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Renata Bottazzi
Serena Trucchi
Matthew Wakefield

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Renata Bottazzi
University of Bologna and Institute for Fiscal Studies, London

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Ca' Foscari University of Venice

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Keywords
Labour Supply, Financial wealth shocks, Wealth effects

JEL Codes
D15, J22

Address for correspondence:
Serena Trucchi
Department of Economics
Ca' Foscari University of Venice
Cannaregio 873, Fondamenta S.Giobbe
30121 Venezia - Italy
e-mail: serena.trucchi@unive.it

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wp.dse@unive.it

Department of Economics
Ca' Foscari University of Venice
Cannaregio 873, Fondamenta San Giobbe
30121 Venice Italy
Fax: ++39 041 2349210

March 2019

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Renata Bottazzi (University of Bologna and Institute for Fiscal Studies, London)
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Abstract

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* The name order of authors is alphabetical.
Contact details: Bottazzi: renata.bottazzi (at) unibo.it, Department of Statistical Sciences - University of Bologna, via Belle Arti 41, Bologna, 40126 (BO), Italy;
Trucchi: serena.trucchi (at) unive.it, Department of Economics, Ca' Foscari University of Venice;
Wakefield: matthew.wakefield (at) unibo.it, Department of Economics, University of Bologna.
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The usual disclaimer applies.

1. Introduction

When faced with wealth shocks, do individuals adjust their labour supply? How strong are any adjustments? In a world in which increasing longevity, and modifications to pension systems, are encouraging individuals to accumulate private wealth, such questions are increasingly pertinent. Answers to these questions will be important for designing pensions and other policies that shape asset returns and incentives to accumulate wealth. The aggregate nature of asset price movements also means that these labour supply responses are important for trend and business cycle movements in economic output.

We aim to provide evidence on the responsiveness of labour supply to resource shocks, using data on Italy in the mid and late 2000s, a period that includes a considerable shock to financial asset values. During this period there were substantial movements in labour market participation rates in Italy, particularly for younger and older workers. At the start of the current century, employment rates for older workers (aged 55 – 64), and for youth (ages 15 - 25), were both just below 30%. By 2010, the employment rate of older workers was above 35%, while youth employment had fallen to 20%. The youth employment rate has remained at or below this level ever since but the employment rate of older workers has continued to climb, to just above 50% in 2017. [1] While we certainly do not have the ambition to explain such trends[2], our results do fit in with the pattern as they indicate that negative shocks to financial wealth led to increased labour supply, and these results are mainly driven by older workers.

A challenge for studies aiming to identify the wealth (or "income") effect that we are interested in, is to find a source of variation in resources that is independent of household labour-supply choices, and that will not also be associated with a change in behaviour due to a "substitution" (or wage) effect. To address this, we import from the consumption literature the idea that a shock to asset values can provide a source of variation in wealth that is

[1] Annual employment rates for these age groups are displayed in Appendix Figure A1.

[2] These trends are a motivation for the studies of Boeri, Garibaldi and Moen (2016) and Bertoni and Brunello (2017). Both papers exploit increases in pension ages as a source of exogenous variation in the employment of older workers and find that the retention of these workers has restricted employment opportunities for younger individuals in Italy, particularly at a time of recession. The reforms that they exploit should not confound our study since individual financial wealth shocks will be unrelated to changes in pension age and because the biggest variation in pension ages (and the "Monti" Government that enacted it) occurred after the period of our data.

exogenous to households' behaviour. The shock comes from the 2006 – 10 period that we choose for our study. Italy's FTSE-MIB fell by more than 60% between May 2007 and March 2009, with a large part of this fall in the middle part of 2008. [3] Households that held wealth in stocks thus suffered a sudden, potentially large and mostly unanticipated shock to their financial wealth.[4] Using this shock to asset values as a source of variation and exogeneity, we present estimates for the responsiveness of labour supply to changes in resources based on an Instrumental Variables (IV) estimator and its associated reduced form. The IV estimator is related to that developed by Banks et al (2012) to estimate the propensity to consume out of a wealth shock, and we have used a similar estimator in our own study of consumption responses in Italy (Bottazzi et al, 2013 and forthcoming).[5] The details of our estimators are discussed in section 3.

