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Andrew Benito and Jumana Saleheen

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Andrew Benito⁽¹⁾ and Jumana Saleheen⁽²⁾

Abstract

This paper examines labour supply adjustment — both hours worked and participation decisions. The analysis focuses on the response of each to financial shocks, employing data from the British Household Panel Survey. Results suggest that employees whose financial situation deteriorates relative to what they expected, increase their labour supply in response. That response is consistent with models of self-insurance that incorporate labour supply flexibility. The shock reflects several factors including financial wealth and a partner's employment situation. The response is significantly larger for those who change job, consistent with the importance of hours constraints within jobs. The propensity to participate in the labour market also appears to respond to the financial shock but that is somewhat less robust than the hours response.

Key words: Labour supply, self-insurance.

JEL classification: J22.

(1) Bank of England. Email: andrew.benito@bankofengland.co.uk

(2) Bank of England. Email: jumana.saleheen@bankofengland.co.uk

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Publications Group, Bank of England, Threadneedle Street, London, EC2R 8AH
Telephone +44 (0)20 7601 4030 Fax +44 (0)20 7601 3298 email mapublications@bankofengland.co.uk

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Summary

How households adjust their behaviour in response to macroeconomic shocks, such as unexpected changes to their income, has a key bearing on how the economy responds to those shocks – and what the appropriate policy response should be.

Discussions of households' responses to shocks often emphasise households' spending response. But another key decision made by households is their labour supply. That decision has a key bearing on the overall supply side of the economy. The two sets of decisions on spending and labour supply are also likely to be connected to one another. So understanding households' labour supply behaviour may also help us understand the demand-side consequences of various shocks for the economy. Put simply, if households respond to shocks by altering their labour supply this places less onus on any spending response. It will also have important consequences for wages and prices.

This paper explores empirically the use of labour supply as a 'buffer', in the sense that it helps a household absorb some shock. That response has been highlighted in recent models of household behaviour. These relax an assumption present in earlier models that focused exclusively on households' spending and saving behaviour, and took their labour supply as fixed. Flexible labour supply in response to uncertainty may also help account for some 'puzzles' in household behaviour. That includes understanding why households work relatively long hours while young – when wages are relatively low, but future incomes are highly uncertain – and work shorter hours while old, when wages are typically much higher. It could also help rationalise why estimated spending responses to changing asset prices have often seemed 'small' relative to the predictions of a standard life-cycle model. An ability to respond through labour supply means less emphasis need be placed on spending to achieve some adjustment.

There is, however, little empirical evidence on the use of labour supply as a response to shocks, although there is a long tradition of estimating elasticities of labour supply to income and wages. This paper focuses on labour supply as a response to financial shocks – whatever their source – using individual-level data on around 80,000 person-year observations in Britain, available from the British Household Panel Survey. The indicator for a 'financial shock' is based on whether an individual is surprised by how their financial situation changed over the past year, compared to how they had expected it would change one year earlier.

An important constraint on the use of hours of work as a response to a financial shock is the incidence of hours constraints. Many jobs offer limited scope to adjust paid hours by working paid overtime, and there are significant costs incurred in trying to find an alternative or second job. Our analysis begins by documenting the scope for hours adjustment through working paid

overtime and second jobs. While that flexibility is greater in manual than non-manual occupations, many individuals do have significant scope to adjust their remunerated hours without changing job. Around one half (one fifth) of manual (non-manual) male employees work paid overtime. A somewhat lower proportion of women employees work paid overtime, with a much higher proportion of women working in non-manual occupations. Around 8%–10% of employees have a second job. Among those that do work ‘extra’ hours, the hours worked average around one quarter of their regular contracted hours. Simple stylised facts like this suggest many individuals have scope to adjust to any financial shocks by changing their desired hours.

Our results for hours adjustment suggest employees’ hours of work respond positively to an adverse financial shock. Moreover, this effect is largely restricted to those who change job during the year in question. That suggests that hours constraints within jobs are important and labour mobility between jobs is key for facilitating individuals’ labour supply response to a financial shock.

The presence of hours constraints within jobs may determine whether participation responds in addition to hours worked. For instance, in response to a financial shock, individuals may delay retirement rather than increase their current hours of work. So we look at the participation decision and how this varies with the experience of a financial shock, while controlling for other factors that are related to individuals’ propensity to participate. Our analysis finds that this margin of labour supply adjustment does respond to a financial shock. We find this applies to both men and women. Perhaps surprisingly, we find no evidence that the effect is larger among the old, for whom the decision of delaying retirement is more pertinent.

Some recent theoretical models suggest labour supply responses may interact with credit constraints faced by some households, particularly those with high levels of debt. More indebted households may have less of an available borrowing capacity to respond to any adverse shock and may face a stronger motive to respond to the shock by raising their labour supply. Our analysis addresses this possibility.

At the time that some shock affects the economy, reflected in a fall in financial wealth or other factors that have a bearing on households’ financial situation, labour demand may also weaken. The financial turmoil and recession of 2007-09 would appear to be a prime example of that. As labour demand weakens, this may make it difficult for households to realise an increase in labour *supplied*. That does not mean that labour supply issues can be ignored – only that one has to look at both labour supply and labour demand together. That is likely to be important to understand the cyclical properties of labour quantities and real wages.

1 Introduction

How do households respond to financial shocks? This general question is central to any discussion of how some macroeconomic news affects the outlook for the economy and the appropriate policy response. Such responses, which might include consumer spending and labour supply responses, are also central to discussions of inequality as revealed in consumption and income (Blundell (2009)). Shedding light on the possible use of labour supply as a response to financial news is the aim of this paper.

The ‘first generation’ of self-insurance models of household saving took labour supply as fixed – for example in the self-insurance model of Deaton (1991) and buffer stock saving framework of Carroll (1992). Any adjustment in these models comes through consumer spending. But more recent studies relax that fixed labour supply assumption (eg, Low (2005); Attanasio *et al* (2005)). These papers point clearly to the use of labour supply. That operates both as a means of insuring against income risk, *ex ante* – with workers supplying less labour when they believe the world (and their labour income) is more stable – and as a means of responding to a given shock, *ex post*.

This paper considers the use of labour supply as a buffer in an *ex-post* sense – as a response to some financial shock. The source of the shock is not explicit in the data considered, but it is likely to be a broad measure of financial shocks, capturing a range of unexpected changes to income or wealth. Flexible labour supply may also help account for other ‘puzzles’ in household behaviour. That includes understanding why households work relatively long hours while young - when wages are relatively low - and shorter hours while old, when wages are typically much higher. It could also help rationalise why estimated spending responses to changing asset prices have often seemed ‘small’ relative to the predictions of a standard life-cycle model (Poterba (2000); French (2000)). An ability to respond through labour supply means less onus need be placed on spending to achieve some adjustment.

While models with flexible labour supply seem to match certain ‘*ex-ante*’ stylised facts of household behaviour more closely, there is relatively little evidence on the use of labour supply as a response to shocks. At the same time, empirical evidence on labour supply and hours worked suggests it is difficult for individuals to change their hours worked. Hours constraints are pervasive and changing jobs is costly (Stewart and Swaffield (1997); Bryan (2007)). This complicates the likely use of labour supply at the intensive margin of hours worked and places a premium on empirical evidence.

Our results, based on an analysis of data from the British Household Panel Survey (BHPS), point quite clearly to the use of hours worked as a response to financial shocks, and support the use of labour supply as a buffer in response to financial shocks. An important part of our work is

to use a financial shock variable that can be constructed from the panel nature of the BHPS (eg, Boheim and Ermisch (2001); Benito (2009)). Our results confirm the importance of allowing for labour supply flexibility in understanding household behaviour. The results also indicate the importance of changing job as a means of facilitating a significantly larger labour supply response. Effects on hours worked are estimated at being several times larger where the employee changes job; and for those remaining in the same job hours of work responses are at the margins of significance. So the results are also consistent with the importance of hours constraints within jobs.

The remainder of the paper is organised as follows. Section 2 outlines the theoretical background drawing on recent models of household behaviour with uncertainty and flexible labour supply. The discussion also highlights the likely importance of hours constraints within jobs. Section 3 presents estimation results for labour supply adjustment. These estimates are based on panel data methods for hours adjustment and participation decisions and their responses to financial shocks. Section 4 concludes.

2 Economic background

2.1 Theoretical background

A relatively small but growing number of theoretical models of household behaviour highlight the use of labour supply as a response to financial news.

