. These fall under headings agreed with ESRC for the first five-year period of funding with some adjustments to targets to reflect changes in the scientific, user engagement and knowledge transfer programme.

The Centre will seek to meet or exceed these targets. Figures are annual or annual averages unless stated otherwise.

1. Scientific outputs
   a. 10 articles in refereed international journals
   b. 30 working papers in the CeMMAP series, of which 10 by Centre staff
   c. 40 seminar presentations, 12 conference presentations, 2 invited addresses
   d. 20 research seminars organised

2. International and interdisciplinary collaboration
   a. 4 presentations at conferences abroad
   b. 30 international visitors hosted
   c. 100 international participants at UK-based Centre events
   d. 1 interdisciplinary event
   e. 1 meeting co-organised with an international partner

3. Engagement with non-academic stakeholders
   a. Training courses:
      i. 9 courses organised
      ii. 25 public sector participants
      iii. 10 private sector participants
      iv. 20 international participants
   b. Website: 15,000 visitors per month

4. Capacity building
   a. 3 masterclasses organised
   b. 5 conferences or workshops organised
   c. 1 PhD scholar conference organised every other year
   d. 800 participants from higher education
   e. 100 participants from abroad
   f. 50 participants from outside higher education
   g. 3 Centre PhD students supervised over 5 years
   h. 1 postdoctoral researcher mentored in 5 years
   i. Website: 4 new resources added

5. Cofunding and organisational effectiveness
   a. Additional research funds sought: £100,000
   b. Minimal staff turnover
   c. Annual Advisory Board meetings
   d. Biannual Troika meetings
   e. Financial management: sound and thrifty budgeting supported by quarterly monitoring against an agreed cash limit

Appendix – Detailed Financial Tables

This Appendix provides detailed financial tables for financial years 2007/8 (9 months), 2008/9, 2009/10 and 2010/11 (3 months). The tables provide details on the budget agreed in the Centre's contract, the actual expenditure made and the amounts received from ESRC.

	Financial Year 2007/8 (9 months)		
	Budget	**Actual Expenditure (at full cost)**	**ESRC Contribution**
Academic Related Staff	219,005	224,280	192,881
Clerical Staff	14,946	22,455	19,311
Indirect Costs	100,029	89,484	76,957
Travel and Subsistence	36,489	13,593	11,690
Other Costs	39,004	33,187	28,541
Estates	28,784	11,064	9,515
Equipment	57,022	42,175	36,270
Total	495,279	436,238	375,165

	Financial Year 2008/9		
	Budget	Actual Expenditure (at full cost)	ESRC Contribution
Academic Related Staff	299,839	302,653	260,281
Clerical Staff	20,431	27,768	23,880
Indirect Costs	136,935	129,575	111,435
Travel and Subsistence	49,952	56,610	48,684
Other Costs	53,394	57,465	49,420
Estates	39,404	41,648	35,818
Equipment	0	1,651	1,420
Total	599,955	617,370	530,938

	Financial Year 2009/10		
	Budget	**Actual Expenditure (at full cost)**	**ESRC Contribution**
Academic Related Staff	308,036	356,374	306,482
Clerical Staff	21,041	29,639	25,489
Indirect Costs	140,701	181,169	155,805
Travel and Subsistence	51,326	78,144	67,204
Other Costs	54,862	76,444	65,742
Estates	40,488	58,231	50,079
Equipment	0	2,356	2,026
Total	616,454	782,357	672,827

	Financial Year 2010/11 (3 months)		
	Budget	Actual Expenditure (at full cost)	ESRC Contribution
Academic Related Staff	76,871	104,509	89,878
Clerical Staff	7,661	7,597	6,533
Indirect Costs	36,143	42,920	36,911
Travel and Subsistence	13,184	42,963	36,948
Other Costs	14,093	4,398	3,783
Estates	10,400	13,795	11,864
Equipment	0	70	60
Total	158,352	216,252	185,977

Here is a summary of budget and expenditures over the life of the Centre under ESRC funding from July 1st 2007 to June 30th 2010.

	Summary to 30 June 2010 (36 months)		
	Budget	**Actual Expenditure (at full cost)**	**ESRC Contribution**
2007/8 (9 months)	495,279	436,238	375,165
2008/9	599,955	617,370	530,938
2009/10	616,454	782,357	672,827
2010/11 (3 months)	158,352	216,252	185,977
Total	1,870,040	2,052,217	1,764,907

For the first 36 months the Centre has underspent its budget by about 5.5% when comparing the actual ESRC contribution to the original budget. Most of this underspend has been on DI salaries but with new appointments made in the autumn of 2009 it is expected that the final expenditure will be in line with the budget.

The overall cash limit was reduced early in 2010 in line with the national agreement on indexation which has reduced the total contract price by some £30,000. Since IFS is not in receipt of any underpinning grants it has had to contribute just over £285,000 towards costs to date.

Looking forward, the budgets up to June 30th 2012 are expected to be as follows:

	Financial Year 2010/11		
	Budget	**Actual Expenditure (at full cost)**	**ESRC Contribution**
Academic Related Staff	304,927	400,000	344,000
Clerical Staff	21,200	30,000	25,800
Indirect Costs	144,570	175,000	150,500
Travel and Subsistence	52,737	55,000	47,300
Other Costs	56,371	55,000	47,300
Estates	41,601	40,000	34,400
Equipment	0	0	0
Total	621,406	755,000	649,300

	Financial Year 2011/12		
	Budget	**Actual Expenditure (at full cost)**	**ESRC Contribution**
Academic Related Staff	309,854	434,169	373,385
Clerical Staff	21,500	30,000	25,800
Indirect Costs	148,515	185,000	159,100
Travel and Subsistence	54,176	60,000	51,600
Other Costs	57,909	60,000	51,600
Estates	42,736	40,000	34,400
Equipment	0	0	0
Total	634,690	809,169	695,885

	Financial Year 2012/13 (3 months)		
	Budget	**Actual Expenditure (at full cost)**	**ESRC Contribution**
Academic Related Staff	80,456	135,000	116,100
Clerical Staff	5,500	7,750	6,665
Indirect Costs	37,978	55,681	47,886
Travel and Subsistence	13854	15,000	12,900
Other Costs	14,808	15,000	12,900
Estates	10,928	12,491	10,742
Equipment	0	0	0
Total	163,524	240,922	207,193

The overall summary therefore for the remainder of the period is expected to be as follows.

	Summary to June 2012		
	Budget	Actual Expenditure (at full cost)	ESRC Contribution
To March 2010	1,711,688	1,835,965	1,578,930
2010/11	621,406	755,000	649,300
2011/12	634,690	809,169	695,885
2012/13	163,524	240,922	207,193
Total	3,131,308	3,641,056	3,131,308

As an independent research institute the Institute for Fiscal Studies receives no underpinning grant. However it remains committed to funding the difference between the actual expenditure and the amount received from the ESRC under fEC arrangements. In total for this grant it is expected to be some £500,000 over the lifetime of this first contract.

Here are details of all the funding secured by the Centre during the period of the award (including the ESRC award).

Funding Source	Amount	% of total funding
ESRC Centre	£3,131,308	81.5%
Other ESRC	£216,178	5.6%
EU	£495,811	12.9%
Total	£3,843,297	100%