Our data come from the Bank of Italy's Survey on Household Income and Wealth (SHIW). These data contain detailed information on respondents' labour-market outcomes, and our dependent variables use information on whether individuals work, on the number of hours that they work, and on the level of their labour income. The data also contain rich information on households' demographic and economic characteristics including, crucially for our purposes, on their asset ownership and the values of asset holdings. The survey sample is representative of the Italian resident population and there is a rotating panel component. This impressive set of characteristics of the dataset, coupled with exogeneity from the wealth shock, make our study of broad interest for those wishing to understand labour supply responses to resource shocks.

We are not the first researchers to look at labour-supply responses to wealth and wealth shocks. To meet the need for exogenous, non-wage related shocks to financial resources, some recent papers have looked at how households respond to lottery wins.[6]

[3] The evolution of stock prices in Italy is documented in more detail in Online Appendix Figure A2

[4] Our emphasis on the effects of financial wealth is related to the fact that, unlike in the US and UK, house prices in Italy did not drop dramatically in the early part of the Great Recession (Agenzia del Territorio, 2012).

[5] The IV estimator has also been used by Crawford (2013) to look at the effect of wealth changes on the retirement plans of older people in England.

[6] Other papers have looked at how labour supply responds to inheritances, though few have been able to make the distinction between expected receipts and shocks due to unexpected inheritances (the importance of the distinction is made clear in the analysis of retirement of Brown et al., 2010). Hurst and Lusardi (2004) and Disney and Gathergood (2009) have considered the relationship between wealth and entrepreneurship, but both papers conclude that there is little evidence that inheritances or house price shocks encourage self-employment by unbinding liquidity constraints.

These interesting papers have provided broadly consistent results. Based on Swedish lottery data, Cesarini et al (2017) estimate that winners of substantial lottery prizes adjust their earnings to offset about 1% of the lottery prize in each of the first ten years after the lottery win; they also find that this response is mostly due to a reduction of hours (rather than shifting to lower paid employment), and structural estimation suggests lifetime marginal propensities to earn in the 15 – 17 % range. Instead for Dutch lottery winners, Picchio et al (2017) find a marginal propensity to earn of around (minus) 5%, with this response spread across 3 years after the win when large prize winners are included in the sample, or seeming more immediate if large prizes are excluded. Earnings responses to lottery wins were also found in the seminal work of Imbens et al (2001), who had data on Massachusetts lottery players. Prizes in the Massachusetts lotteries were spread over a 20 year period rather than being paid in a single lump sum, and in their favoured specifications the authors found earnings responses equivalent to around 11% of the annualised prize in each of the first six years after a lottery win. These different papers also found results that were consistent in other dimensions, for example pointing to weak (Picchio et al, 2017), or little or no (Cesarini et al, 2017; Imbens et al, 2001), differences in responses for men and women. Our contribution to this literature comes from exploiting a different shock to wealth, and so estimating effects for a different sample of the population (those who hold risky financial wealth, rather than those who play lotteries) which seems interesting given the potential cyclical importance of asset price shocks. In addition, in contrast to a lottery win, the wealth shock we exploit is negative and it is possible that responses to negative shocks differ from responses to positive news.[7]

Other papers have focussed, more closely than we do, on this cyclical element of asset price shocks. Coile and Levine (2011) find evidence that households in the US of around retirement age responded in their labour supply to the recent stock market crash, but this effect did not fully offset the effects of unemployment on these older workers. Using a related methodology for the UK, Disney, Radcliffe and Smith (2015) find little evidence of wealth effects on labour supply in the UK. Using different empirical variation, Disney and Gathergood (2018), find significant effects of house price shocks on the labour supply of

[7] This kind of asymmetry has been found for consumption responses to house-price changes (Disney, Henley and Gathergood, 2010).

younger individuals and older men. Our data and method allow us to focus on quantifying the labour-supply response to shocks to financial wealth.