Low (2005) introduces labour supply flexibility into a partial equilibrium life-cycle model with ‘self-insurance’. Households accumulate savings partly as a buffer against future labour income uncertainty. The ability to flex labour supply is shown to have the following effects relative to the case with inflexible labour. First, it reduces saving while young. That is because the ability to respond flexibly through additional labour supply to any adverse shock reduces the need to self-insure by accumulating savings beforehand; saving when middle aged rises. Second, hours of work while young are higher – since individuals accumulate some of their buffer stock of savings against future uncertainty not simply by depressing their spending but also by raising labour supply ahead of that uncertainty. This implication helps resolve the puzzle of labour supply over the life-cycle that individuals seem to work longer hours while young, despite the fact that their wages are significantly lower. When older and uncertainty is resolved, having accumulated assets means that they can reduce labour supply, despite the higher wages. Third, it is shown how greater substitutability between consumption and leisure weakens the precautionary motive as both consumption and hours become more hump shaped.

The model of French (2005) highlights the effects of uncertainty – about wages and health – on labour supply, while focusing on retirement decisions. In that model households face severe borrowing constraints, being unable to borrow against future labour (or pension) income. Large

fixed costs of working are required to fit the profiles for participation and hours worked – and that also implies a high responsiveness to wages through retirement behaviour at older ages. The model predicts that labour supply elasticities should be increasing in age.

Bottazzi *et al* (2007) focus on the role of housing (and debt) and how this affects labour supply decisions in a model with wage and house price uncertainty. Households are subject to a collateral constraint in their secured borrowing decision. Additional labour supply affords one way of relaxing that constraint. In response to a wage shock, it is less costly to adjust labour supply than to change consumption of housing by moving home. This implies that households close to their borrowing constraint will experience a larger labour supply response than those households with more spare borrowing capacity.

Labour supply decisions may of course be made at the household rather than individual level. Attanasio *et al* (2005) employ a similar life-cycle model to Low (2005) to highlight the possibility that within a household, labour supply may respond to the partner's financial situation (see also Blundell (2009)). Partly simply because there is greater scope for adjustment – with lower average participation rates and hours worked – this response may be larger for women, the case on which Attanasio *et al* (2005) focus. Similar reasoning suggests it should be larger among the old, where participation rates are lower.

To summarise, these self-insurance models with flexible labour supply – taken together – have generated some supplementary predictions for the labour supply response to a financial shock. First, any effect should be greater for those who are close to their borrowing limit. Second, the effect should be larger among older employees, for whom the elasticity of labour supply is higher. Note that the first prediction may work against this latter prediction – the old are less likely to be credit constrained, having (in general) accumulated assets and do not face as steeply sloped an earnings profile. Third, the shock may partly reflect the partner's financial situation and shocks to that such as loss of work for the partner. That response may be larger for women than men.

2.2 *Hours constraints*

These theoretical models inevitably abstract from several features that shape labour supply in practice. One such feature is the presence of hours constraints – which a number of studies have highlighted as important.

Stewart and Swaffield (1997) noted that many (manual) employees work hours significantly different to their preferred level, at the prevailing hourly wage. That may make adjustment through labour supply difficult and/or undesirable. Precisely how to interpret these hours constraints is not straightforward, but *prima facie* they appear inconsistent with the canonical

model of labour supply, where individuals work their desired hours or can switch costlessly between jobs with different hours on offer.

In terms of interpreting how some individuals work different hours to what they would like, one possibility is that fixed costs of employment (eg, training or social insurance) may effectively make short hours unprofitable for the firm. A competitive outcome can then imply workers working more hours than desired but fewer hours than the employer would like. Another possibility is that this is a temporary phenomenon and people being ‘off their labour supply curve’ will be corrected through labour mobility. Individuals then match with the hours offer that they desire. But deviations from desired hours seem to persist for quite long periods of time suggesting that any costs of mobility must be high (Bryan (2007)). A third alternative possibility is that the standard model of labour supply is wrong in a deeper sense and instead the labour market has monopsonistic features. High costs of worker mobility may effectively confer some monopsony power to employers implying workers are ‘bargained off’ their labour supply curve (Naylor (2002)).

In terms of understanding how households might respond to a financial shock these models would seem to have a common implication: in practice it may be difficult for employees to raise their hours worked in response to some shocks. An emphasis on hours constraints might offset the previous theoretical prediction of an hours worked, labour supply response to a financial shock. An obvious implication of hours constraints within jobs is that any response should be greater when an employee changes job (Blundell *et al* (2008)).

3 Estimation strategies

Estimation methods for labour supply adjustment cover both changes in hours worked and labour force participation. Heckman (1993) emphasises the importance of distinguishing the two types of effect. Heckman (1993) also notes the traditional view that the participation margin is a more important margin for labour supply adjustment than is that of hours. The analysis of hours worked draws on a difference-in-differences estimator approach. Our analysis of labour force participation employs a dynamic random effects probit model.

3.1 Regression-adjusted difference-in-differences estimator for hours worked

A standard difference-in-differences estimator that compares the change in experience of treatment and control groups can be implemented in a standard least squares regression applied to panel data (eg, Stewart and Swaffield (2008)). By the same token, this means that the effect of some ‘shock’ can be understood in a difference-in-differences framework.

Stewart and Swaffield (2008) and Blundell *et al* (2008) examine the effects of certain policy interventions (the national minimum wage and changes in in-work benefits, respectively) on hours worked. But the framework can be borrowed to estimate the effect of any shock that is assumed to affect one group and not another. This estimator is designed to address the question: how would hours of work have changed for those that experienced a financial shock had they not experienced a financial shock, and by how much did their actual labour supply evolve differently from that? This is the ‘treatment effect on the treated’. The standard difference in differences estimator is given by:

$$\hat{\alpha} = (\bar{h}_{t2}^{(1)} - \bar{h}_{t1}^{(1)}) - (\bar{h}_{t2}^{(2)} - \bar{h}_{t1}^{(2)})$$

This takes the change in average hours worked (per week) of those affected by the shock (superscripted as group (1)) and deducts the change in average hours worked of the comparison group, those who do not experience a financial shock (group (2)). This can be implemented as a standard linear regression model (that being a model for the conditional mean of the dependent variable). Implemented in that way, the estimating equation is the following.

$$\Delta h_{it} = X'_{it}\beta + \alpha q_{it} + \gamma_t + \varepsilon_{it}$$

where ‘*i*’ indexes employees, $i=1,2\dots N$ and ‘*t*’ indexes years $t=1992, 1993\dots 2007$. ‘*h*’ is a measure of weekly hours worked (see below). *X* is a set of regressors correlated with hours worked. *q* is the measure of the financial shock (also discussed below) and α is its effect on hours worked, the main parameter of interest. As presented there is one type of financial shock, although empirically this will be generalised to allow for both positive and negative surprises to one’s financial situation. γ_t is a set of year effects to control for macroeconomic influences on hours worked. ε_{it} is an error term.

As with any difference-in-differences estimation, there are two key identifying assumptions. First, those individuals subject to the financial shock should not be prone to a different trend in hours worked to those that do not experience the shock. Second, there should be no ‘spillover’ effects from the labour supply choices of those experiencing the shock to those that do not experience the shock. Under these assumptions, least squares estimation of (1) and $\hat{\alpha}$ provides an unbiased estimate of the average effect of a financial shock on labour supply (hours) of the treated group, those affected by the shock.

It is also assumed that experiencing a financial shock is not correlated with factors that are related to labour supply decisions. Or rather, given the regression-adjusted nature of the difference-in-differences estimator it is assumed these are controlled for by the inclusion of the additional controls in *X* (eg, Stewart (2004)).

3.2 Dynamic random effects probit models for participation decisions

We also examine the propensity to participate in the labour market and how this is affected by a financial shock. Our estimating equation consists of:

$$y_{it} = 1\{\gamma y_{it-1} + X'_{it}\beta + \alpha_i + u_{it} > 0\}$$

where ‘ i ’ indexes individuals, $i=1,2..N$ and ‘ t ’ indexes years $t=1992, 1993..2007$. $1\{A\}$ is the indicator function for the event A , so that an individual is either observed participating in the labour market (as an employee, self-employed or unemployed) or is outside the labour force.¹ The model includes a lagged dependent variable, y_{it-1} , with associated coefficient ‘ γ ’ indicating the degree of state dependence in the participation decision. A vector of explanatory variables X have associated parameter vector, β . The regressor set includes a set of year dummies to control for common macroeconomic effects. The financial shock terms are also included in X , as well as other ‘taste shifters’. The model includes a set of individual-specific effects controlling for unobserved heterogeneity, α_i . In the random effects model these are assumed $\alpha_i \sim N(0, \sigma_\alpha^2)$ with the error term u_{it} assumed to be (standard) normally distributed and serially uncorrelated.² The individual-specific heterogeneity and error term are assumed uncorrelated with each other and with the covariates, X and y_{it-1} .

