The Influence of Unsecured Debt on Consumer Responses to an Adverse Labour Market Shock – implications from a rational agent model*

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Abstract

We use a rational agent model of savings and labour supply to considering how consumer responses to a worsening of labour market opportunities could be influenced by the extent of private sector indebtedness. Our simulations indicate that responses to a negative labour market shock depend crucially upon the forms of credit rationing to which the population is subject, the expectations of the population, and the time horizon of concern. If the shock is anticipated, or is not recognised, then short-run consumption responses to the regime change projected by our model tend to be small. If, in contrast, the population is surprised by the regime change, and perceives the change to be permanent, then simulated consumption responses in the year following the negative labour market shock are sufficiently large to pose a risk to macro-economic stability. Furthermore, these short-run consumption responses are found to be exaggerated by the imposition of strict credit limits – even where the population is not immediately at risk of experiencing such limits – and dampened when there is a positive relation between the value of debt and the associated interest charge. Consumption responses tend to be amplified when considered over a longer time horizon, although the method of credit rationing is made less important.

1 Introduction

The preceding decade has been something of a golden age in the United Kingdom, characterised by high growth, low unemployment, low inflation, and a high degree of stability in each of these three economic indicators. The one potential blemish on this record is the extent to which private sector indebtedness has grown over the same period – rising from 65% of annual GDP in 1997 to 99% of annual GDP – just over £1.3tn – today (2007).[1] This rising debt has been interpreted by many commentators as an indication that the golden age cannot last – that we are living beyond our means, and that sooner or later the mounting debts will need to be repaid.[2] Such fears have motivated a substantial research effort, with the general finding that the financial strain associated with current levels of private sector borrowing falls well within the historical experience. Yes, so the argument goes, we are borrowing more

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[1] The value of total personal sector loans reported by the Office for National Statistics, ONS, for 1997Q1 is £508bn, and for 2007Q1 is £1,301bn (code NNRE). Annual GDP reported by the ONS for the UK to 1997Q1 is £780bn, and to 2007Q1 is £1,319.485bn (code YBHA).

[2] Summers notes that the "great danger is that optimism can become a self-denying prophecy if it leads to excessive extension of credit, irrational capacity creation and unsustainable levels of spending", Comment, *Financial Times*, 26 Dec 2006. Similarly, Samuel Britain states that "There is a whiff of *The Last Days of Pompeii* in the atmosphere", with reference to the current use debt by "Anglo-American shoppers and home owners", Comment, *Financial Times*, 25 May 2007.

than ever before, but we also enjoy higher incomes and higher growth, and these make the mounting debts affordable. The key assumption that underlies this conclusion is the economic context against which the mounting debts are compared – in context of the prevailing economic environment there is ample empirical research to suggest that the existing consumer debt is of little cause for concern. But what if the economic environment were to deteriorate? How might the accumulated indebtedness of the private sector influence consumer responses to a less buoyant, more uncertain economic environment? We use a rational agent model of savings and labour supply to explore this issue, by considering how consumer responses to a worsening of labour market opportunities could be influenced by the extent of private sector indebtedness.

The benign nature of the economic environment has been widely cited as a reason why we should not worry too much about the historically high levels of consumer debt that are currently observed. In a speech made in 2004 by the then Deputy Governor of the Bank of England, for example, it was suggested that various aspects of the benign economic environment "have given households the confidence that present levels of debt are quite rational from the point of view of their balance sheets".[3] At the same time, the Department for Trade and Industry expressed the view that "Overall, the maintenance of macro-economic stability with low inflation, low interest rates and high levels of employment is expected to ensure that, for most households, existing levels of debt are sustainable".[4] As recently as November 2006, it was concluded that the extent of personal sector indebtedness was unlikely to influence monetary policy because it was unlikely to have a significant influence on overall consumer spending.[5]

In spite of the above observations, historical experience suggests that care should be exercised before discounting the influence that private sector indebtedness has on consumer spending. In the US, for example, Olney (1999) reports that the Great Depression was in part attributable to the rapid accumulation of instalment credit during the 1920's.[6] Punitive treatment of credit payment default meant that, when financial stress hit in the 1930's, households cut back sharply on their consumption rather than default on their loan repayments. This, Olney suggests, played an important role in turning a recession into a depression.

It may be argued that a repeat of the above scenario is made less likely by ongoing policy reform undertaken in the UK and elsewhere to soften the treatment of credit payment default. This is indeed

[3] *Puzzles in today's economy - the build up of household debt*, speech by Sir Andrew Large, Deputy Governor of the Bank of England, at the Association of Corporate Treasurers' Annual Conference, Newport, 23 March 2004.

[4] DTI, *Tackling Over-Indebtedness – Action Plan 2004*, p. 3.

[5] *Inflation Report*, November 2006, Bank of England, p. 15, and Waldron & Young (2006).

[6] The consumer credit boom of the 1920's in the US followed the recognition by Henry Ford and Alfred P. Sloan that selling to the mass-market was facilitated by the provision of methods of finance. The same was not true in the UK, where consumer credit did not expand rapidly until after the Second World War. The reduction observed for GDP during the 1930's in the UK is largely accounted for by the contemporary fall in exports (see Corner (1956) for an evaluation of the role played by exports in causing the Great Depression of 1930 in the UK, and Sefton & Weale (1995), p. 184, Table A.2 for related data).

true – up to a point. Such policies are likely to reduce consumer responses to adverse circumstances *at any given level of indebtedness.* The same policies also, however, reduce precautionary incentives to limit the accrual of debt. This second effect implies that such policies may, perversely, exaggerate the influence that an economic downturn has on household consumption, a concern that seems warranted given the unprecedented level of debt now held by the private sector.[7]

We use a rational agent model of the household to explore the responsiveness of consumer demand to a worsening of labour market opportunities. The model assumes that consumption and labour supply decisions are made as though individuals maximise expected lifetime utility, given their existing circumstances, preferences, and beliefs regarding the future. The model has been specifically designed to capture key characteristics identified by the empirical literature as having an important influence on household saving and indebtedness. We explore consumer responses to a change in labour market opportunities, paying particular attention to credit constraints, expectations, and time horizons.

Outline of the report

Section 2 describes contemporary data of private sector indebtedness in the United Kingdom. A non-technical description of the rational agent model, and the environmental change considered for analysis are provided in Section 3. Simulated behavioural responses to a worsening of labour market opportunities are reported in Sections 4 and 5, focussing specifically on how these responses depend upon the indebtedness in a population. Section 4 considers the influence of individual specific circumstances on behavioural responses to a deteriorated labour market, and how these are affected by alternative models of credit rationing. In contrast, Section 5 explores the influence of expectations on indebtedness and behavioural responses to the environmental change. A summary and interpretation of the analytical findings are provided in the conclusion.

2 Recent Trends in Personal Sector Indebtedness

Substantially different measures of private sector indebtedness tend to be reported by macro and micro data sources, an observation that is commonly attributed to deficiencies in the micro data. This is because financial institutions are consulted to obtain data regarding personal sector indebtedness for use in the National Accounts, whereas micro data sources rely upon the responses of individuals to survey questionnaires. It is of note in this context that, although details regarding the value of mortgage debts are commonly found to match fairly closely between the two data sources, micro data usually under-represent the value of unsecured indebtedness described by the National Accounts. This

[7] It is interesting to note that high street banks have recently blamed "aggressive marketing of personal bankruptcies and insolvency agreements to consumers in financial difficulty for a dramatic rise in UK bad debts", head-line report, *Financial Times*, 01 Aug 2006.

has been taken to suggest that individuals may be unable or unwilling to accurately report the value of various forms of unsecured loans that they hold (see Antoniewicz et al. (2005) for details regard data in Canada, Italy, and the United States). The current section consequently focuses upon observations drawn from National Accounts data.

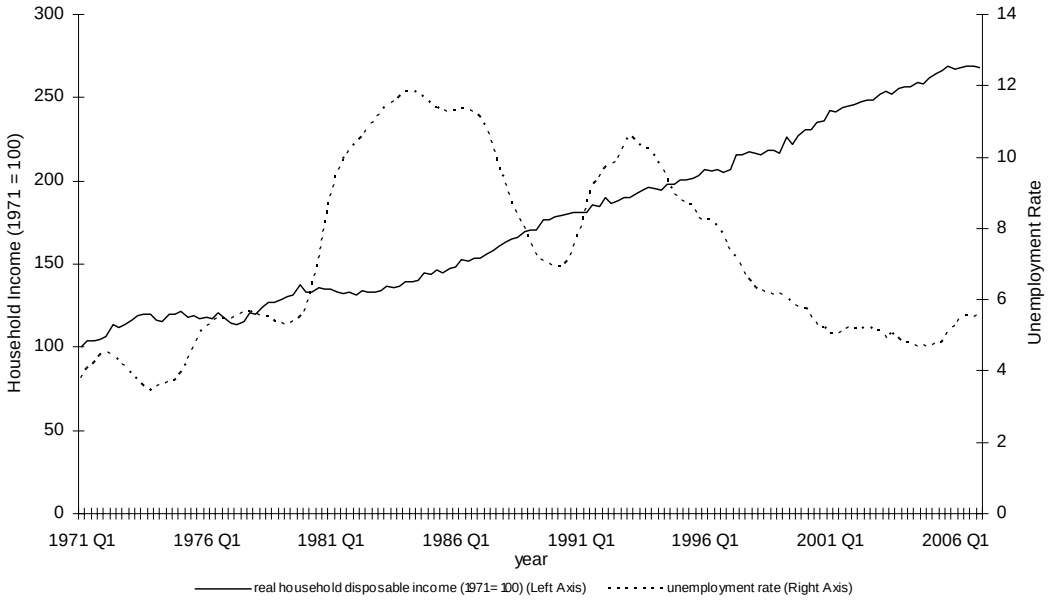
The period following the housing market crisis of the early 1990's has been particularly favourable for holding debt in the UK. Figure 1 displays five key statistics that place the current borrowing environment in its historical context. The top panel of the figure reports quarterly data for income growth and fluctuations in the unemployment rate observed since 1971Q1 (the earliest date for which data are available). These data indicate that real disposable household income has grown reasonably smoothly at a rate of 2.8% per annum during the last three and a half decades, and is now 2.7 times what it was in 1971.[8] At the same time, the unemployment data reveal a substantial degree of temporal variation, peaking at values in excess of 10% during the recessions of the early 1980's and early 1990's, between troughs that are as low as 3.4% (1973Q4). In this context, the last 10 years are notable for the low and stable unemployment rates observed.