A preview of our main results is as follows. Our baseline point estimates indicate that a reduction in risky financial wealth of 1000 euro would lead to 2 to 3 hour increase in annual labour supply, and a reduction in the likelihood of leaving work of between 0.05 and 0.08 percentage points. When combined with the (large) mean losses in risky wealth among holders of such wealth in our sample, these estimates suggest average increases in labour supply of between one part-time working week and one full-time working week, or a decrease of between 0.5 and 1 percentage point (or 10 and 20 percent) in the likelihood of leaving work. In financial terms, we find a 5 to 6 percent marginal propensity to earn to recover the wealth loss. We find that our results are mainly driven by older workers (between 50 and retirement age), and that responses are relatively similar for men and women. We also find tentative evidence that the responses persist for at least one survey wave after the period of the wealth shock.

The paper is organised as follows. Section 2 describes the data that we exploit and section 3 details our empirical method. Section 4 presents and discusses results. First, we present results for our baseline sample for changes in hours of work and in the likelihood of leaving employment, and then for changes in labour earnings. We also check robustness to restricting the sample to holders of risky assets. Subsequently, we explore heterogeneity in results across populations defined by age and sex. The final results look at whether effects persist for a sample wave after the period of the wealth shock. Section 5 concludes.

2. Data

The Italian Survey on Household Income and Wealth (SHIW) is a representative sample of the resident population. From 1987 onward the survey is conducted every other year (with a two-year gap between 1995 and 1998) and covers about 24,000 individuals and 8,000 households[8]. The panel component of the survey sample involves approximately 50% of households being re-interviewed in the following wave.

The survey contains a rich set of household and person characteristics as well as

[8] A household is a group of individuals related by blood, marriage or adoption and sharing the same dwelling.

information on incomes and savings, and on household wealth and labour supply. Wealth data is rich, containing both participation and value for a range of financial assets, housing wealth, and businesses. For the purpose of our analysis, we use data for the years 2004-2010. In this way we are able to observe changes in labour supply and wealth between 2006 and 2008, and between 2008 and 2010. The information from 2004 (and 2006 and 2008) is used as required to construct lagged variables. The variation provided by the period of the large adjustment to financial asset values in 2007-08, is helpful for our empirical method.

We now describe the SHIW labour supply and wealth variables that we exploit.

Table 2.1: Descriptive Statistics, Labour Supply

	Mean	Median	N
Hours of Work			
All	973.1	960	7143
2008	970.9	864	3526
2010	975.2	960	3617
HH with risky assets	1136	1440	1208
2008	1107.7	1440	602
2010	1164.4	1440	606
Change in Hours of Work			
All	-65.57	0	7143
2008	-52.51	0	3526
2010	-78.29	0	3617
HH with risky assets	-87.38	0	1208
2008	-82.39	0	602
2010	-92.34	0	606
Work			
All	0.5461	1	7143
2008	0.5383	1	3526
2010	0.5538	1	3617
HH with risky assets	0.6358	1	1208
2008	0.6262	1	602
2010	0.6452	1	606
Leave Work			
All	0.05488	0	7143
2008	0.05729	0	3526
2010	0.05253	0	3617
HH with risky assets	0.04967	0	1208
2008	0.04817	0	602
2010	0.05116	0	606

SHIW labour supply variables. The SHIW dataset provides detailed information on labour supply, including regarding whether agents work, and about hours of work, potentially across multiple jobs. There is also information on sector and industry of employment, and on

whether individuals are self-employed or work as employees. Our main dependent variables use information on whether agents have work, and on hours of work.

Descriptive statistics for these variables in our sample, and for households with and without risky financial assets, are provided in Table 2.1. In the table, hours of work are annual hours worked by an individual,[9] and change in hours of work are the difference in annual hours worked between the current survey year and the previous one. Being in work is defined as having any paid job in the survey year, and those recorded as leaving work are individuals who are not in work in the current survey year but were in work in the previous one.

SHIW financial wealth variables. The SHIW dataset collects detailed information on household portfolios. Respondents are asked about ownership of, and about amounts of wealth held in, each of many types of asset. Assets are grouped in broad categories: cash (bank accounts and saving certificates); Italian government bonds (with different durations); domestic bonds and investment funds; Italian shares; foreign bonds and shares; and, other minor categories. Within each broad category individuals are asked about a detailed set of assets. SHIW also provides information on household wealth in several types of mutual funds, and these funds can be categorised according to the extent to which they expose the holder to stock-market risk.