The inclusion of the lagged dependent variable (y_{it-1}) alongside unobserved heterogeneity (α_i) generates an ‘initial conditions problem’ if, as seems likely, the two are correlated (Heckman (1981)). Heckman (1981) presents an estimator that deals with this issue but that requires convincing exclusion restrictions. An alternative estimator proposed by Wooldridge (2005) is simpler to implement, does not require exclusion restrictions and has been shown to provide similar results to the Heckman estimator in both small and large samples (see Arulampalam and Stewart (2009)). Our results focus on the Wooldridge (2005) estimator.³

Some survey evidence seems consistent with the likely importance of labour supply responses – at least in some circumstances. A survey by the Building Societies Association of a sample of households that had fallen into mortgage arrears in 2009 but who corrected those arrears enquired how they had managed to do that. Labour supply responses – working longer hours and taking a second job - feature strongly among these responses, and indeed feature more prominently than the ‘reduced spending’ response.⁴ We now aim to confront that hypothesis with data more formally.

¹ The following labour market states are all classified as outside the labour force: retired, family carer, full-time student, long-term sick or disabled, on maternity leave, on a government training scheme or the residual category ‘something else’.

² Stewart (2006) considers the case where there is serial correlation in the error term

³ Cappellari and Jenkins (2009) employ the Wooldridge estimator while studying the dynamics of social assistance benefit receipt.

⁴ When large financial pressures need correcting in the short term – such as falling into mortgage arrears – a labour supply response at the intensive margin (hours worked) seems more likely than when adjustment can be corrected over the medium term, such as in response to weaker asset prices. This may contribute to the prominence of the labour supply responses in this survey.

4 Data and results

4.1 The data

Data are drawn from the British Household Panel Survey (BHPS) for the years 1991 to 2007. The BHPS is an annual, panel-based survey of households in Britain (formally, those living south of the Caledonian Canal) beginning in 1991 with a sample of approximately 5,500 households. Individuals join the survey when they form households with one of these original sample members. The BHPS provides detailed information on employment including working hours, incomes, education and standard demographic characteristics. Information on financial positions is more limited. Interviews essentially take place in the autumn of each calendar year.

One qualitative indicator concerns responses to questions regarding how individuals expect their ‘financial situation’ to change over the following year. In each year each individual is also asked how their financial situation changed over the past year. Comparing an individual’s experience for the year with what one year previously they had expected for that year provides a useful indicator of a financial surprise or shock (eg, Boheim and Ermisch (2001); Benito (2007, 2009)). This has the advantage over using observed outcomes for wages, employment, house prices or anything else that might be related to a shock, that some changes in these outcomes may be expected or even voluntary, and may not therefore reflect the kind of *ex-post* shock of interest.

Studies of labour supply adjustment through hours worked by Stewart and Swaffield (2008) and by Blundell *et al* (2008) both use the BHPS. The sample employed here is selected on the basis of individuals who are employed, working positive hours in at least two successive years, were aged less than 65 in the first year they appear in the panel, and did not belong to the BHPS ‘booster’ samples undertaken in 1999 and 2001.⁵

4.2 Data description

Data description proceeds in two stages. First, some proxies for the likely flexibility of hours are presented, based on different types of hours worked (contracted hours, paid and unpaid overtime and second jobs). Second, given its importance to the analysis, additional data description of the financial shock variable is presented. That includes a general data description of the covariates used.

How variable are hours worked?

Employees may face different adjustment costs for adjusting their hours in different ways. Paid overtime and second jobs are likely to afford greater flexibility – being capable of being changed at low cost – than contractual hours.

⁵ These booster samples were added for Scotland and Wales in 1999 and Northern Ireland in 2001 in order to facilitate country-level analysis.

The narrowest measure of hours in the BHPS is core, contracted hours normally worked (excluding overtime and meal breaks). The broadest measure is total hours normally worked including overtime (paid and unpaid) and any hours worked in a second job. Between these measures, other definitions include only paid overtime in the main job, paid and unpaid hours in the main job and all remunerated hours (contracted hours plus paid overtime and second job's hours).

How widespread is working 'extra' hours (over contractual hours)? Table 2 shows that one half of male employees work overtime, either paid or unpaid. In the case of non-manual male employees that is mostly unpaid, although almost 20% of male, non-manual employees work paid overtime. Among manual workers, almost all overtime is paid overtime. The proportions are a little lower for women. Around 10% of employed men and women have second jobs.

Quantitatively, how significant are these extra hours worked? Table 2 also indicates the number of 'extra' hours worked relative to their normal contract hours, among those working overtime, paid overtime or second jobs, respectively. The overall impression is that extra hours are quite important – and that includes paid extra hours. Among those working overtime (paid or unpaid) their overtime hours are on average almost one quarter of their main contracted hours. The proportion for *paid* overtime is around 20%-25%. As noted above, a smaller proportion of people have second jobs than work paid overtime. But having incurred the search costs of obtaining an additional job, the hours they allocate to their second jobs are a significant proportion of their main job's hours, particularly for women and average around 20%-30%. Of course there is considerable variation across individuals around these mean values.

Hours variability over the year is another indicator of scope for hours adjustment. The mean absolute change in total paid hours worked per week is 3.9, which is over 10% of average total paid hours. Table 1 shows some simple sample splits illustrating that this mean hours variability varies significantly with individual characteristics, experiences and preferences. Hours variability is greater for men (4.1 hours) than women (3.7 hours). Larger differences emerge for the private v public sector comparison (almost a full hour per week) and for the manual v non-manual comparison (1.3 hours). Those that stated they wanted to work different hours see greater hours variability, suggesting they are able to act on that preference to some extent. A similar finding for hours constraints is obtained by Boheim and Taylor (2004). Those that experienced a financial shock exhibit slightly greater hours variability, consistent with their wanting to change hours in response to financial surprises (defined in Section 3, below) and being able to act on that to a degree.

The single most important characteristic for (longitudinal) hours variability over time is whether the individual changed job in the past year (Blundell *et al* (2008)). The mean absolute change in

hours for those that change job of 6 hours per week compares to an equivalent figure for those that did not change job of 3.3 hours per week.⁶

So to summarise, hours variability is greater among men, manual workers in the private sector, those that had wanted to work different hours, experienced a financial shock and, quite crucially, changed job. These characteristics can of course be combined. As one example, for those who changed job, experienced a negative financial shock and also preferred to work more hours (the year before), the mean absolute change in hours over a year is close to 10 hours per week (based on a sample of 421 individuals).

Who experiences a financial shock?

Tables 3 and 4 summarise the factors related to experiencing a financial shock. In Table 3, the main covariates are split by whether an individual experiences a financial shock, both positive and negative. Broadly speaking, those experiencing a negative shock are on average less highly educated, have a lower hourly wage (which may proxy their human capital), have lower wage growth, are more likely to have separated from their partner in the past year; they are a similar age and experience similar house price appreciation (on the self-reported measure used here) to other individuals.

As a further exercise in data description, Table 4 reports results from probit models for the experience of an adverse financial shock as a function of these characteristics.⁷ This helps control for associations among the covariates in seeing how the experience of a negative shock is related to individual and household characteristics in the raw data.

Table 4 indicates that having experienced an adverse financial shock is more likely for those who are young, have low household income and have had low income growth over the year. Public sector workers are less likely to experience an adverse financial shock. A higher hourly wage and higher wage growth on the year are similarly negatively related to the propensity to experience a shock, and are highly statistically significant. There is only modest evidence suggesting that, having controlled for wage, income and other terms, being degree-educated is associated with a lower incidence of experiencing a negative financial shock. A financial shock is significantly more likely to be recorded by someone whose partner lost their job in the past year.

Among men, for the 1991 to 2007 sample (column 1) the probability of having a negative shock is raised by 0.092 if the partner loses their job (evaluated at the means of the data) while for

⁶ A job change can occur either at the same employer or by changing employer. Using the BHPS job history files would allow us to distinguish between these two types of job move, although preliminary analysis indicated that would involve the loss of around two thirds of the sample so that distinction was not pursued.

⁷ Since this is intended simply as an exercise in data description, these probit models do not control for random effects.

women it is raised by 0.164 (column 3). These coefficients are well determined, with robust t-ratios in excess of 5. Since the mean proportion that report a negative financial shock is 0.27 (0.28) for men (women), the partial effect of a partner having lost their job is large – and especially so for women. There is little or no suggestion that how the house value has varied over the year is related to a financial shock.⁸ On that basis, households would appear not to attach much weight on how their house price has varied relative to what they might have expected in assessing how their financial situation has surprised them.⁹

Data on pension status are rather limited in the BHPS. But in the 2001 and 2005 waves of the survey some more detailed information on occupational pension provision is available. In those years, we know whether the employee has an occupational pension and whether it is a defined contribution (DC) pension or a defined benefit (DB) pension. We also know whether the individual has a private (non-occupational) pension, which will be DC in nature. Whether the scheme is DB or DC should have a bearing on the risk the individual is exposed to. For those on DC schemes, that should translate into a higher propensity for experiencing a negative shock. That would be especially true in 2001 when there was a marked equity market correction. Through 2001, the FTSE-All share index fell by 15%, having fallen at one point by 26%.