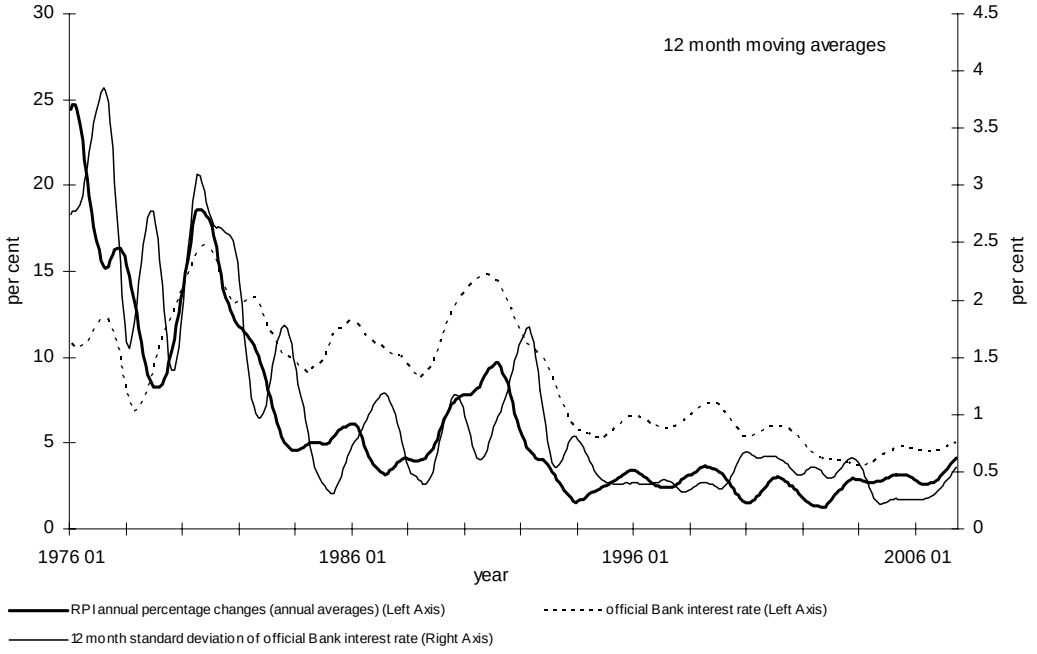
The bottom panel of Figure 1 reports 12 month moving averages for inflation, the base interest rate, and interest rate volatility. The figure makes clear that all three of these statistics have exhibited a downward trend during the past three decades, and have been relatively low and stable for the last decade. Although the highs observed following the OPEC oil crisis may be taken as something of an outlier, inflation, interest rates, and interest rate volatility were also substantially higher during the recessions of the early 1980's and 1990's than they have been for the last 10 years.[9]

Strong income growth, low inflation, and low interest rates imply that debt is now more affordable than it was in the past. Low unemployment, and low interest rate volatility imply that debt servicing has been less risky. In this context, it is of little surprise that households have chosen to take on more debt. The extent to which household indebtedness has grown is depicted in Figure 2, which reports quarterly ratios of mortgage debt and unsecured credit to disposable income. These data reveal that mortgage debt has grown particularly strongly over the 20 year period for which data are available – the mortgage to disposable income ratio is now (2007Q1) just over twice what it was in 1987Q1. Although the ratio of unsecured debt to disposable income has exhibited more variation than that for mortgages (declining after the housing crisis of 1990), it has also exhibited strong growth, and is now more than one and a half times what it was in 1993Q4. It is of note that both debt ratios are now higher than

[8] Code NRJR refers to population aggregates, and so tends to slightly overstate the growth of disposable income measured on a per capita basis.

[9] The low and stable rates of inflation that have been observed during the last five years in the UK coincide with the implementation of inflation targeting that began in 1992. See the Bank of England website (http://www.bankofengland.co.uk/monetarypolicy/history.htm) for details regarding the evolution of monetary policy in the UK.





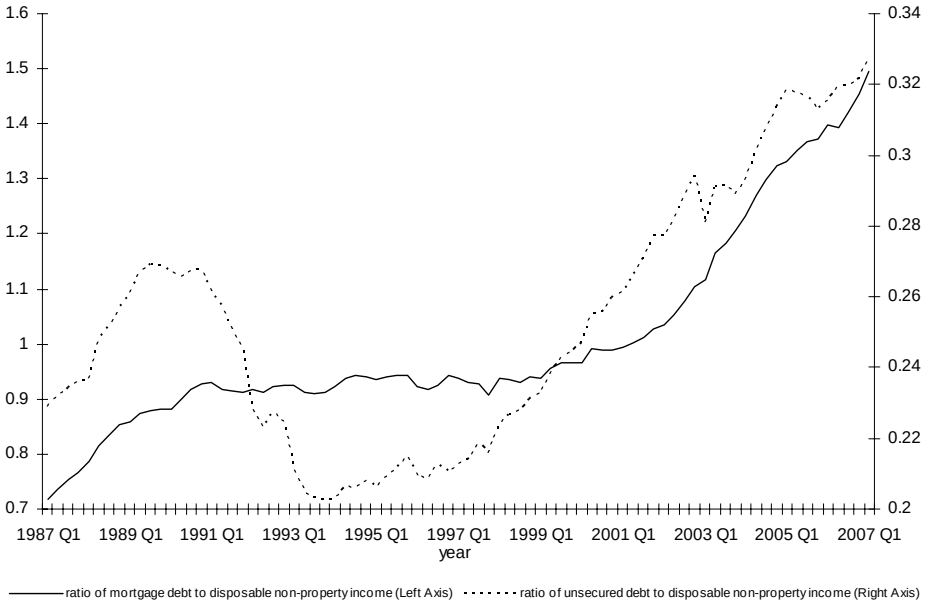
Source: Data reported by the ONS or the Bank of England

ONS codes: Real household disposable income = NRJR, unemployment rate = 100.(1 - MGRZ / MGSF), Retail Prices Index (RPI) = CZBH

BoE codes: Monthly average of official Bank of England interest rate = IUMABEDR

RPI data reported from 1976 to align to earliest date for which official Bank interest rate available

Figure 1: Historical Economic Indicators for the UK



Source: All data reported by the Office for National Statistics

ONS codes: Mortgage debt = NNRQ + NNRR + NNRS, unsecured debt = NNRG + NNRK + NNRU

Disposable non-property income = RPQK - ROYL + ROYT - NRJN + ROYH

Figure 2: Debt to Disposable Income Ratios for the UK

they have been at any other time in the past 20 years.

Although the debt to income ratios reported in Figure 2 show substantial growth since 1987, the favourable economic conditions have offset the associated impact on household budgets and balance sheets. Figure 3 reports quarterly data for the mortgage debt to financial assets ratio, unsecured debt to financial assets ratio, and the aggregate debt servicing ratio.[10] The figure indicates that all three statistics fell from peaks observed in 1990Q3, with only the ratio of mortgage debt to financial assets now greater than the value it was then. Furthermore, responses to qualitative surveys suggest that people now find their debts less burdensome than in the past.[11] These statistics consequently suggest that, in spite of the well publicised rise in private sector debt, the financial well-being of households does not appear to have deteriorated substantially during the past decade.

3 The Analytical Model

This section provides a brief, non technical description of the model that is used to project behavioural responses to a deterioration of labour market opportunities. For a more complete description, the interested reader is referred to van de Ven & Weale (2007).

[10] As Nickell (2004) notes, the rise in the value of household assets is predominantly due to an increase in financial assets, as the effects of the housing boom tend to cancel out from a population wide perspective.

[11] See, for example, *Over-indebtedness in Britain: a DTI report on the MORI financial services survey, 2004*, see: http://www.dti.gov.uk/files/file18550.pdf.

Source: Data reported by the ONS or the Bank of England

ONS codes: Mortgage debt = NNRQ + NNRR + NNRS, unsecured debt = NNRG + NNRK + NNRU, financial assets = NNML

BoE codes: Debt servicing ratio – unpublished calculations by the Bank of England

Figure 3: Debt Servicing and Debt to Assets Ratios for the UK

3.1 A non-technical description

The current report is based upon observations drawn from a dynamic microsimulation model. It is a *microsimulation* model because it describes the effects of a given change in the economic environment for *individual* households, which differ from one another over a range of considered characteristics. The model is *dynamic* in the sense that it is capable of projecting individual households forward *through time*, eventually generating the entire life course for each. Microsimulation models are widely used to explore the distributional consequences of various changes to the economic environment, and are very valuable for distinguishing the effects of policy changes on households of different types. For example at budget time we are used to statements of the type that "A family with two young children is better off, but a pensioner household is worse off".

In most microsimulation models, behaviour is represented by simple statistical equations that reflect correlations described by survey data. For example, an equation may be estimated that describes savings as a linear function of age, income and family circumstances. Labour supply may be treated in the same way, or at best treated as the outcome of a static optimisation. Unfortunately, these approaches are rarely suitable for exploring responses to counterfactual policy environments due to a problem that is commonly referred to in economics as the Lucas critique. The Lucas critique points out that many choices, and decisions about the work/leisure and consumption/savings margins in particular,

are sensibly regarded as intertemporal. It follows that current consumption and labour supply depend upon an individual's prevailing circumstances *and their expectations regarding the future*. If a policy experiment is likely to influence expectations, then estimates of statistical (reduced form) equations will not provide a valid description of behaviour under the counterfactual policy environment, as they will embody the expectations that prevailed during the period covered by the data used for estimation.

The current report, by contrast, is based upon a *rational agent* model, which represents the consumption/saving and work/leisure choices of households as the outcome of a process of dynamic optimisation. In this model, agents are considered to make their decisions, taking into account their individual specific circumstances and expectations regarding the future. Importantly, expectations in the model are explicit, and are varied in line with policy experiments, which ensures that the behavioural responses generated by the model are robust to the Lucas critique described above.

Households are considered to be fully described by nine characteristics:[12]

age	- consumption	- number of adults	- number of children	- private pensions
wage rate	- labour supply	- net liquid wealth	- time of death	

The model is designed to consider household behaviour from age 20 to the maximum terminal age of 110, disaggregated into annual increments. Between ages 20 and 64, households are considered to make decisions regarding consumption and labour supply, and from age 65 all households are assumed to be retired so that they make decisions about consumption only. Households choose their consumption and labour supply in any year to maximise their expected lifetime utility, given their existing circumstances, preferences, and beliefs regarding the future. A household's circumstances are described by their age, number of adults, number of children, wage rate, net liquid (non-pension) wealth, private pension rights, and time of death. Preferences are defined by a utility function (that is the same for all households), and expectations relate to the prevailing economic environment.

Care has been taken in specifying the model to capture factors that have been identified by the empirical literature as having an important influence on the financial welfare of households and their use of debt. A review of the empirical evidence (discussed in van de Ven & Weale (2007)) indicates that age and the treatment of pension wealth have a substantial bearing on the extent of indebtedness that is described by survey data. Furthermore, the most prevalent causes given for financial hardship are the loss of income, low income / over commitment, relationship breakdown, and unanticipated expenses. Hence, of the seven characteristics that define the circumstances of a household, four are considered to be stochastic (labour income, relationship status, number of children, and time of death), and three are considered to be deterministic (age, private pensions and net liquid wealth).

[12] We do not distinguish households on the basis of education in the current study, although this characteristic is also considered in van de Ven & Weale (2007).

In the terminology of the dynamic programming literature, consumption and labour supply are control variables that are considered to be selected to maximise the value function, subject to seven state variables, four of which are stochastic, and three deterministic. The value function assumes that intratemporal preferences between consumption and leisure take a Constant Elasticity of Substitution form, and intertemporal preferences are time separable and also of a Constant Elasticity of Substitution form. These assumptions regarding the value function are standard in the related literature.

3.2 Experimental counterfactuals considered for analysis

The rational agent model described above is used to consider how behavioural responses to a worsening of labour market opportunities are influenced by the extent of indebtedness in a population. Specifically, we assume that there exist two potential states of the world, which are distinguished by the probabilities of receiving a low wage offer. In one state of the world, which is calibrated to contemporary survey data, the probability of receiving a low wage offer is set to 30% for singles, and 5% for couples – these probabilities are referred to as 'low' in the discussion that follows. In the counterfactual state of the world, both probabilities are increased by 4%, to 34% for singles and 9% for couples – probabilities that are subsequently referred to as 'high'. This increase in the probability of a low wage offer for singles and couples broadly reflects the variation in unemployment rates that was observed between the periods 1980-1996, when unemployment was 9.7% on average, and 1997-2005 when unemployment was 5.5% on average. We consider behavioural responses that result from a once-and-for-all shift from the low probability regime to the high probability regime, representing a worsening of labour market opportunities. This policy experiment could, for example, reflect the domestic impact of a rise in the competitiveness of the global market for labour.