There is some evidence that those with a DB pension are less likely to be recorded as having experienced a shock, at least among men. The raw data show that men with a DB pension are significantly less likely to have experienced a negative shock compared to those with a DC pension, with a robust t-ratio on the DB pension term of -1.96 (column 2), and a marginal effect estimated at almost 0.05. Among women, there is less evidence of this pattern. However, adding a DC term that is interacted with a dummy for 2001 – when the large equity price falls occurred – attracts a significantly negative marginal effect, put at 0.149 (robust t-ratio = 2.35). That result is not obtained for men. That suggests that at least among women the financial shock term picks up large equity price movements for those with DC schemes, whereas those with DB schemes, both men and women, are estimated to be more insulated from adverse financial shocks.

Conventional models for labour supply reviewed by Blundell and MaCurdy (1999) consider (log) hours as a function of an own-wage term and unearned income (typically proxied by the partner's labour income in the case of married women as well as interest income). These models rarely include any direct measure of financial (or housing) wealth. Based on the results reported above (Table 3), our measure of a financial shock appears related to financial wealth surprises (eg, through the DC versus DB pension terms) which these labour supply models rarely capture. Our approach for hours worked, following that of Blundell *et al* (2008) and Stewart and Swaffield (2008), also has the advantage of being much more straightforward to estimate and

⁸ This suggests our financial shock term is unlikely to pick up the effects of house price shocks on labour supply – an effect on which Henley (2004) focuses.

⁹ That may be because they plan to remain in the same home for many years, in which case there is little net financial gain from house price appreciation – and particularly if they plan to move to a similarly sized next home. Those planning on trading down (up) soon would be the major winners (losers) from house price gains.

interpret than those models.¹⁰ However, compared to a standard labour supply model with earned and unearned income effects, our models are decidedly reduced-form; the financial shock term will pick up both of these effects, along with others that are related to wealth and changes in household structure. A small number of studies have looked at the effects of wealth on labour supply, focusing on the effects of financial ‘windfalls’. These studies generally find that receiving positive windfalls to one’s wealth (eg, associated with a lottery) reduce labour supply. This also offers an alternative approach to the one pursued here. Henley (2004) presents what would appear to be the sole UK study of how wealth windfalls affect labour supply.¹¹

4.3 Estimation results

Regression-adjusted difference-in-differences for hours worked

Table 5 presents results from the regression-adjusted difference-in-differences estimator for hours worked. The coefficients reported in the table indicate the change in weekly hours worked for a negative financial shock and a positive financial shock – both relative to the base group of no shock, that is, one’s financial situation reported as similar to what one expected a year before.

There are two key results. First, there is evidence in favour of the key prediction that employees respond to financial shocks by adjusting labour supply. Men affected by a negative financial shock tend to increase their hours worked (relative to no shock). Among women, a negative shock is associated with a significant increase in hours relative to a positive shock, although this is not significant relative to the base group of no shock. For women, a stronger result is that in response to a positive financial shock, they reduce hours worked.

Second, changing job is important for facilitating that labour supply response. An employed man experiencing a negative financial shock that changes his job experiences an increase in hours worked by 1.2 hours per week on average. A man who does not change job raises his hours by much less, only about 15 minutes per week, although still statistically significant. Among women, the effects of shocks are also more significant for job changers than those who do not change job. For women, that comes through more in the form of reducing hours in response to a positive financial shock – and generates a large effect at around 1.5 hours per week among job changing women experiencing a positive shock. The results suggest that changing job within a firm is strongly related to hours adjustment. That is also true for those job changes that involve a change of employer – at least for men.

How does labour supply adjustment differ by age? We split the sample at around median, aged 40, and report results separately for the two sub samples. The results suggest that the relatively

¹⁰ Blundell and MaCurdy (1999) highlight difficulties in interpreting many labour supply elasticities owing to the range of functional forms used.

¹¹ Some of the windfalls included by Henley (2004), such as redundancy payments, may be related to participation decisions for reasons unrelated to how they affect the marginal utility of wealth.

young are more flexible in adjusting their hours worked. Among other things, the young may differ by having less firm-specific and job-specific human capital. This may increase their flexibility to respond to changes to their hours preferences, although adding a control for a job move does not change the pattern of results very much.

We examined the robustness of these results by changing the set of control variables. The addition of additional controls for changes in household composition (ie, a change in marriage status, birth of a child or a child reaching primary school age) made next to no difference to the results cited in Table 5.

A prediction of the Bottazzi *et al* (2007) model is that mortgage-holders face higher adjustment costs (to changing mortgage-related outgoings) in the face of a wage shock and this makes them more likely to adjust by raising their labour supply. This does not find empirical support in our regressions. Among the sample of men we find larger labour supply responses for those without a mortgage, with an estimated response of 0.779 hours in terms of total paid hours compared to an equivalent response of 0.346 hours, among those with a mortgage.

Among those without a mortgage, around two thirds are renters with one third owning their property outright. These of course may be quite different groups, particularly in terms of their likelihood of being liquidity constrained, and renters have precommitted rental payments that those who own outright do not have. So those who own outright may be a better comparison group for those with a mortgage under the Bottazzi *et al* (2007) model. Estimating the same hours adjustment equations for those who own their properties outright again fails to offer much evidence to support that view. The estimates are less well determined, likely reflecting the smaller sample size and are generally borderline significant. But the point estimates of the responses for the group of those who own their property outright are generally a little larger in absolute magnitude than for the group of mortgagors.

The model of Bottazzi *et al* (2007) predicts a highly non-linear response between debt and labour supply responses. The largest responses should be among those that are closest to exhausting their borrowing capacity being close to their borrowing limit. Such borrowing capacity is likely to be related to the loan to value ratio on the property.¹² Table 6 reports results that try to assess this hypothesis, considering whether those mortgagors with high loan to value ratios experience greater labour supply responses than those with lower loan to value ratios (but who have a mortgage). The median loan to value ratio of those with a mortgage is 0.46 and we use this as the threshold to define the two samples. We are not able to uncover evidence that those with higher loan to value ratios, that have smaller equity cushions to borrow against, have any larger labour supply responses.

¹² See Benito (2006a) for an analysis of how the collateral constraint affects the housing market. Benito and Mumtaz (2009) present evidence of how the collateral constraint (through the current loan to value ratio) affects spending plans consistent with liquidity constraints operating on some households.

Employing the loan to income ratio as an indicator of borrowing capacity generates a similar pattern of results. There is little evidence suggesting that those with higher loan to income ratios – perhaps with less of an untapped marginal borrowing capacity – respond by raising their hours worked to a greater extent.

As an alternative indicator of financial distress as regards housing payments, we consider whether the household reports that they have had problems paying for their housing (whether owned or rented) over the year. A relatively small sample (around 1,100 men and 1,400 women) reports payment difficulties on this measure. This makes isolating a well-determined coefficient more difficult than for the larger sample of those reporting no payment difficulties. That point notwithstanding, the pattern does not lend any general support to the idea that those with payment difficulties – that might find it more difficult to extend their borrowing further – respond by raising their labour supply to a greater extent than other households.

As Bottazzi *et al* (2007) highlight, in cross-section homeowners work longer hours and that seems to hold even after controlling for how availability of mortgage finance might differ between homeowners and non-homeowners. Our evidence points to little significant difference between the two groups' responses to financial surprises in terms of their hours worked. That might suggest that the longer hours worked by homeowners might be a more long-term response to financial pressures.

Hours preferences

Many employees appear to work hours that differ from what they would like at the prevailing wage (Stewart and Swaffield (1997)). So labour supply responses seem likely to depend on where the individual's hours were relative to what they desired. Those who initially wanted to work longer hours seem more likely to respond to a negative financial shock by raising their hours worked. Those who initially wanted to work less might find their desired hours closer to their actual hours after being adversely affected by a financial shock – making them less likely to change the amount they work.

We estimate similar equations for the change in hours separately according to preferences over hours worked. These are reported in Table 7. Those who declare that they had wanted to work longer hours are estimated to experience the largest positive change in hours in response to a negative shock, irrespective of whether they change job or not. The term for the negative financial shock term attracts a coefficient (robust t-ratio) for men of 1.163 (2.14) paid hours and 0.962 (1.98) hours among women. For those who wanted to work fewer hours the equivalent coefficients are 0.092 and -0.100 , respectively and both insignificant. Those who were working

similar hours to their desired level, see an intermediate response, although better determined, likely reflecting the larger sample sizes in this group.

We conclude that the hours worked response will depend on where an individual's hours are relative to their desired hours. The overall pattern is consistent with labour supply preferences responded as expected to a financial shock.

Separately, we have also considered family-level hours adjustment, redefining the unit of observation to total hours worked by a couple with two adult members (with or without children). These results – which for parsimony we do not report here – confirm the pattern found above. In particular, a negative shock to the male member of the couple is associated with a rise in the hours worked by the couple; a positive shock reported by the female household member is associated with reduced joint hours of work. This pattern of results holds for both the narrow definition of hours of work (main job only) and the broader measure of hours which includes hours worked in second jobs.

Participation decisions

Table 8 presents average participation rates before and after experiencing a financial shock – as well as similar participation rates among a comparison group that do not experience the shock in the base year. The raw data are consistent with a positive labour supply response following a negative financial shock for women – but not for men. Average participation rates seem untrended for both groups prior to the year of the shock, for both men and women. Following the adverse shock, the average participation rate for women rises by around 1.7 percentage points, while for those women not experiencing the shock it falls marginally. A raw difference in differences estimate of the effect of the financial shock on participation rates puts this at 0.023 for women but only 0.004 for men.

As a further introduction to the data, Table 9 presents transition rates between participation and non-participation for both men and women, and how these appear to vary in the raw data with a negative shock. The high value entries across the principal diagonal of the two-by-two matrix indicate high rates of persistence in labour force participation. That persistence seems lower for those that experience a negative financial shock, however. Among men that experience no shock between successive years and are outside the labour force, 7.6% of them transit to become participants in the following year. That proportion rises to 22.8% among those men that experience a negative financial shock (in the previous year). A similar pattern obtains among women. While 10.4% of non-participants that experience no financial shock transit to participation in the following year, that proportion rises to 25.3% among women that experience a negative financial shock.

Table 10 reports estimation results from various dynamic random effects (RE) probit models for the propensity to participate in the labour market. The set of regressors is similar to that of Hyslop (1999) who examined married women's labour supply in the United States. We extend that regressor set for indicators of health status, which prove highly significant, and for the financial shock terms. The results reported in Table 10 report the standard RE probit model under the assumption that the initial conditions (y_{i0}) are exogenous. Subsequent results in Tables 11 and 12 apply the Wooldridge estimator which conditions on those initial observations of the individual for participation.

Before focusing on labour supply as a buffer, there are several other interesting aspects of the results. First, there is consistent evidence of state dependence, as indicated by a quantitatively large and statistically significant lagged dependent variable. That obtains after controlling for unobserved heterogeneity through the random effects as well as personal characteristics. As expected, the estimated degree of state dependence falls significantly when we control for initial conditions (Table 11) – but state dependence remains statistically significant and quantitatively large throughout. Second, the terms for individual characteristics are intuitive. Those with higher levels of education are more likely to be participants, both for men and women, consistent with education raising the returns to participation.¹³

Third, turning to the role of the financial shocks, there is significant evidence that individuals respond to positive and negative financial surprises by adjusting their labour supply at the extensive margin. That estimated effect obtains after controlling for state dependence and personal characteristics. Without controlling for initial conditions (Table 10), among men an adverse financial shock is estimated to raise the predicted probability of participating in the labour market by 0.014 (t-ratio=3.05) relative to the case of no financial shock. Among women, the equivalent marginal effect associated with an adverse financial shock is to raise the participation probability by 0.025 (t-ratio=3.21). The role for financial surprises is further highlighted by comparing the effect to that associated with a positive financial surprise which, again relative to the omitted group of no financial surprise, lowers participation rates for both men and women.

That finding is somewhat sensitive to whether we control for initial conditions using the Wooldridge (2005) Conditional Maximum Likelihood (CML) estimator. In Table 11, while the estimates that control for initial conditions, state dependence and unobservables generate a statistically significant coefficient on the negative shock term, adding the list of personal controls drives the financial shock terms to insignificance – for both men and women. It is the

¹³ Table 11 reports marginal effects calculated by normalising on the error variance of the error term σ_u (see Arulampalam (1999) for a discussion).

inclusion of the age controls that accounts for this. This may reflect the fact that the young face more risk, and with it a greater incidence of negative shocks, than do older age groups.¹⁴ A related possibility is that the young tend to be less risk averse and so are more likely to experience negative shocks (and to be more mobile). It is not entirely clear that one should control for that particular role associated with age, even though there may be other good reasons for controlling for age.

In column 7 we consider one additional experiment in the sample of married women. We have already shown that the negative financial shock in part picks up variation induced by a partner losing their job. In column 7 we consider directly evidence for an added worker effect, associated with whether a woman enters the labour force associated with their partner having lost his job. We find little evidence in support of this hypothesis.¹⁵

How does this participation response to the financial shock vary by age? The young might be better able to flex labour supply (eg, by moving geographically) but against that, older workers have lower participation rates in general giving them greater scope to adjust participation, for example by delaying retirement. We estimate separate results for a relatively young age group – those aged under 35 in the first survey year they appear in the sample – and a relatively old age group – those aged 45 or over. Among both men and women the response to financial shocks is estimated to be stronger among the young, highlighted by a significantly negative participation response to a positive financial shock.

The model of Bottazzi *et al* (2007) suggests that those with less borrowing capacity see a greater tendency for labour supply response through participation. In their model that response occurs predominantly through the participation decisions of (married/cohabiting) women.¹⁶ In Table 12, we report results obtained from the Wooldridge estimator that control for initial conditions for a sample of married women. We estimate separate models according to balance sheet characteristics of the household.

Columns 1 to 3 consider different types of housing tenure status. These results are most favourable to the Bottazzi *et al* (2007) model. The participation response is estimated to be largest for those that are owner-occupiers and in particular for those households who hold a mortgage. Across the three samples, this is the only group where the participation propensity of married women responds significantly to a financial shock.

¹⁴ The incidence of negative shocks is 0.31 among those aged under 30; 0.30 for ages 30-39; 0.29 for ages 40-49; 0.27 for ages 50-59 and 0.20 for ages 60+. See Benito (2006b) for a study showing how income uncertainty, specifically risk of job loss, affects consumer spending.

¹⁵ Stephens (2002) notes that the literature has generally indicated a small or negligible added worker effect from married women's labour supply. That is interpreted as consistent with spells of unemployment among husbands being transitory. Stephens (2002) finds somewhat stronger evidence for the United States based on a distinction between voluntary and involuntary job displacement.

¹⁶ For the same reason, theoretical models of self-insurance with flexible labour supply focus on (married) women's labour supply (eg, Attanasio *et al* (2005); Bottazzi *et al* (2007)).

Using the loan to value ratio as an (inverse) measure of unused borrowing capacity is considered in column 4 to 6 of Table 12. These results are less favourable to the Bottazzi *et al* (2007) model. The groups of households with lower loan to value ratio, and higher borrowing capacity, are more likely to respond through a higher participation propensity of the woman.

Bottazzi *et al* (2007) emphasise a strong non-linearity in the labour supply response, with the marginal response being stronger at particularly high levels of debt. This hypothesis attracts little direct support. The group with a loan to value ratio of 0.65 or above has a similar responsiveness to groups with slightly less debt. It may be that loan to value ratios are more difficult to measure than the simple characteristic of housing tenure status. Another possibility, more favourable to the model of Bottazzi *et al* (2007), is that we are not able to consider the highest loan to value ratios at which their non-linearity emerges owing to insufficient sample sizes.

Overall, the pattern of results supports the idea that the indebted as a group experience a stronger labour supply response to financial shocks at the participation margin. That finding was not apparent in terms of hours of work responses among the employed. And there is less support for the Bottazzi *et al* (2007) result that this response should be still stronger among those with particularly high levels of indebtedness.

5 Conclusions

Labour supply may offer an important means for households to adjust to financial shocks. Recent models of self-insurance with flexible labour supply emphasise this response. This paper has examined labour supply responses using data from the British Household Panel Survey for the period 1991 to 2007.

Labour supply responses might apply at both the intensive (hours) and extensive (participation) margins. The paper has examined both. An important constraint influencing households' hours response to financial shocks is the hours constraints they face. We demonstrate, however, that the incidence of paid overtime – applying to around one third of men and one fifth of women employees – and second jobs – held by around one in ten employees – suggest that many individuals are likely able to adjust their hours worked at relatively low cost, should they wish. Nonetheless, our results also suggest that changing job greatly facilitates a larger hours adjustment.

Participation decisions also appear to respond to financial surprises. These responses hold after controlling for state dependence, individual-specific heterogeneity, initial conditions and a range of personal characteristics, but the estimates are sensitive to whether or not we control for age. Overall, the pattern of results does not provide much support for the conventional wisdom –

although largely based on earlier sample periods – that most labour supply responses come through the extensive margin of participation rather than the intensive margin of hours worked by the employed.

Our results indicate that the labour supply response may also be related to the balance sheet position of the household. There was, however, relatively little evidence that labour supply adjustment is strongly related to the household’s level of indebtedness. Further evidence on this issue would clearly be welcome. There might be added value from deriving that evidence from a time when balance sheets were likely to have played a more ‘active’ role in affecting credit conditions. The sample period considered here – during which credit conditions were relatively and perhaps progressively relaxed – might be one reason why balance sheets were not found to interact strongly with labour supply responses.