We assume that there is an exogenously defined probability of transitioning from the low probability regime to the high probability regime in any given year. Individuals who experience the low probability regime in any given year are considered to make their decisions to take into account the considered probability of a future regime change. Sensitivity of behavioural responses to the extent of private sector indebtedness is explored with regard to individual specific circumstances, alternative models of credit rationing, and assumptions regarding the beliefs upon which decisions are considered to be made.

The data required to explore behavioural responses to the environmental change described here were generated by the rational agent model using the following procedure:

1. The life histories for a *base population* of 20,000 households were generated by the rational agent model, subject to the relevant assumptions regarding liquidity constraints and agent expectations prior to the environmental change. The only difference between the base populations simulated for the alternative experimental scenarios that are considered for analysis relate to assumptions

regarding credit rationing and agent expectations. Importantly, all of the simulated base populations were generated using the same stochastic innovations to describe population heterogeneity.

2. At each age between 20 and 110 – the entire lifetime considered for analysis – the characteristics of each household as simulated in the relevant base population were identified.

3. Given the characteristics identified for the base population, consumption and labour supply were projected forward n years, on the basis of the counterfactual policy environment, again subject to the relevant assumptions regarding liquidity constraints and agent expectations following the environmental change. These projections are based upon the same stochastic innovations that were used to generate the base populations, so that the only differences between the behaviour simulated under the base population and the counterfactual policy environment relate to the assumed liquidity constraints and agent expectations assumed for the alternative simulations.

4. The effects of the labour market deterioration were then measured by comparing the behaviour projected forward under the respective counterfactual policy environment, against the behaviour generated for the base population.

It is useful in presenting the analysis to distinguish between *short-run* and *long-run* responses to the environmental change. Rational behaviour, as discussed in the preceding subsection, depends upon both individual specific characteristics and expectations regarding the economic environment. In a dynamic model, like the one considered for the current report, individual specific characteristics are a product of past decisions and the experienced economic environment. The wealth that a household holds at age 45, for example, will be a product of its past labour supply and consumption decisions, and its experiences regarding taxes, investment returns, and wage rates. Short-run behavioural effects relate to decisions made with regard to individual specific characteristics that are a product of at least one alternative to the prevailing economic environment. As such, the short-run is also sometimes referred to as the transition period, during which the full effects of a particular environmental change are taken to work their way through the economy. The long-run, by contrast, relates to decisions that depend upon individual specific characteristics that are entirely consistent with the prevailing economic environment. Discussion reported in Sections 4 and 5 focuses upon a short-run time horizon of one year, $n = 1$, and a long-run horizon of 91 years, $n = 91$, the entire simulated lifetime.

3.3 Intuition behind the rational agent model as it relates to saving and indebtedness

The model used in the current study implies that, all else being equal, an individual would prefer to smooth their consumption between two time periods, rather than to consume a large amount in

one period and very little in another. This is a property of the function that is assumed to describe individual preferences, and the parameters that were found to best reflect the survey data against which the model was calibrated. In this context, an individual will choose to spend more than their income in any given period if they expect that their consumption "needs" in relation to their disposable income will decline.

Consumption needs are considered to be defined by the numbers of adults and children in a household, by labour supply during the working lifetime, and by the time of death. Three of these four factors are subject to uncertainty, and the fourth (labour supply) is a choice variable. Expectations regarding the timing of death influence saving incentives for retirement – the longer an individual believes that they are going to live, the greater the incentive to save, which competes with immediate consumption for available credit. In contrast, labour supply tends to increase demand for immediate consumption, as the preferences considered for analysis imply that consumption and leisure are direct substitutions. This may arise, for example, due to the costs of working, or the desire to unwind after work through the pursuit of expensive leisure activities. Of course, labour supply also results in higher disposable income, so that the aggregate effect of working on wealth is usually positive.

The impact of the numbers of adults and children in a household on saving and indebtedness are more complex. An increase in household size raises consumption needs through the assumption of the McClement's equivalence scale, and also raises disposable income through the demographic dependance assumed for the tax and benefits system. With regard to the number of dependent children, the adjustments assumed for the tax system at low incomes more than off-set changes to the assumed equivalence scale, so that households with dependent children tend to be better off than those without. With regard to the number of adults, the disposable income of couples is augmented relative to singles by both the tax system and the wage generating process, which imply that couples tend to be better off than otherwise similar single adults.

These assumptions drive the motives for saving and indebtedness in the rational agent model. In the case of young single adults, for example, the anticipation that they will marry and obtain a dependent child at some time in the future gives rise to the expectation of an improvement in their financial circumstances. As noted above, the assumed preference structure implies that these adults will try to smooth their consumption inter-temporally, going into debt when young with the expectation of paying the debt off when their circumstances improve. Alternatively, a household that is comprised of an adult couple when young may choose to go into debt to obtain an immediate benefit from the income growth with age that is embodied by the assumed wage generating process. If this household subsequently suffers a marital dissolution, then their indebtedness may be exaggerated by the motives experienced by young single people to take on additional debt. Furthermore, households that experience a low wage

offer will also expect their incomes to rise in the future, which motivates dis-saving in the model.

With regard to the policy experiment that is the focus of the current report, an increase in the rate of involuntary unemployment influences household consumption as implied by the rational agent model in two important ways. First, the reduced incomes of households that become unemployed as a result of the negative labour market shock imply that consumption generated by the model will fall, even if behaviour (for any given combination of household characteristics) remained invariant to the change in the economic environment. This type of 'direct' effect can be explored without resorting to an explicit model of behaviour, as in DTI (2004).[13] In addition to this, however, all households – even those that do not experience an immediate change in their circumstances – can be expected to react to the altered nature of their economic environment. This 'indirect' effect – which can only be explored using a structural model like the one considered here – can be substantial, particularly because it influences the entire population rather than just those who are immediately affected by the environmental change.

Although the factors referred to above are easily described, it is not possible to come to any conclusions regarding the magnitude of the respective effects without detailed simulations. That is the subject of discussion in the next section.

4 Private Sector Indebtedness and Responses to a Deteriorated Labour Market

This section considers the impact of private sector indebtedness on behavioural responses to a deteriorated labour market. The section begins with some background discussion, and a description of the experiments that are considered for analysis. We then report simulated behavioural responses to a deteriorated labour market, before summarising results at the end of the section.

As a point of clarification, the analysis here distinguishes between "short-run" and "long-run" effects. In the current context, the short-run refers to the year following the deterioration considered for the labour market, so that the environmental change has not had time to feed through to the savings accrued by individuals. The long-run, by contrast, refers to some time in the distant future, when the savings of individuals fully reflect the higher probability of being involuntarily unemployed.

An important factor that influences the behavioural responses implied by a rational agent model like the one considered for the current study is the nature of the imposed liquidity constraints, and the proximity of considered agents to those constraints. In this study, the experiments are explicitly designed so that the availability of credit remains unchanged between counterfactuals – counterfactuals

[13] The Department of Trade and Industry, for example, have found that a 10% fall in incomes in 2004 would cause 0.5% (from 7.6 to 8.1) of individuals to fail their unsecured debt test for over-indebtedness, and 1% (from 9.2 to 10.2) to fail their total debt test for over-indebtedness (*Over-indebtedness in Britain: a DTI report on the MORI financial services survey, 2004*).

that are compared are based on the same age specific credit limits and the same functions for interest charges. Hence, for the analysis reported here, higher indebtedness implies closer proximity to the considered liquidity constraints. Throughout this section reference is consequently made to "the extent of indebtedness", rather than "the proximity to liquidity constraints", with sensitivity analysis conducted in relation to the liquidity constraints that are imposed. Before reporting behavioural responses to the deterioration considered for the labour market, we begin by reviewing observations from the related literature concerning the behavioural effects of assumed liquidity constraints, and describe the specific experiments considered for analysis.

4.1 Background and description of the experiments considered for analysis

Since the mid 1980's, a great deal of work has been done to explore the influence of liquidity constraints on consumption and savings behaviour in the context of uncertain future labour income.[14] Simulation studies have suggested that liquidity constraints can affect the consumption behaviour of individuals, even if they have a low probability of ever actually running out of liquid credit, and theoretical advances mean that the underlying processes are now well understood.[15] Furthermore, empirical analyses suggest that liquidity constraints play an important role in determining consumer behaviour in practice (e.g. Zeldes (1989*a*) and Gross & Souleles (2002) using US data, and Stephens (2006) and Benito & Mumtaz (2006) for recent studies using UK data). Gross & Souleles (2002), for example, use a detailed panel data-set compiled by several different credit card providers in the US to determine the influence of credit supply on consumption. They find that the average marginal propensity to consume out of liquidity is strongly significant, ranging between 10 and 14 percent. They also find that the MPC is higher for individuals who are close to their credit limit (consistent with a binding liquidity constraint), and lower but significant for those starting well below their credit limit (consistent with a precautionary savings motive).

In the current context, the nature of the liquidity constraints assumed by the rational agent model influences the implied willingness/ability of households to accumulate debt prior to the environmental change, and the willingness/ability to use debt to maintain consumption following a negative labour market shock. In the preceding sentence we are careful to distinguish a household's 'willingness' to accrue debt from its 'ability'. This is because these terms reflect alternative dimensions along which a liquidity constraint can be applied. So called 'hard' liquidity constraints refer to credit limits, beyond which a household cannot borrow even if it would otherwise like to do so. 'Soft' constraints, by contrast,

[14] Carroll (2001), p.27, cites Zeldes (1984) as the first study in this field.

[15] See Zeldes (1989*b*) for an early example of simulation work, and Low (2005) for a contemporary example. Regarding the theoretical underpinnings of precautionary savings motives, see Carroll & Kimball (1996) for behavioural responses in the absence of liquidity constraints, Carroll & Kimball (2001) when households are not permitted to borrow, and Fernandez-Corugedo (2002) when differential interest rates apply to savings and borrowing.

refer to the costs that discourage – but do not prevent – the accrual of debt, such as higher interest rates charged on the extension of additional credit.