When some shock such as a fall in equity prices affects the economy, other contemporaneous shocks may weaken demand. The financial turmoil and recession of 2007-09 would appear a prime example of that. If labour demand also weakens, this may make it difficult for households to realise an increase in labour *supplied*. That does not mean that the labour supply issues highlighted in this paper can be ignored – only that one has to look at both labour supply and labour demand together. That is likely to be important in understanding the cyclical properties of labour quantities and real wages and perhaps how these might vary from one recession to another.

Table 1: Scope for hours flexibility

	Male		Female	
	Manual	Non-manual	Manual	Non-manual
	N=15,386	N=19,692	N=6,079	N=30,675
Works overtime	0.571	0.558	0.323	0.401
Works paid O/T	0.528	0.172	0.289	0.165
Has second job	0.081	0.089	0.119	0.101
<i>Average hours worked – ratio of extra to main hours for those working extra hours</i>				
Overtime	0.250	0.238	0.264	0.237
Paid overtime	0.252	0.200	0.268	0.241
Second job	0.187	0.179	0.384	0.300

Note: Ratio of extra to main hours takes each category of extra hours individually.

Table 2: Hours variability at the employee level

	Mean absolute change in weekly hours	Difference	t-test (H ₀ : equality of means)
Male	4.1		
Female	3.7	0.4	8.8
Private sector	4.2		
Public sector	3.3	0.8	17.2
Manual	4.8		
Non-manual	3.6	1.3	25.0
Wanted to work different hrs (t-1)	4.3		
Works similar hours to desired (t-1)	3.6	0.7	15.5
Financial shock (t-1)	4.0		
No financial shock (t-1)	3.7	0.3	6.7
Changed job	6.0		
Not changed job	3.3	2.7	49.6
With mortgage	3.7		
No mortgage	4.3	0.6	11.7
<i>Memo</i>			
Changed job, negative shock (t-1), & wanted to work more hours (t-1)	9.9		

Note: Table reports mean absolute change in hours worked (ie, whether positive or negative) across successive waves of the BHPS.

Table 3: Summary statistics (sample means)

	Male			Female		
	Negative shock	No shock	Positive shock	Negative shock	No shock	Positive shock
<i>Personal characteristics</i>						
Age	38.1	39.0	39.0	38.1	39.9	38.6
Degree-educated	0.142	0.178	0.203	0.14	0.155	0.174
A-levels	0.158	0.132	0.138	0.12	0.117	0.118
<i>Job characteristics</i>						
Manual job	0.446	0.430	0.410	0.169	0.164	0.157
Public sector	0.200	0.212	0.216	0.387	0.417	0.427
Hourly wage (£, 2007 prices)	11.081	11.473	12.252	8.44	8.91	9.5
Real wage growth	0.009	0.046	0.048	0.019	0.035	0.051
Job change	0.287	0.287	0.328	0.306	0.281	0.346
Employer change	0.142	0.127	0.134	0.139	0.110	0.121
<i>Household characteristics</i>						
Real income growth	0.003	0.052	0.067	-0.013	0.048	0.081
Partner lost job	0.012	0.037	0.038	0.028	0.014	0.012
Became divorced	0.014	0.011	0.012	0.034	0.013	0.014
House price growth	0.077	0.073	0.073	0.067	0.074	0.077
Observations	8,047	15,018	5,547	7,716	15,737	5,848

Note: Educational attainment, manual job, public sector, job and employer change, partner lost job and became divorced are dummy indicator variables, so the table reports sample proportions.

Table 4: Propensity for negative shock

	Male		Female	
	[1]	[2]	[3]	[4]
<i>Personal characteristics</i>				
Age*	-0.184 (-4.90)	-0.215 (-4.04)	-0.279 (-7.69)	-0.317 (-6.25)
Degree-educated	-0.011 (-0.90)	-0.036 (-1.52)	-0.025 (-2.01)	-0.047 (-2.27)
A-levels	0.010 (0.83)	0.017 (0.90)	-0.029 (-2.48)	-0.029 (-1.66)
<i>Job characteristics</i>				
Manual	-0.001 (-0.16)	-0.004 (-0.30)	-0.004 (-0.31)	-0.009 (-0.58)
Public sector	-0.015 (-1.50)	-0.003 (-0.13)	-0.007 (-0.83)	-0.002 (-0.13)
Hourly wage*	-0.143 (-1.84)	0.092 (0.66)	-0.344 (-3.77)	-0.191 (-1.26)
Real wage growth	-0.121 (-5.84)	-0.157 (-5.31)	-0.032 (-1.89)	-0.081 (-3.42)
DC pension		-0.009 (-0.30)		0.023 (0.70)
DB pension		-0.057 (-2.23)		-0.031 (-1.26)
<i>Household characteristics</i>				
Real hhold income growth	-0.076 (-3.84)	-0.075 (-2.67)	-0.084 (-5.87)	-0.074 (-3.66)
Partner lost job	0.117 (5.59)	0.108 (3.14)	0.174 (5.51)	0.098 (2.06)
Became divorced	0.127 (2.72)	0.065 (0.88)	0.251 (6.87)	0.250 (4.62)
House price growth	0.007 (0.19)	0.067 (1.24)	-0.032 (-0.97)	-0.071 (-1.43)
Year dummies	Yes	Yes	Yes	Yes
Actual proportion	0.273	0.290	0.244	0.248
Predicted proportion	0.268	0.284	0.241	0.251
Maximum likelihood	-7,105.03	-3,031.57	-6,718.01	-3,071.66
Observations	12,299	5,118	12,410	5,607

Note: Table shows the marginal effects associated with maximum likelihood probit estimates of experiencing a negative financial shock (robust t-statistics in parentheses). The samples with the DC pension terms are restricted to 2001 and 2005 surveys, where these data are available. * indicates coefficient multiplied by 100.

Table 5: Effect of financial shocks – regression-adjusted difference-in-differences estimates

	MALE		FEMALE	
	Total paid hours – main job	Total paid hours – including second job	Total paid hours – main job	Total paid hours – including second job
Diff-in-diff with control vector	<i>n</i> = 23,373	<i>n</i> = 23,135	<i>n</i> = 24,093	<i>n</i> = 23,861
Negative shock (t-1)	0.444 (3.93)	0.474 (4.07)	0.273 (2.56)	0.272 (2.42)
Positive shock (t-1)	-0.047 (-0.38)	-0.034 (-0.27)	-0.293 (-2.67)	-0.430 (-3.78)
ALTERNATIVE SAMPLES (with control vector)				
Changed job	<i>n</i> = 4,941	<i>n</i> = 4,891	<i>n</i> = 4,962	<i>n</i> = 4,915
Negative shock (t-1)	1.311 (4.07)	1.237 (3.76)	0.452 (1.42)	0.271 (0.83)
Positive shock (t-1)	0.743 (2.01)	0.782 (2.12)	-1.116 (-3.14)	-1.388 (-3.86)
Did not change job	<i>N</i> = 16,486	<i>N</i> = 16,318	<i>N</i> = 17,084	<i>N</i> = 16,921
Negative shock (t-1)	0.160 (1.37)	0.217 (1.77)	0.168 (1.58)	0.231 (2.01)
Positive shock (t-1)	-0.178 (-1.34)	-0.169 (-1.23)	-0.108 (-1.01)	-0.199 (-1.76)
Changed employer	<i>n</i> = 3,521	<i>N</i> = 3,483	<i>N</i> = 3,503	<i>N</i> = 3,464
Negative shock (t-1)	1.488 (3.72)	1.402 (3.46)	0.688 (1.75)	0.606 (1.51)
Positive shock (t-1)	-0.363 (-0.71)	-0.435 (-0.86)	-0.539 (-1.11)	-0.646 (-1.31)
Not change employer	<i>N</i> = 26,111	<i>N</i> = 25,847	<i>N</i> = 27,499	<i>N</i> = 27,256
Negative shock (t-1)	0.298 (2.99)	0.341 (3.31)	0.189 (2.10)	0.214 (2.23)
Positive shock (t-1)	0.012 (0.10)	0.032 (0.28)	-0.194 (-2.13)	-0.288 (-3.02)
age<40	<i>N</i> = 12,280	<i>N</i> = 11,952	<i>N</i> = 12,168	<i>N</i> = 11,853
Negative shock (t-1)	0.758 (4.70)	0.793 (4.76)	0.339 (2.11)	0.273 (1.62)
Positive shock (t-1)	-0.049 (-0.27)	-0.033 (-0.18)	-0.310 (-1.88)	-0.471 (-2.78)
age>=40	<i>N</i> = 11,093	<i>N</i> = 12,141	<i>N</i> = 10,967	<i>N</i> = 12,008
Negative shock (t-1)	0.090 (0.58)	0.182 (1.32)	0.111 (0.69)	0.244 (1.66)
Positive shock (t-1)	-0.054 (-0.32)	-0.288 (-1.99)	-0.049 (-0.28)	-0.401 (-2.65)

Table 5 (cont.)