Scenarios considered for analysis

The current section focuses upon behavioural responses to the environmental change described in Subsection 3.2, based upon three alternative assumptions regarding the imposed liquidity constraints:

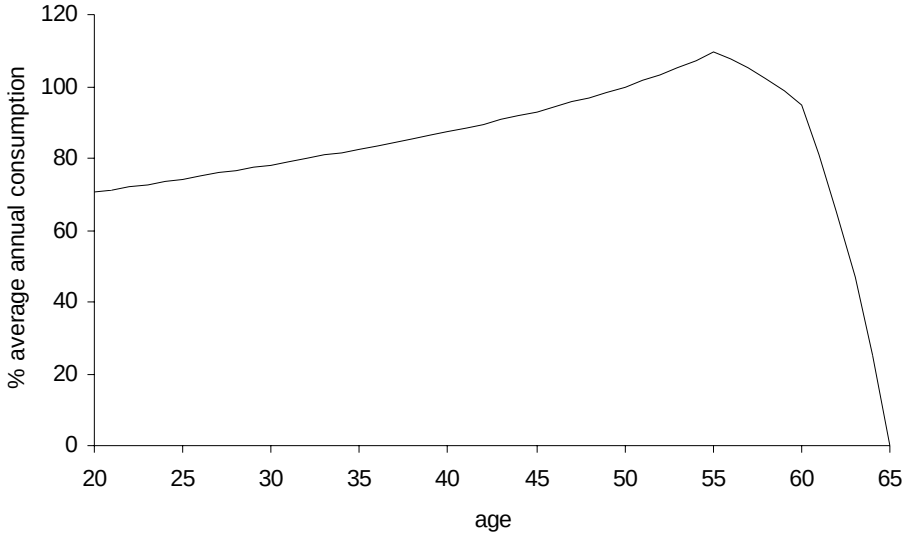
- the *no-debt scenario.* In this scenario households are unable to accrue unsecured debt, and receive a fixed rate of return on any positive balances of net liquid wealth. This simple (hard) liquidity constraint is often assumed for models of the type considered here (see, for example, Sefton et al. (2007)).

- the *hard-constraint scenario.* In this scenario, the hard liquidity constraint that is applied under the no-debt scenario is relaxed, so that households are permitted to hold unsecured debt (negative net liquid assets). Importantly, however, no soft liquidity constraint is applied, so that negative balances of net liquid wealth are subject to the same interest rate as positive balances.

- the *complex-constraint scenario.* In this scenario, households are subject to the same hard liquidity constraint as considered under the hard-constraint scenario. In addition to this, however, the complex-constraint scenario also applies a soft liquidity constraint, so that the interest charged on unsecured debt is considered to vary with respect to a household's debt to income ratio. The rational agent model was calibrated to survey data assuming this specification for credit rationing.

All three of the scenarios that are considered here are based upon the assumption that the *a priori* probability of a regime change tends toward zero, and that agents take this into account in planning for the future. Households are consequently assumed to behave as though they will always be subject to a low probability of a low wage offer up to the age at which the negative labour market shock occurs. Expectations regarding a low wage offer are then revised in line with the considered labour market shock. This behavioural assumption tends to exaggerate household preferences for indebtedness prior to the labour market shock, as explored at length in Section 5. We now describe in more detail the hard and soft liquidity constraints that were adopted for the hard-constraint and complex-constraint scenarios.

The hard liquidity constraint that is adopted for both the hard-constraint and complex-constraint scenarios was specified to provide maximum flexibility, while at the same time omitting the possibility of numerical errors in the model's solution procedure. A numerical error will result in the model if a household is required to consume less than or equal to zero in any period to satisfy the imposed hard



Notes: Monetary values expressed as percentages of average annual household consumption simulated between ages 20 and 110, with ages weighted to match the population structure described by the 2001 Census, equal to £28,281.

Figure 4: Age Specific Credit Limit Assumed for Analysis

liquidity constraint. This, combined with the assumption that all households must have paid off their debts by age 65, resulted in the adoption of an age specific credit limit defined in terms of the minimum disposable income stream that is permissable under the analysis. Figure 4 indicates that the hard liquidity constraint adopted for the model calibrations rises smoothly from 70% of annual consumption at age 20 to 110% at age 55, before falling away rapidly to 0 at age 65.

The soft liquidity constraint that is assumed only for the complex-constraint scenario describes the interest rate applied to net liquid assets by:

$$r_{i,t} = \begin{cases} r^I & \text{if } w_{i,t} > 0 \\ r_l^D + \left(r_u^D - r_l^D\right) \min\left\{\frac{-w_{i,t}}{\max[x_{i,t}, 0.7h_{i,t}]}, 1\right\}, r_l^D < r_u^D & \text{if } w_{i,t} \leq 0 \end{cases}$$

where $w_{i,t}$ denotes the net liquid wealth of household i at time t, $x_{i,t}$ is household private income, $h_{i,t}$ is the household's wage rate, and $r^I = 4\%$ is the return to positive balances of net liquid wealth. This specification for the interest rate implies that the interest charge on unsecured debt increases from a minimum of $r_l^D = 7\%$ p.a. when the debt to income ratio is low, up to a maximum rate of $r_u^D = 15\%$ p.a., when the ratio is high.[16] The specification also means that households in debt are treated more generously if they are working than if they are not. The hard-constraint scenario, by contrast, is based upon the assumptions that $r^I = r_l^D = r_u^D = 4\%$. The assumption that the maximum rate of interest is charged when net debt is equal to or greater than the household full-time employment wage reflects the observation that less than 1 percent of households recorded by the 2000/01 BHPS with some labour

[16] This range of interest charges for household debt is based upon averages between January 2000 and August 2005 (the most recently available data at the time of writing) of the end of month average interest rates charged on unsecured personal loans for the lower bound, and of the end of month weighted average interest rates charged on credit cards for the upper bound, as reported by the Bank of England.

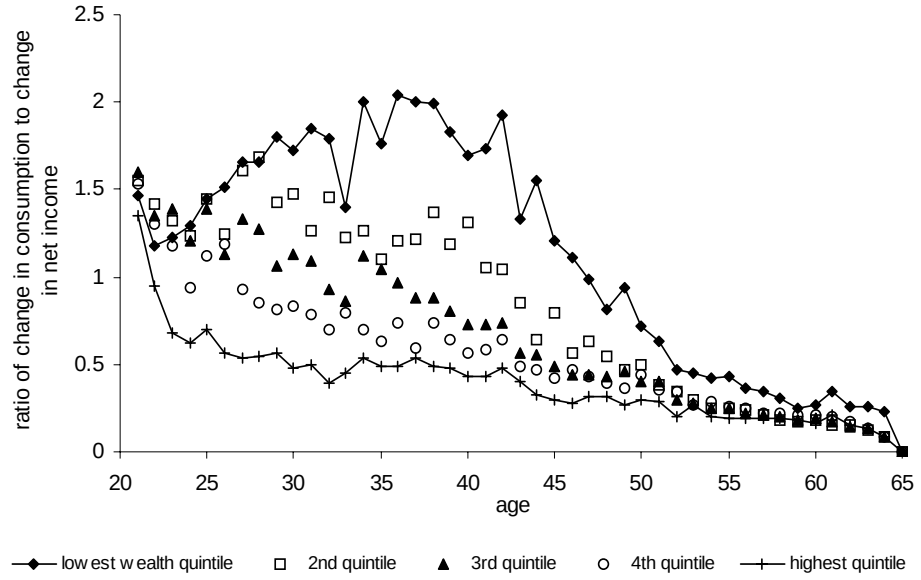
income had unsecured debt that exceeded their annual gross labour income.

4.2 Behavioural responses in the short-run

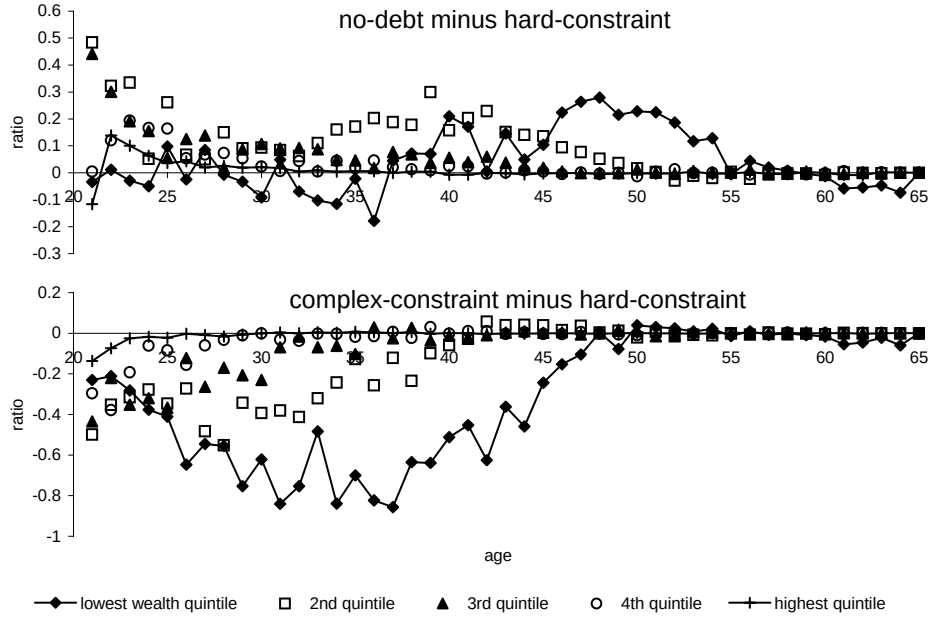
The current analysis focuses upon two principal dimensions of population heterogeneity that influence behavioural responses to the considered labour market deterioration. On the one hand, a household's age determines the period over which a deterioration in labour market opportunities can influence their financial circumstances. A negative labour market shock is of no concern to a household that has already retired, but has a large impact on one that has only just begun its working life. As the circumstances of a household at any age are the product of its past decisions and the economic environment through which it has lived, we can anticipate that the deterioration in labour market opportunities will have a less pronounced effect on the behaviour of older households, particularly as they near the end of their working lives. On the other hand, the debt that a household has accrued limits its ability to inter-temporally smooth the effects on consumption of a negative shock to disposable income.

Consumption responses in the year following the considered labour market deterioration, specified as ratios of the associated impact on disposable income are reported for population wealth quintiles in Figure 5. Panel A of the figure indicates that consumption responses in the year following the environmental change tend to be stronger at young ages, and fall off to zero at age 65. This is consistent with the discussion reported in the previous paragraph, and reflects the fact that households in excess of age 65 are unaffected by the deterioration considered for labour market opportunities. It is of note that many of the consumption responses reported in Panel A of Figure 5 exceed the influence on disposable income of the deterioration considered for the labour market. This is because the behavioural responses that are reported here are driven by two underlying factors. The first – and most obvious – is the direct effect that the environmental change has on household disposable incomes. If this effect was solely responsible for the behavioural responses reported here, then we should expect affected households to smooth the impact of the negative income shock through future years – the ratios reported in Panel A of Figure 5 should be uniformly below one, and for many quintiles substantially below one. In addition to this direct effect, however, households are considered to revise their expectations to take into consideration the deteriorated labour market opportunities. This motivates households to accrue precautionary savings to offset the higher probability of receiving a low wage offer. As this motive influences the behaviour of the entire population, including those that do not immediately suffer a low wage offer as a result of the environmental change, it gives rise to a much larger fall in consumption than would otherwise be observed. As noted above, sensitivity to this behavioural assumption is explored in Section 5.

With regard to population heterogeneity, all households are assumed to begin their economic lives at



Panel A: behavioural responses for the hard-constraint scenario



Panel B: differences between alternative experimental scenarios

Source: Age profiles generated by rational agent model using calibrated parameters reported in Table 4 of van de Ven & Weale (2007) and amended for alternative experimental scenarios as described in Section 4.1 of the current report.

Notes: Wealth quintiles defined with respect to net liquid assets, by age under the respective base population.

Figure 5: Ratios of Consumption Responses to Disposable Income Changes in the Year Following a Deterioration in Labour Market Opportunities – statistics by age and experimental scenario

age 20 with zero wealth. Hence, there is very little heterogeneity observed for the behavioural responses of alternative wealth quintiles during the first few ages that are considered for analysis. By age 23, however, the consumption responses of the most wealthy population quintile to the environmental change are found to be much smaller (relative to the associated change in disposable incomes), than for the remainder of the population. Similarly, by age 26 the consumption responses of the fourth wealth quintile tend to be lower than those of the third quintile, which in turn tend to be lower than those of the second quintile. Finally, by age 29 the responses of the second quintile are found to understate those of the least wealthy 20% of households. These observations indicate that private sector indebtedness exaggerates behavioural responses to a negative macro-economic shock – poorer households find themselves more exposed to the worsened economic environment as they are less able to smooth consumption through "rainy days".[17]

Panel B of Figure 5 reveals the impact on household behavioural responses of alternative assumptions regarding credit rationing in the model. The statistics suggest that behaviour is most sensitive to a negative labour market shock under the no-debt scenario, followed by the hard-constraint scenario, with the complex-constraint scenario coming a distant third. It is interesting to note that the hard-constraint scenario is very similar to the no-debt scenario, but with the available credit of households being cut back to zero at age 20. In relation to these two scenarios, it is of little surprise that behavioural responses should be exaggerated when households are given less financial flexibility – the associated results also suggest that larger consumption responses that reported here would be obtained under the hard-constrain and complex-constraint scenarios if households were assumed to hold some debt at age 20.

The impact of household indebtedness on responses to a negative labour market shock is further revealed by comparison of the hard-constraint with the complex-constraint scenario. Households in the hard-constraint scenario tend to hold more debt at each age (after age 20), than in the complex-constraint scenario, where the accrual of debt is discouraged by punitive interest charges. Hence comparisons between the two scenarios tend to highlight the fact that private sector indebtedness exaggerates behavioural responses to a negative labour market shock – poorer households are less financially flexible, and consequently subject to larger distortions when the economic environment deteriorates.

An alternative perspective is given by population aggregate statistics, obtained by discounting the age specific statistics to adjust for assumed wage growth of 1.9% p.a., and weighting the simulated data to reflect the age structure described by the 2001 Census. These population aggregates suggest that consumption would fall in the year following the negative labour market shock, by 1.20% under

[17] This more pronounced consumption response to the labour market shock for households that are more indebted is consistent with empirical analysis reported by Balke (2000).

the no-debt scenario, by 1.14% under the hard-constraint scenario, and by 1.04% under the complex-constraint scenario. In 2006, final household consumption expenditure in the UK was £750bn[18], so that the alternative assumptions made here regarding credit rationing translate to consumption responses in the year following the labour market shock of between £7.8bn and £9.0bn.

4.3 Behavioural responses in the long-run

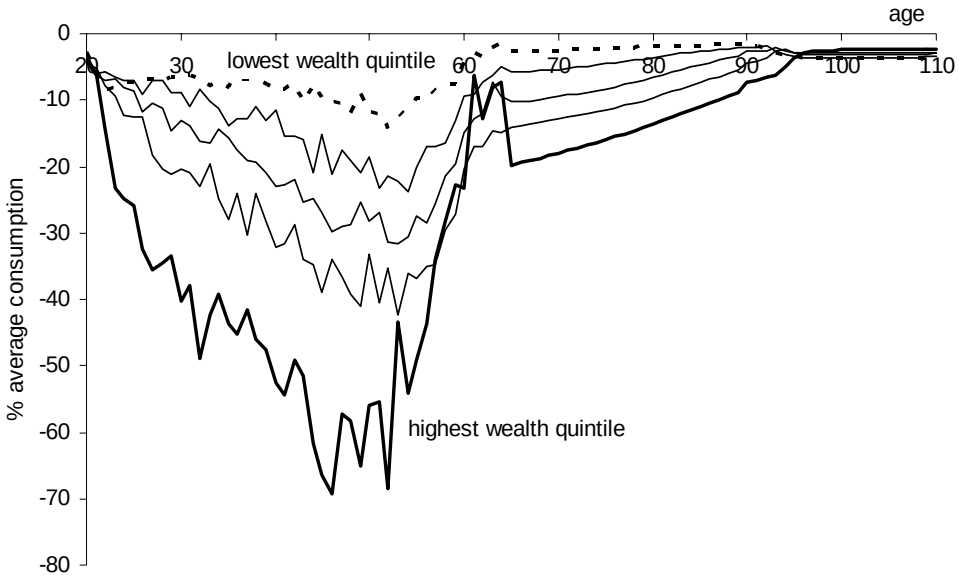
We now explore long-run consumption responses to the labour market deterioration. As observed in the preceding subsection, all three of the experimental scenarios that are reported here have similar implications for the relative consumption responses of population quintiles distinguished by net liquid wealth, with the alternative models of credit rationing considered by each scenario primarily influencing the scale of the simulated responses. Discussion consequently focuses upon quintile specific statistics reported for the hard-constraint scenario, before comparing the alternative scenarios on the basis of population average statistics.

Figure 6 reports statistics for consumption responses and income effects of the deterioration considered for labour market opportunities, by wealth quintile. Panel A of the figure indicates that the increase considered for the probability of a low wage offer tends to reduce the disposable incomes of households by a larger amount as wealth increases. This is attributable to two effects. First, higher wealth households tend to earn higher labour incomes on average, so that the increase in the probability of a low wage offer has a larger absolute impact on labour income. Second, the fall in labour incomes causes a fall in household savings, thereby reducing property income – an effect that is also skewed toward higher wealth households.

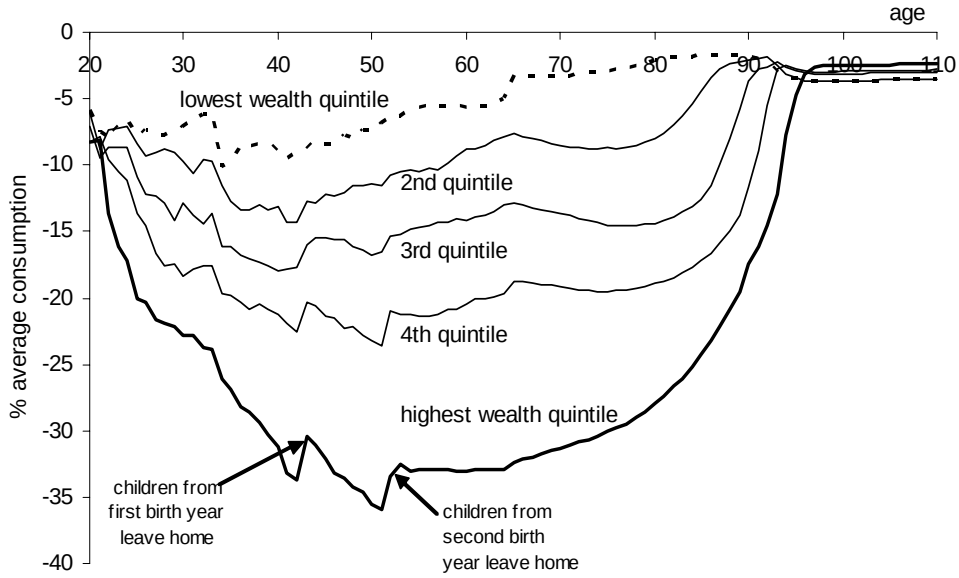
It is of note in Panel A of Figure 6 that the highest wealth quintile, relative to the larger population, suffers a smaller fall in disposable income between ages 57 and 64 than for the remainder of the working lifetime. This is due to labour supply responses of the highest wealth quintile. Motives that underly the preferred timing of retirement in the simulations differ with household circumstances. At the bottom of the wealth distribution, households tend to make very little private provision for old age, and the timing of retirement is driven primarily by the generosity of state provided retirement benefits. At the top of the wealth distribution, by contrast, households tend to rely primarily upon private financial provisions in old age, and consequently retire when their private wealth is sufficiently high. The fall in household wealth resulting from the higher probability of a low wage offer consequently results in later retirement for more wealthy households. The statistics reported in Panel A of Figure 6 highlight the fact that this behavioural influence tends to be limited to the highest wealth quintile.

The consumption responses reported in Panel B of Figure 6 are highly intuitive, and therefore require

[18] ONS code ABPF



Panel A: disposable income effects by wealth quintile



Panel B: consumption responses by wealth quintile

Source: Age profiles generated by rational agent model using calibrated parameters reported in Table 4 of van de Ven & Weale (2007) and amended for the hard-constraint scenario as described in Section 4.1 of the current report.

Notes: Monetary values expressed as percentages of average annual household consumption simulated between ages 20 and 110, with ages weighted to match the population structure described by the 2001 Census, equal to £28,281. Wealth quintiles defined with respect to net liquid assets, by age under the respective base population.

Figure 6: Long-Run Effects of Labour Market Deterioration on Simulated Consumption and Disposable Income by Age and Wealth Quintile – hard-constraint scenario

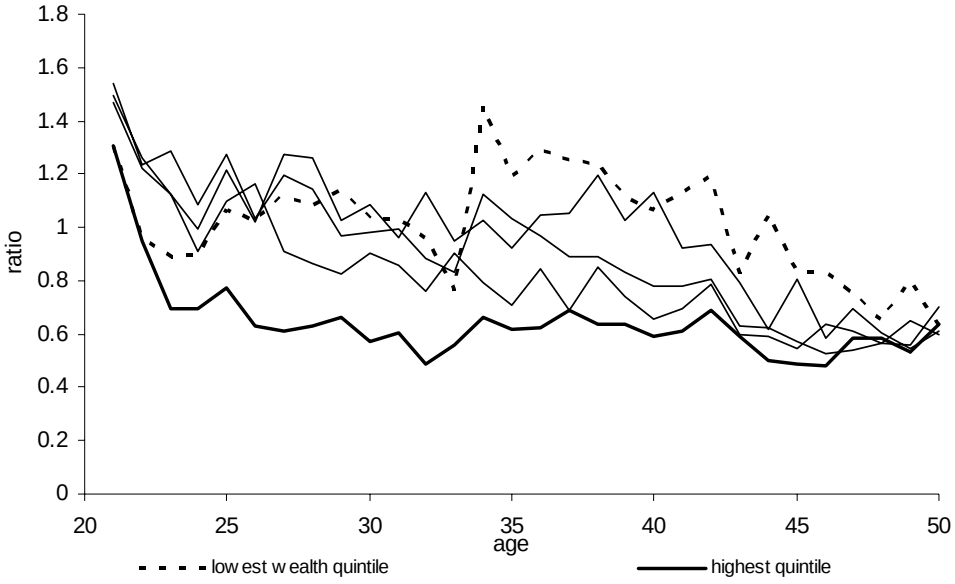
little comment. Higher wealth households are observed to reduce their consumption by more on average than those with lower wealth, which is explained primarily by the attendant falls in disposable income that are discussed above. An alternative perspective of consumption responses by wealth quintile is provided by Figure 7, which restates the consumption responses reported in Panel B of Figure 6 as ratios of the associated disposable income effects reported in Panel A of Figure 6.

Panel A of Figure 7 reports long-run consumption to disposable income response ratios calculated for ages 20 to 50, and Panel B of the figure reports for the entire simulated lifetime. Comparing Panel A of Figure 7 against Panel A of Figure 5 indicates that response ratios measured across wealth quintiles tend to be condensed in the long-run simulations. In contrast to the short-run effects, the long-run ratios exhibit a negative correlation with age that appears to be more consistent throughout the simulated population. The negative correlation arises because of the stronger precautionary saving motives associated with the increase in the probability of a low wage offer.