	N = 9,820	N = 9,727	N = 3,702	N = 3,659
Negative shock (t-1)	0.589 (3.11)	0.653 (3.33)	0.372 (1.19)	0.288 (0.87)
Positive shock (t-1)	-0.300 (-1.38)	-0.258 (-1.17)	-0.440 (-1.32)	-0.422 (-1.19)
Non-manual	N = 16,553	N = 13,408	N = 20,391	N = 20,202
Negative shock (t-1)	0.326 (2.39)	0.329 (2.34)	0.256 (2.27)	0.273 (2.32)
Positive shock (t-1)	0.094 (0.62)	0.084 (0.54)	-0.270 (-2.34)	-0.433 (-3.65)
With mortgage	N = 16,142	N = 15,981	N = 16,370	N = 16,221
Negative shock (t-1)	0.263 (2.11)	0.346 (2.70)	0.282 (2.24)	0.292 (2.19)
Positive shock (t-1)	-0.065 (-0.47)	-0.003 (-0.02)	-0.155 (-1.24)	-0.294 (-2.25)
Without mortgage	N = 7,231	N = 7,154	N = 7,723	N = 7,640
Negative shock (t-1)	0.865 (3.62)	0.779 (3.13)	0.214 (1.07)	0.189 (0.91)
Positive shock (t-1)	-0.022 (-0.08)	-0.117 (-0.44)	-0.632 (-2.88)	-0.766 (-3.43)
Own outright	N = 3,305	N = 3,270	N = 3,505	N = 3,460
Negative shock (t-1)	0.656 (2.06)	0.573 (1.76)	0.414 (1.72)	0.384 (1.56)
Positive shock (t-1)	0.095 (0.29)	-0.042 (-0.12)	-0.628 (-2.30)	-0.524 (-1.86)

Note: Control variables included in the regressions consist of financial expectations for the year ahead (2), education dummies (2), age, housing tenure (2), public sector employee and manual worker.

Table 6: Variation by borrowing capacity

	MALE		FEMALE	
	Total paid hours – main job	Total paid hours – including second job	Total paid hours – main job	Total paid hours – including second job
ALTERNATIVE SAMPLES (with control vector)				
LTV (t-1) < 0.5	N = 7,216	N = 7,144	N = 7,550	N = 8,379
Negative shock (t-1)	0.218 (1.16)	0.309 (1.60)	0.458 (2.42)	0.448 (2.27)
Positive shock (t-1)	-0.203 (-0.98)	-0.126 (-0.59)	-0.037 (-0.22)	-0.175 (-1.00)
LTV(t-1) >=0.5	N = 6,855	N = 6,786	N = 6,593	N = 6,542
Negative shock (t-1)	0.267 (1.41)	0.342 (1.75)	0.186 (0.93)	0.216 (1.01)
Positive shock (t-1)	0.188 (0.88)	0.245 (1.11)	-0.376 (-1.87)	-0.564 (-2.68)
LTV(t-1) >=0.75	N = 2,976	N = 2,950	N = 2,826	N = 2,802
Negative shock (t-1)	0.232 (0.80)	0.335 (1.12)	0.179 (0.59)	0.089 (0.27)
Positive shock (t-1)	0.035 (0.11)	0.068 (0.19)	-0.515 (-1.64)	-0.763 (-2.34)
Problems paying for housing? Yes.	N = 1,135	N = 1,123	N = 1,394	N = 1,378
Negative shock (t-1)	0.722 (1.26)	0.548 (0.93)	0.438 (0.87)	0.264 (0.50)
Positive shock (t-1)	-0.921 (-0.83)	-1.323 (-1.19)	-0.082 (-0.12)	-0.292 (-0.42)
Problems paying for housing? No.	N = 18,194	N = 18,016	N = 18,422	N = 18,261
Negative shock (t-1)	0.435 (3.51)	0.510 (3.97)	0.206 (1.69)	0.199 (1.55)
Positive shock (t-1)	-0.074 (-0.55)	0.009 (0.07)	-0.243 (-2.00)	-0.439 (-3.48)

Note: LTV samples restricted to homeowners with a mortgage.

Table 7: Variation by hours preferences

Preferences over hours worked (t-1)	MALE		FEMALE	
	Total paid hours – main job	Total paid hours – including second job	Total paid hours – main job	Total paid hours – including second job
Work fewer hours (t-1)	<i>N</i> = 8,450	<i>N</i> = 8,372	<i>N</i> = 7,440	<i>N</i> = 7,383
Negative shock (t-1)	0.092 (0.48)	0.060 (0.30)	-0.100 (-0.54)	-0.163 (-0.84)
Positive shock (t-1)	-0.042 (-0.19)	-0.089 (-0.40)	-0.329 (-1.64)	-0.469 (-2.29)
Work more hours (t-1)	<i>n</i> = 1,479	<i>N</i> = 1,454	<i>N</i> = 1,754	<i>N</i> = 1,715
Negative shock (t-1)	1.163 (2.14)	1.031 (1.84)	0.962 (1.98)	0.744 (1.45)
Positive shock (t-1)	0.117 (0.15)	-0.064 (-0.08)	0.436 (0.74)	-0.133 (-0.21)
Work similar hours (t-1)	<i>N</i> = 13,285	<i>N</i> = 13,159	<i>N</i> = 14,799	<i>N</i> = 14,668
Negative shock (t-1)	0.569 (4.06)	0.647 (4.45)	0.238 (1.88)	0.280 (2.08)
Positive shock (t-1)	-0.088 (-0.60)	-0.019 (-0.13)	-0.198 (-1.54)	-0.290 (-2.14)

Table 8: Average participation probabilities

	Male				Female				Married Women			
	Negative shock	No negative shock	Positive shock	No positive shock	Negative shock	No negative shock	Positive shock	No positive shock	Negative shock	No negative shock	Positive shock	No positive shock
<i>Years relative to shock</i>												
<i>t-4</i>	0.838	0.794	0.824	0.802	0.671	0.646	0.702	0.642	0.670	0.653	0.709	0.645
<i>t-3</i>	0.839	0.794	0.836	0.800	0.663	0.649	0.719	0.637	0.665	0.655	0.724	0.641
<i>t-2</i>	0.840	0.793	0.833	0.801	0.668	0.648	0.710	0.640	0.669	0.653	0.719	0.643
<i>t-1</i>	0.836	0.795	0.847	0.797	0.665	0.649	0.716	0.639	0.663	0.655	0.725	0.642
<i>t=0</i>	0.830	0.798	0.860	0.795	0.661	0.650	0.741	0.633	0.661	0.656	0.749	0.636
<i>t+1</i>	0.841	0.794	0.850	0.797	0.676	0.645	0.711	0.640	0.676	0.651	0.715	0.645
<i>t+2</i>	0.840	0.794	0.854	0.796	0.683	0.643	0.710	0.641	0.689	0.647	0.712	0.646
<i>t+3</i>	0.840	0.794	0.853	0.797	0.683	0.643	0.706	0.642	0.691	0.647	0.712	0.646
<i>t+4</i>	0.845	0.792	0.843	0.799	0.695	0.639	0.694	0.645	0.696	0.645	0.712	0.647
<i>Avg t-4 – t-1</i>	0.838	0.794	0.835	0.800	0.667	0.648	0.712	0.640	0.667	0.654	0.719	0.642
<i>Avg t+1 – t+4</i>	0.842	0.794	0.850	0.797	0.684	0.643	0.705	0.642	0.688	0.648	0.713	0.646
Difference relative to no shock	0.004		0.018		0.023	-	-0.009	-	0.028		-0.012	

Table 9: Transition rates between participation and outside the labour force (%)

Male					Female						
Negative shock		No negative shock		Negative shock		No negative shock					
<i>0</i>	<i>1</i>	<i>0</i>	<i>1</i>	<i>0</i>	<i>1</i>	<i>0</i>	<i>1</i>	<i>0</i>	<i>1</i>		
<i>0</i>	77.2	22.8	<i>0</i>	92.4	7.6	<i>0</i>	74.7	25.3	<i>0</i>	89.6	10.4
<i>1</i>	3.0	97.0	<i>1</i>	3.6	96.4	<i>1</i>	7.8	92.2	<i>1</i>	7.3	92.7

Note: '0' denotes outside the labour force and '1' denotes participation.

Rows represent labour market state in year 't-1', and columns their status in year 't'.