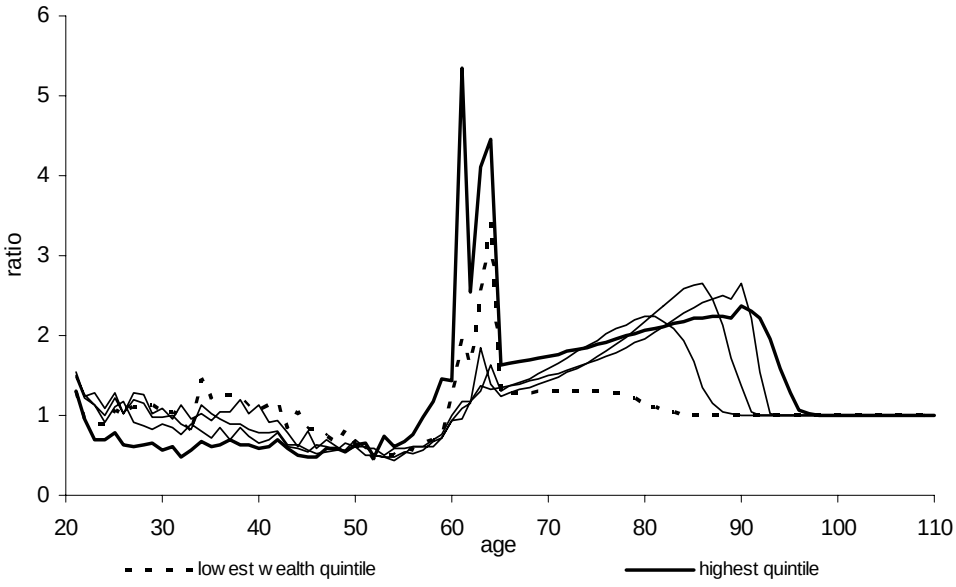
Panel B of Figure 7 indicates that the consumption response ratios tend to rise strongly from the early 50s to peak around age 64, just prior to state pensionable age in the simulations. The two panels of Figure 6 indicate that the strong rise in long-run consumption response about state pensionable age is attributable to the smaller falls in disposable income that are generated about retirement. From age 65 households are subject to uncertainty only as it applies to their time of death, and so the associated simulated behavioural effects are smooth relative to the working lifetime. The ratios for all population quintiles converge to 1 from age 97 because all households exhibit constrained behaviour very late in the simulated lifetime. Between ages 65 and 97 the ratios reported in Panel B of Figure 7 exhibit a peak due to precautionary behavioural responses in the context of lower holdings of wealth.

Figure 8 reveals that the model of credit rationing is made less important when a long-run analytical perspective is taken, an impression that is reinforced by population aggregate statistics. Specifically, discounting by assumed wage growth of 1.9% p.a. and weighting the age specific statistics to reflect the population structure described by the 2001 Census implies that consumption would fall in the long-run by 1.71% p.a. under the no-debt scenario, by 1.72% p.a. under the complex-constraint scenario, and by 1.70% p.a. under the hard-constraint scenario. The variation between these three population aggregate statistics – which all exceed the associated short-run effects – could reasonably be attributed to the tolerances assumed for the rational agent model's solution.

That the particular model of credit rationing assumed for analysis should have a less pronounced influence on household consumption responses to the increase in the probability of a low wage offer in the long-run than the short-run is intuitive. In the short-run households are surprised by the environmental shock, given the expectations that are assumed here to govern household behaviour. The shock primarily gives rise to a more pronounced precautionary savings motive. In the short-run, households



Panel A: statistics for ages 20 to 50

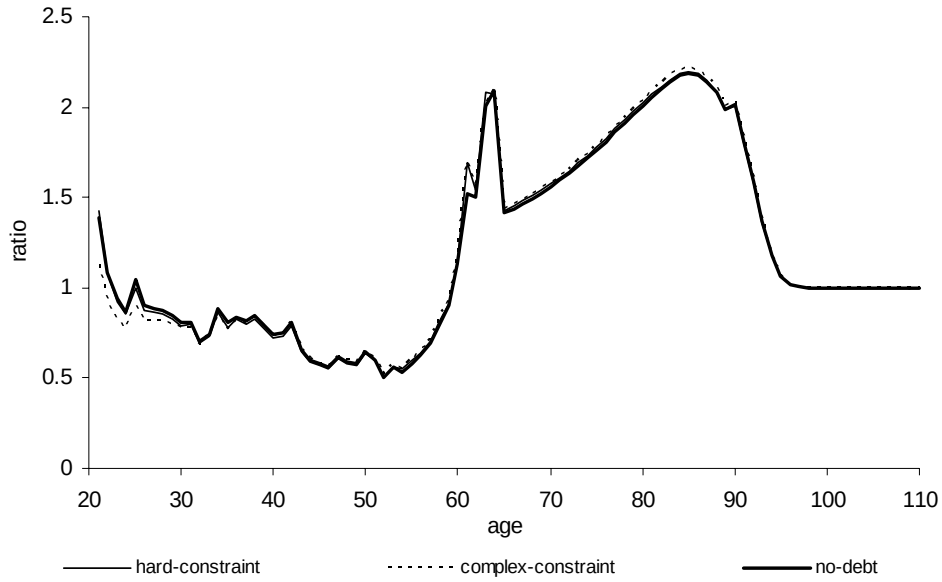


Panel B: statistics for ages the entire simulated lifetime

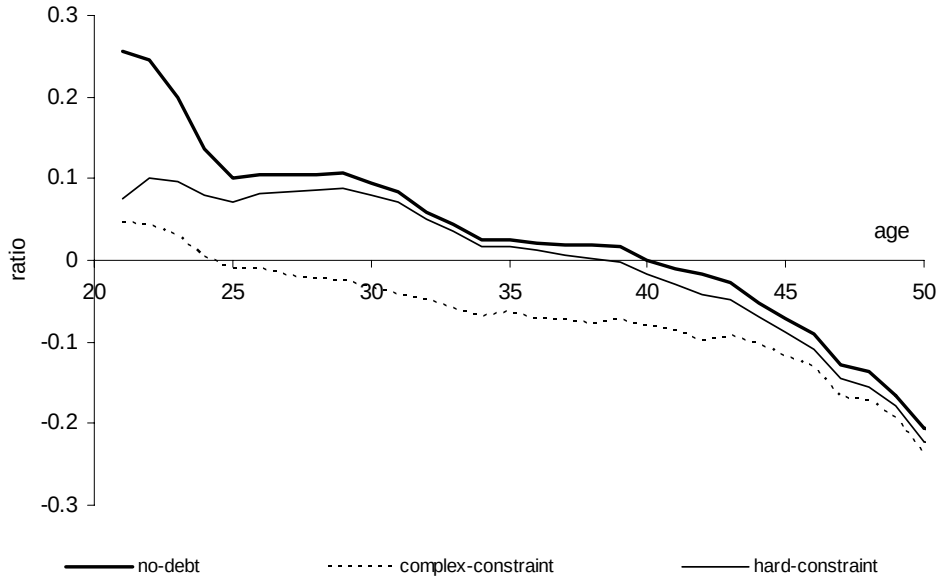
Source: Age profiles generated by rational agent model using calibrated parameters reported in Table 4 of van de Ven & Weale (2007) and amended for the hard-constraint scenario as described in Section 4.1 of the current report.

Notes: Wealth quintiles defined with respect to net liquid assets, by age under the respective base population.

Figure 7: Ratios of Consumption Responses to Disposable Income Changes in the Long-Run Following a Deterioration in Labour Market Opportunities – hard-constraint scenario



Panel A: long-run average response ratios



Panel B: short-run minus long-run response ratios

Source: Age profiles generated by rational agent model using calibrated parameters reported in Table 4 of van de Ven & Weale (2007) and amended for alternative experimental scenarios as described in Section 4.1 of the current report.

Notes: Wealth quintiles defined with respect to net liquid assets, by age under the respective base population.

Figure 8: Ratios of Consumption Responses to Disposable Income Changes by Credit Rationing Scenario

will consequently tend to hold less wealth than they would have done had they known with certainty when the negative labour market shock was going to happen, which represents an increased motive to save. This motive is exaggerated as the liquidity constraint is made more pressing, particularly for younger households.

Households in the long-run, by contrast, are able to adjust their behaviour to the revised economic conditions in view of the imposed model of credit rationing, so that the models of credit rationing have a similar effect on consumption simulated under both the base and counterfactual environments. Hence, when differences between the base and counterfactual simulations are taken, the consumption responses to the imposed liquidity constraints cancel out.

4.4 Summary

- The level of personal sector indebtedness tends to exaggerate behavioural responses to a negative labour market shock - poor households cut back their consumption most severely because they are most exposed to adverse shocks to their financial circumstances.

- Responses to a negative labour market shock are exaggerated when credit is less freely available because this limits the ability of households to smooth their consumption through temporary adverse circumstances.

- Increasing interest charges on debt tends to discourage the accumulation of debt, thereby weakening the behavioural responses to a negative labour market shock.

- In the long-run, heterogeneity in behavioural responses to the deteriorated labour market are drive primarily by effects on household wealth.

- The influence that the model of credit rationing has on behavioural responses to a deterioration of labour market opportunities is reduced as the time that households have to adjust to the altered economic environment increases. In the very long-run, the form that credit rationing takes has no real impact on behavioural responses to a negative labour market shock because household behaviour is fully adjusted to take the model of credit rationing into account.

- A 4% rise in the probability of involuntary unemployment is simulated to reduce aggregate private sector consumption by 1.0-1.2% in the year following the shock (depending upon the model of credit rationing imposed), and by 1.7% in the long-run.

5 The Influence of Expectations on Simulated Behavioural Responses

Section 4 draws attention to the importance of population indebtedness, and liquid capital more generally, in determining behavioural responses to a negative labour market shock. Attitudes toward indebtedness are influenced appreciably by expectations regarding the future economic environment. This section considers the impact of alternative *a priori* expectations on household indebtedness and behavioural responses to a worsening of labour market conditions. As in Section 4, the current discussion is divided into four subsections. We begin by defining the experiments that are considered for analysis, before exploring the short- and long-run effects of the regime change, and provide a summary at the end of the section.

5.1 The experiments considered for analysis

The current analysis focuses upon three behavioural scenarios:

- the *optimistic scenario.* In this scenario, the probability of a regime change is assumed to tend toward zero. Households are consequently assumed to behave as though they will always be subject to a low probability of a low wage offer up to the age at which the negative labour market shock occurs. Expectations regarding a low wage offer are then considered to be revised in line with the considered labour market shock.

- the *pessimistic scenario.* In this scenario, the probability of a regime change is assumed to tend toward one. Households are consequently assumed to behave as though they will always be subject to a high probability of a low wage offer, both before and after the considered labour market shock.

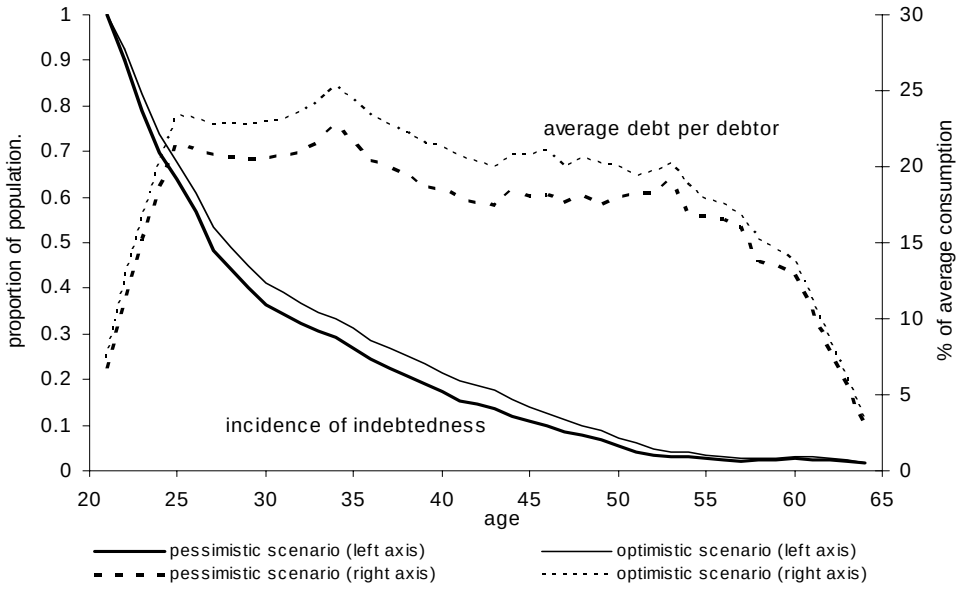
- the *naïve scenario.* This assumes that households behave as though they will always be subject to a low probability of a low wage offer, regardless of the probability to which they are actually subject.

All three of the scenarios that are reported here are based upon the model of credit rationing described by the complex-constraint scenario considered in Section 4. Hence, the complex-constraint scenario reported in Section 4 is the same as the optimistic scenario that is reported here, providing a link between the two sections.

The assumptions that underly the three scenarios described above are summarised in Table 1. Given the description provided in Section 3.2 of the environmental counterfactual that is considered for analysis, the optimistic and pessimistic scenarios represent extreme assumptions regarding the considered probability of a regime change that are natural focal points of interest. In contrast to these two, the

Table 1: Probabilities of Receiving a Low Wage Offer by Simulation Scenario

	Base Population		Counterfactual Projection	
Scenario	Expectation	Environment	Expectation	Environment
optimistic	low prob	low prob	high prob	high prob
pessimistic	high prob	low prob	high prob	high prob
naïve	low prob	low prob	low prob	high prob



Source: Age profiles generated by rational agent model, based calibrated parameters reported in Table 4 of van de Ven & Weale (2007) and amended as described in Table 1 of the current report.

Notes: Indebtedness defined with respect to household non-pension wealth

Monetary values expressed as percentages of average annual household consumption simulated between ages 20 and 110, with ages weighted to match the population structure described by the 2001 Census, equal to £28,281.

Figure 9: Statistics of Indebtedness in the Assumed Base Populations of Alternative Experimental Scenarios

naïve scenario cannot be rationalised, as it assumes a belief structural following the regime change that is inconsistent with the altered economic environment. The naïve scenario is of interest here because it focusses attention upon 'direct effects', in which behavioural responses to the policy environment are suppressed.

The alternative behavioural scenarios referred to above permit an analysis of the effects of indebtedness on responses to a worsening of labour market opportunities, because they have different implications for the extent of indebtedness in their respective base populations. Related statistics are reported in Figure 9.

Figure 9 indicates that both the incidence of indebtedness and the average debt per debtor are higher in the base population assumed for the optimistic scenario than the pessimistic scenario. The effects on the incidence of indebtedness are found to be most pronounced during the period between ages 30 and 40, when consumption needs are relatively high. These statistics are reinforced by population

aggregates for the respective populations. An aggregate perspective can be obtained on the figures for indebtedness. Discounting by assumed wage growth, and weighting age specific averages to reflect the population structure described by the 2001 Census obtains an aggregate for unsecured debt in the base population for the optimistic scenario of £16bn, and £13bn under the pessimistic scenario. Similarly, aggregate asset holdings rise from £1,208bn in the base population under the optimistic scenario to £1,273bn under in the pessimistic case.[19] It is interesting to note that these differences are entirely due to the differences in the assumed beliefs, as the same economic environment is imposed for the two base populations that are reported in the figure. Specifically, the pessimistic scenario assumes a belief structure that exaggerates precautionary incentives to save, giving rise to less indebtedness than observed for the base population generated under the optimistic scenario.

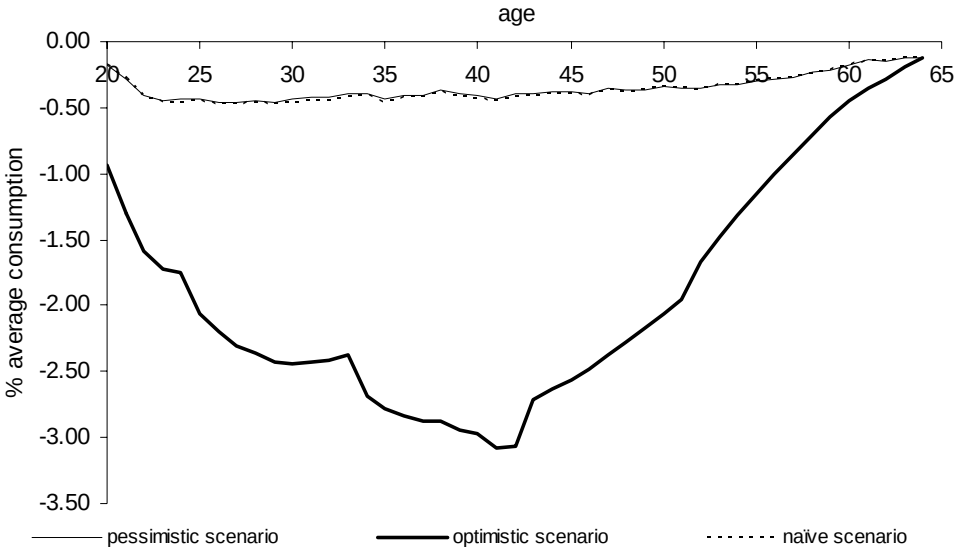
5.2 Behavioural responses in the short-run

Analysis of the alternative scenarios considered here revealed no significant behavioural responses over the labour supply margin. Furthermore, the influence of individual specific heterogeneity is explored at length in Section 4. The current discussion consequently focuses upon statistics of consumption for the full simulated population.

The effects of the respective environmental scenarios on average consumption by age are reported in Figure 10. All three series reported in Figure 10 indicate a fall in consumption during the working lifetime in the year that the labour market is considered to deteriorate. Furthermore, each of the three series describes a similar age profile, falling from 20, before rising again to age 65. As in the preceding section, the increase in the probability of a receiving a low wage offer has no influence on households from age 65 because all households are considered to have retired by that age. Figure 10 is particularly interesting in its depiction of the relative scale of the consumption responses consequent on a rise in the probability of a low wage offer. The largest fall – by a wide margin – is observed for the optimistic scenario, whereas the naïve and pessimistic scenarios describe a very similar consumption response to the deterioration considered for the labour market.

An alternative perspective of the consumption responses can be obtained by considering the population aggregates. Discounting the consumption effects reported in the Figure 10 to control for simulated wage growth of 1.9% p.a., and weighting the age specific averages to reflect the population structure described by the 2001 Census, obtains population aggregate effects for consumption of -0.18% for both the naïve and pessimistic scenarios, and -1.04% for the optimistic scenario. Hence, if the optimistic scenario provides a valid description of the economic environment, then a 4% rise in the perceived probability of a low wage offer would result in a fall in aggregate consumption of just over 1%, equal

[19] It must be remembered that in our model people do not hold unsecured debt at the same time as owning assets, while the presence of transactions costs makes this a sensible choice in the real world.



Source: Age profiles generated from rational agent model, based on calibrated parameters reported in Table 4 of van de Ven & Weale (2007) and amended as described in Table 1 of the current report.

Notes: Monetary values expressed as percentages of average annual household consumption simulated between ages 20 and 110, with ages weighted to match the population structure described by the 2001 Census, equal to £28,281.

Figure 10: Short-run Effects on Consumption of a Worsening in Labour Market Opportunities, by Experimental Scenario

to £7.5 billion for 2006.[20] This is almost six times the fall that is implied by the pessimistic scenario – in which households are fully prepared for the considered worsening in labour market opportunities – or the naïve scenario – in which households are considered not to recognise the altered economic environment.

What drives the differences in behavioural responses observed between the optimistic and pessimistic experimental scenarios that are described above? Both of these scenarios are based upon the same behavioural assumptions for the counterfactual policy projection. Hence, if identical base populations were considered by the two scenarios, then the two scenarios would result in identical consumption in their respective counterfactual policy projections. As discussed in the preceding subsection, however, larger reserves of available credit are maintained by the base population under the pessimistic scenario. This has two important implications, which relate respectively to the two data series reported in Figure 11. First, it means that households in the pessimistic scenario tend to be better off than those under the optimistic scenario following the regime change, and are able to finance higher consumption as a result – represented in Figure 11 by the 'counterfactual policy projection' series. Second, it means that households in the base population of the pessimistic scenario tend to consume less early in the simulated lifetime than those in the base population under the optimistic scenario, and to consumer more later in life – represented in Figure 11 by the 'base population' series.

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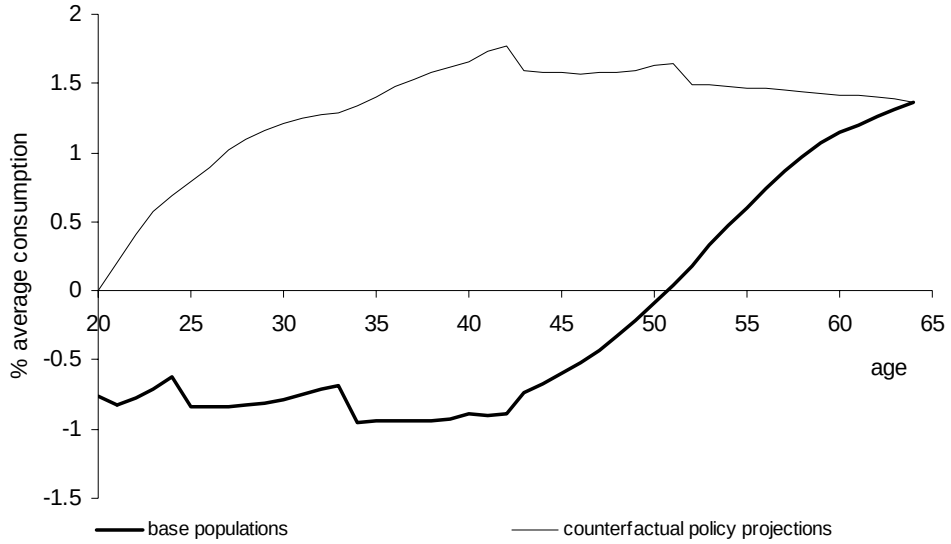


Source: Age profiles generated from rational agent model, based calibrated parameters reported in Table 4 of van de Ven & Weale (2007) and amended as described in Table 1 of the current report.