Table 10: Propensity for labour market participation – y_{i0} exogenous

	Male		Female		Married women		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
lfp_{t-1}	2.922 (92.03)	2.556 (75.04)	2.283 (89.30)	2.031 (74.08)	2.283 (89.30)	1.909 (56.77)	1.959 (55.70)
Negative shock $_{t-1}$	0.173 (5.61)	0.100 (3.05)	0.124 (5.40)	0.077 (3.18)	0.124 (5.40)	0.071 (2.45)	
Positive shock $_{t-1}$	-0.007 (-0.20)	-0.072 (-1.93)	-0.015 (0.58)	-0.027 (-0.99)	0.015 (0.58)	0.004 (0.13)	-0.005 (-0.15)
Spouse lost job $_{it-1}$							-0.106 (-1.44)
Degree-educated		0.242 (5.02)		0.378 (9.44)		0.238 (4.84)	0.231 (4.42)
A-levels		-0.308 (-7.24)		-0.148 (-3.97)		0.067 (1.30)	0.101 (1.80)
Married		0.246 (6.13)		0.040 (1.43)			
Any child aged<4		-0.016 (-0.25)		-0.521 (-15.65)		-0.603 (-15.42)	-0.612 (-14.28)
No. of children		-0.049 (-2.30)		-0.136 (-9.02)		-0.153 (-8.29)	-0.144 (-7.10)
Age dummies	no	Yes (5)	No	Yes (5)	No	Yes (5)	Yes (5)
Health dummies	no	Yes (5)	No	Yes (5)	No	Yes (5)	Yes (5)
Year dummies	Yes (14)	Yes (14)	Yes (14)	Yes (14)	Yes (14)	Yes (14)	Yes (14)
P	0.173 (0.021)	0.075 (0.020)	0.204 (0.016)	0.174 (0.017)	0.204 (0.016)	0.247 (0.020)	0.245 (0.022)
LR Test ($\rho = 0$)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
[p-value]							
Test: $\beta_1 = \beta_2$	0.00	0.00	0.00	0.00	0.00	0.00	-
Log likelihood	-6384.662	-5250.336	-12333.523	-11017.055	-12333.523	-8156.439	-7001.094
Individuals	5,292	5,292	5,996	5,996	5,996	4,500	4,176
Observations	34,582	34,582	39,371	39,371	39,371	28,662	24,922

Note: Table shows coefficient estimates for maximum likelihood random effects probit models of labour force participation (t-ratios in parentheses). ρ indicates the proportion of the error variance accounted for by the individual-specific component. Test: $\beta_1 = \beta_2$ is a test of the hypothesis of the equality of the two financial shock coefficients.

Table 11: Propensity for labour market participation – Wooldridge (2005) estimator

	Male			Female			Married women		
	[1]	[2]	<i>Marginal effects</i>	[3]	[4]	<i>Marginal effects</i>	[5]	[6]	[7]
Lfp _{t-1}	1.970 (47.92)	1.772 (40.34)	0.357	1.644 (61.73)	1.426 (49.75)	0.477	1.601 (49.55)	1.389 (41.00)	1.427 (39.26)
Lfp (t=1)	2.544 (24.75)	2.039 (21.64)	0.462	1.778 (33.66)	1.686 (32.25)	0.564	1.800 (23.22)	1.657 (27.60)	1.653 (25.77)
Negative shock _{t-1}	0.090 (2.39)	0.030 (0.76)	0.003	0.081 (3.15)	0.043 (1.62)	0.013	0.069 (2.28)	0.045 (1.42)	0.077 (2.26)
Positive shock _{t-1}	-0.041 (-0.96)	-0.084 (-1.87)	-0.008	0.004 (0.14)	-0.020 (-0.65)	-0.006	0.016 (0.45)	-0.001 (-0.02)	0.018 (0.47)
Spouse lost job _{it-1}									-0.153 (-1.94)
Degree-educated		0.739 (9.78)	0.043		0.620 (12.36)	0.161		0.323 (5.61)	0.305 (4.98)
A-levels		-0.375 (-6.38)	-0.042		-0.246 (-5.38)	-0.082		-0.026 (-0.44)	0.004 (0.07)
Married		0.226 (4.11)	0.022		-0.018 (-0.53)	-0.006			
Any child aged<4		0.017 (0.20)	0.001		-0.740 (-19.67)	-0.265		-0.805 (-18.80)	-0.834 (-17.68)
No. of children		-0.093 (-3.22)	-0.008		-0.072 (-4.02)	-0.023		-0.073 (-3.47)	-0.076 (-3.32)
Age dummies	no	Yes (5)		No	Yes (5)		No	Yes (5)	Yes (5)
Health dummies	no	Yes (5)		No	Yes (5)		No	Yes (5)	Yes (5)
Year dummies	Yes (14)	Yes (14)		Yes (14)	Yes (14)		Yes (14)	Yes (14)	Yes (14)
<i>P</i>	0.571 (0.019)	0.349 (0.025)		0.390 (0.014)	0.174 (0.017)		0.417 (0.017)	0.354 (0.018)	0.355 (0.019)
LR Test ($\rho = 0$)	0.00	0.00		0.00	0.00		0.00	0.00	0.00
[p-value]									
Test: $\beta_1 = \beta_2$	0.01	0.02		0.02	0.07		0.17	0.26	0.18
Log likelihood	-5633.851	-4687.005		-11186.365	-9957.207		-8243.313	-7433.217	-6374.829
Individuals	5,292	5,292		5,996	5,994		4,500	4500	4,176
Observations	34,582	34,582		39,371	39,368		28,662	28,662	24,922

Note: Table shows coefficient estimates for maximum likelihood random effects probit models of labour force participation (t-ratios in parentheses), using the Wooldridge (2005) estimator. ρ indicates the proportion of the error variance accounted for by the individual-specific component. Test: $\beta_1 = \beta_2$ is a test of the hypothesis of the equality of the two financial shock coefficients.

Table 12: Propensity for labour market participation among married women and household balance sheets – Wooldridge (2005) estimator

	Housing tenure			Housing equity		
	[1]	[2]	[3]	[4]	[5]	[6]
	Mortgagor	Non-mortgagor	Own outright	$ltv < 0.4$	$0.4 \leq ltv < 0.65$	$0.65 \leq ltv$
lfp_{t-1}	1.228 (26.72)	1.637 (31.29)	2.059 (27.99)	1.819 (26.80)	1.045 (17.13)	1.181 (14.13)
$lfp(t=1)_i$	1.557 (20.48)	1.597 (17.32)	1.361 (10.65)	1.240 (12.17)	1.428 (15.60)	1.337 (11.46)
Negative shock $_{t-1}$	0.080 (1.98)	0.003 (0.06)	-0.027 (-0.37)	0.128 (2.01)	0.042 (0.81)	0.022 (0.31)
Positive shock $_{t-1}$	-0.005 (-0.11)	0.001 (0.01)	0.079 (1.00)	0.040 (0.56)	-0.053 (-0.88)	-0.010 (-0.12)
Degree-educated	0.249 (3.68)	0.308 (3.15)	0.046 (0.39)	0.214 (2.31)	0.221 (2.72)	0.154 (1.51)
A-levels	-0.013 (-0.18)	-0.002 (-0.02)	0.022 (0.17)	0.118 (1.04)	-0.085 (-1.02)	-0.041 (-0.39)
Any child aged <4	-0.895 (-17.54)	-0.690 (-8.27)	-0.757 (-4.35)	-0.745 (-7.82)	-0.937 (-15.41)	-0.955 (-11.10)
No. of children	-0.084 (-3.22)	-0.083 (-2.29)	0.011 (0.18)	0.004 (0.11)	-0.123 (-3.86)	-0.049 (-1.13)
Age dummies	Yes (5)	Yes (5)	Yes (5)	Yes (5)	Yes (5)	Yes (5)
Health dummies	Yes (5)	Yes (5)	Yes (5)	Yes (5)	Yes (5)	Yes (5)
Year dummies	Yes (14)	Yes (14)	Yes (14)	Yes (14)	Yes (14)	Yes (14)
P	0.353 (0.024)	0.355 (0.130)	0.283 (-3.53)	0.261 (0.040)	0.323 (0.032)	0.204 (0.016)
LR Test ($\rho = 0$)	0.00	0.00	0.00	0.00	0.00	0.00
[p-value]						
Test: $\beta_1 = \beta_2$						
Log likelihood	-4343.164	-3027.318	-1546.310	-1743.629	-2601.452	-1272.692
Individuals	3,000	2,384	1,248	1,847	2,253	1,570
Observations	17,114	11,548	6,854	7,273	9,841	4,978

Note: Table shows coefficient estimates for maximum likelihood random effects probit models of labour force participation (t-ratios in parentheses), using the Wooldridge (2005) estimator. ρ indicates the proportion of the error variance accounted for by the individual-specific component. Test: $\beta_1 = \beta_2$ is a test of the hypothesis of the equality of the two financial shock coefficients – p-value shown.

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