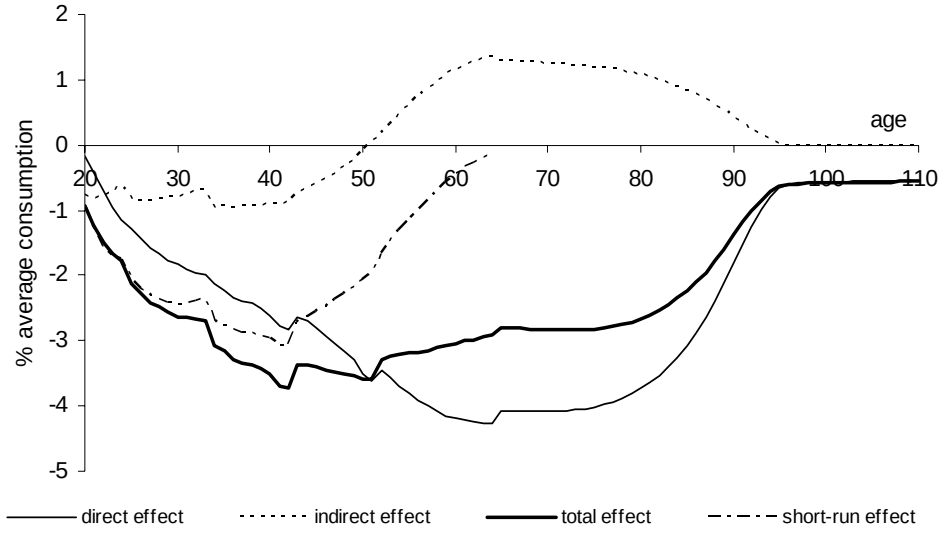
Notes: Monetary values expressed as percentages of average annual household consumption simulated between ages 20 and 110, with ages weighted to match the population structure described by the 2001 Census, equal to £28,281.

Figure 11: Age Specific Average Consumption Generated Under Pessimistic Scenario less Average Consumption Generated Under Optimistic Scenario: Base Populations and Counterfactual Projections

The statistics reported above emphasise the importance of expectations in relation to consumption responses following a labour market shock. Under the naïve and pessimistic scenarios, households are not surprised by the change in labour market conditions, either because they consider the higher prevalence of low wage offers as a temporary occurrence (in the case of the naïve scenario), or because they assumed a high probability from the beginning of their lives (in the case of the pessimistic scenario). Hence, when the shock occurs these households tend not to cut back on their consumption very sharply – their behaviour has not changed as a result of the shock and we are left with the associated direct effect of the policy change. In contrast, households in the optimistic scenario perceive a deteriorated labour market, both in the current period and for the rest of their working lives. They consequently choose to reduce their consumption by more than in the alternative scenarios, in response to the stronger precautionary savings motive that they perceive – their responses embody both direct and indirect effects to the environmental change.

5.3 Behavioural responses in the long-run

As noted in subsection 5.1, both the optimistic and pessimistic scenarios embody the same assumptions regarding the counterfactual projection considered for analysis. This implies that both scenarios imply an identical population in the long-run following a regime change, so that the only differences between the scenarios relate to the base populations that are considered for analysis. The analysis reported in



Notes: Age profiles generated from rational agent model, based on calibrated parameters reported in Table 4 of van de Ven & Weale (2007) and amended as described in Table 1 of the current report.
Monetary values expressed as percentages of average annual household consumption simulated between ages 20 and 110, with ages weighted to match the population structure described by the 2001 Census, equal to £28,281.

Figure 12: Long-run Effects on Consumption of a Worsening in Labour Market Opportunities, by Experimental Scenario

subsection 5.2 reveals that, with particular reference to the optimistic scenario, the differences between the base populations adopted for the optimistic and pessimistic scenarios can be interpreted as the indirect effect of the considered environmental change. Hence, the current discussion omits reference to the naïve scenario as discussed above, and focuses upon comparisons between three simulated populations: the base population considered for the optimistic scenario, L^eL^p (based on the *e*xpectation of a *L*ow probability environment, and a *L*ow probability environment in *p*ractice), the base population considered for the pessimistic scenario, H^eL^p, and the long-run projection for the counterfactual of both the optimistic and pessimistic scenarios, H^eH^p. In relation to the optimistic scenario, we can then define:

$$\begin{aligned} \text{total effect} &= H^eH^p - L^eL^p \\ \text{indirect effect} &= H^eL^p - L^eL^p \\ \text{direct effect} &= H^eH^p - H^eL^p \\ \text{total effect} &= \text{direct effect} + \text{indirect effect} \end{aligned}$$

Figure 12 reports age specific averages for the long-run effects on consumption as described by the three statistics referred to above. Also included for comparison in the figure are the short-run effects on consumption measured for the optimistic scenario, as reported in Figure 10.

Figure 12 reveals that the total effect of the deteriorated labour market under the optimistic scenario tends to be larger in the long-run than in the short-run, driven by the simulated direct effect. The direct effect reflects the impact of an environmental change in the absence of behavioural responses. Figure 10 reveals that the direct effect measured over a one year time horizon – as represented by both the naïve

and pessimistic scenarios – is marginal relative to the associated indirect effect. In contrast, the direct effect measured from a long-run perspective exceeds the magnitude of the associated indirect effect for all but the first three years of the simulated lifetime.

The direct effect of the environmental change is larger in the long-run than the short run because of the compounding influence that the repeated experience of a deteriorated labour market has on the circumstances of a household – the more years over which a birth cohort experiences a deteriorated labour market, the worse off it is. This explains the growth in the long-run direct effect reported in Figure 12 to age 64. From age 64 all households are considered to be retired, during which time they draw down their liquid wealth. This explains the decline projected for the long-run direct effect to maximum terminal age of 110.

The indirect effect reported in Figure 12 restates the differences between the base populations considered for the optimistic and pessimistic scenarios, as reported in Figure 11. Wage uncertainty is highest early in the simulated lifetime, and households would ideally like to have the largest stocks of precautionary savings then. It takes time, however, to build up a precautionary stock of wealth, and during this time wage uncertainty falls. The tension between these two forces explains the profile reported for the indirect effect: early in the simulated lifetime, households reduce their consumption to build up precautionary reserves; later in the lifetime (age 51 in the simulations), wage uncertainty falls to the point where precautionary savings are no long required, and households use the reserves acquired at younger ages to finance higher consumption. In contrast to the direct effect, the indirect effect consequently does not have a uni-directional influence on consumption.

Discounting the consumption effects reported in Figure 12 to control for simulated wage growth of 1.9% p.a., and weighting the age specific averages to reflect the population structure described by the 2001 Census, obtains population aggregates of -1.63% for the direct effect, -0.09% for the indirect effect, and -1.72% for total effect. That the indirect effect tends to wash-out from a population wide perspective should come as little surprise given the countervailing age effects at different stages of the simulated lifetime as discussed above. Furthermore, it is of note that the aggregate for the long-run total effect is 70% higher than the 1% effect observed for the year following the environmental change. These figures emphasise the importance of the time-scale in determining the impact of alternative policy counterfactuals.

5.4 Summary

- If a 4% rise in the probability of involuntary unemployment is fully anticipated by the simulated population, then net indebtedness prior to the labour market shock is 19% lower than when the shock comes as a complete surprise. In the year following the labour market shock, simulated

consumption falls by 0.2% in aggregate if the shock is fully anticipated, and falls by 1% of the shock comes as a surprise.

- If the population perceives the labour market shock to be temporary, then simulated consumption falls in the year following the shock by an aggregate amount that is commensurate with the fully anticipated scenario referred to above.

- Consumption is projected to fall by a wider margin in the long-run following a shock to the labour market (by 1.7%), due primarily to the compounding effect that a deteriorated labour market has on the financial circumstances of households.

6 Implications for Macro-Economic Modelling

The results that are reported in Sections 4 and 5 can be contrasted with what would be found in a simple macro-economic perspective with a representative, infinitely-lived consumer. There, an unanticipated downward jump in labour income that is believed to be permanent once it has occurred would lead to a downward jump in consumption by an equal amount. The whole of the adjustment would occur at once.

With an infinitely-lived consumer the capital stock would remain unchanged in the face of a permanent reduction in labour income. By contrast, in the life-cycle framework which our model represents, any cohort which has a reduced labour income for the whole of its working life, will reduce the amount of capital it builds up to finance its retirement *pari passu*. Thus the eventual reduction in consumption will be larger than with an infinite horizon model.

However our figures show that, when people are taken by surprise by the negative labour market shock, the initial fall in consumption is between 1 and 1.2%, while the eventual long-run reduction in consumption is 1.7%. It is generally accepted in practice that adjustment is gradual rather than abrupt; modelers who rely on infinite-horizon models create this effect by assuming that the welfare delivered by any level of consumption depends in part on previous levels of consumption.[21] Our results, in contrast, suggest that the gradual response may rather be a consequence of the age structure of the population.

The principles behind this point are quite straightforward. Retired people are unlikely to be affected directly by a reduction in labour income since they do not receive labour income. Thus, unless they alter their plans to leave bequests in some way which is not represented in our model, their consumption is unlikely to be affected by the disturbance. People close to retirement will reduce their consumption only slightly because only a small fraction of their total wealth (taking human capital and property/financial wealth together) is affected by the fall in labour income. The full impact of the change will be felt

[21] See, for example, Smets & Wouters (2004).

only by those at the start of their working lives, and the macro-economic response to the change will consequently not be completed until these younger generations near the end of their lives.

7 Conclusions

The current report considers household responses to a deterioration in labour market opportunities, and how those responses depend upon the financial provisions made by the private sector. The analysis is based upon observations drawn from a ration agent model that was designed specifically to capture household behaviour toward indebtedness, and was calibrated to survey data for a representative sample of the full population in the United Kingdom. We explore behaviour generated by the rational agent model, with particular reference to a 4% rise in the probability of involuntary unemployment.

Our analysis suggests that responses to a rise in the probability of involuntary unemployment depend crucially upon the methods of credit rationing, population expectations, and upon the time frame considered for analysis. If the labour market shock is anticipated by the population, or if the population considers the deterioration to be temporary, then consumption responses in the year following the regime change projected by our rational agent model are small – less than 0.2% of aggregate consumption for the examples considered here. If, however, the population is surprised by the regime change, and consider the change to be permanent, then a substantial fall is projected for consumption is projected to fall by 1-1.2% of the pre-transition aggregate depending upon the liquidity constraints that are imposed. A fall in domestic consumption of this magnitude is likely to have important macro-economic implications.

Strict credit limits are found to exaggerate short-run consumption responses to a deterioration in the labour market, particularly for poorer households. Soft liquidity constraints, by contrast, tend to discourage the accrual of debt by households, and consequently weaken the influence on behaviour of hard constraints. In the long-run, the the influence of liquidity constrains on behavioral responses to the considered labour market deterioration are found to cancel out. It is of note that consumption is projected to fall by a wider margin in the long-run following a shock to the labour market than in the short-run, due primarily to the compounding effect that a deteriorated labour market has on the financial circumstances of households.

Our analysis consequently suggests that analyses of short-run consumption responses to adverse economic shocks are likely to understate the practical reality unless they take behavioural responses to the altered economic environment – including the methods of credit rationing – into account. This is less of a problem in the longer-run, when the non-behavioural effects of the environmental change are likely to be more important.

The analysis also supports a managed flow of information to the public. The most preferred option is to provide warning well in advance of a potential negative economic shock. Alternatively, and per-

haps surprisingly, the analysis also gives support to the potential suppression of information dispersal. Suppose, for example, than an unanticipated negative economic shock were to occur. If the consumption responses consequent on the shock being perceived were likely to be sufficiently large to upset macro-economic stability, then it may be sensible to release information slowly, and thereby temporally disperse the impact on the market.

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