If survey respondents report that they hold an asset, they are then asked about how much wealth they held in that asset at the 31st of December in the year after which the survey wave is named (i.e. December 31st 2008 for the "2008 SHIW").[10] Respondents are first asked to indicate in to which of several bands of value their asset fell and then to report a point amount for this value. Failure to report a point amount results in the household being asked whether the value of their holding is nearer to the bottom, middle or top of the band. Since not all individuals give a point amount we use some imputed values for wealth. In imputation we use band and bottom/middle/top information to allocate values by asset.[11]

Since our main regressions are in first differences (see Section 3) we have to be careful

[9] We compute annual hours of work from survey responses regarding average weekly hours, in all jobs excluding occasional ones. Respondents are specifically asked to include overtime hours.
[10] Having end of year wealth means we have data on households at close to the top of the stock market (at the end of 2006) and at close to the bottom of the crash (at the end of 2008).
[11] To have a homogeneous measure of asset values we do not use imputed values provided by the Bank of Italy, since they are not available for the 2004 wave. We need to rely on imputation by the Bank of Italy for (the sum of) three types of deposit in 2006, since information on the band they belong to is not available.

about the fact that imputation could considerably increase noise to signal ratio, especially where individuals report holdings in the relatively broad top bands of asset values. For this reason in our sample selection we exclude from the sample households who do not provide a point amount and ever report being in the top bands (imputed wealth in a single asset above 150 000 euros with no upper limit). Our sample selection also requires information on the variables included in our regressions and panel information (for a subset of variables) for three consecutive waves (to have a difference and lagged information), and we select individuals between ages 25 and 69. In households with more than one member, we keep the household head and his or her spouse.[12] We end up with a sample of around 7000 person-year observations.

3. Methodology

It is familiar that forward-looking models suggest that when faced with unexpected changes (or "shocks") to lifetime resources, households should adjust their consumption and saving behaviour. Further, such models of "smoothing" would suggest that households should adjust on other margins too, including through their choices over leisure and labour-supply. We aim to understand whether, and how strongly, wealth shocks affect labour supply. To investigate this, we will look to relate changes (first-differences) in labour supply choices, to changes in the value of (financial) wealth:

$$\Delta l_{ht} = \alpha + \omega \, \Delta w_{ht} + \varepsilon_{ht} \qquad (1)$$

Where: h and t indicate household and time period; l is a labour supply choice; w is the relevant measure of wealth; α and ω are coefficients and ε is an error term; and, Δ indicates "first difference" so that $\Delta l_{ht} = l_{ht} - l_{h(t-1)}$, with differences of other variables defined analogously.

Simply implementing equation (1) empirically by relating changes in labour supply to contemporaneous changes in wealth, is unlikely to provide a value of ω that can be interpreted as an unbiased estimate of the effect of wealth changes on labour supply. The complication is one of endogeneity since one way to increase wealth is to work and earn more. That is, an agent who works (and earns) more will increase wealth more than an

[12] We also perform our analysis including other adult household members. Details are available on request.

otherwise similar agent who works less. This will generate a positive correlation between wealth changes and labour supply changes, even if (or when) the wealth changes are not causing adjustments to labour supply. Failure to account for this would thus lead to an upwards bias in the estimated coefficient.

We apply a method of dealing with this endogeneity that has been used in the consumption literature, and regress the change in labour supply on the "passive" part of the change in wealth. The "passive" part of the change in wealth is the part that comes from capital gains and changes in asset values, rather than the part that is generated by choices about how much to earn, spend and save. [13]

To arrive at a value for the passive part of the change in wealth, we take a fixed wealth portfolio for each household, and calculate how the value of this portfolio would have changed due to changes in asset values and in the absence of any active saving (or dissaving) by the household. More concretely, consider calculating the change in the value of this fixed portfolio (hereafter "the calculated change in wealth") for an individual whose change in labour supply and wealth are observed for the period 2006 to 2008. A candidate fixed portfolio is the amounts of assets held in 2006. The household might (for example) have a certain amount of cash deposits, domestically held shares, and domestically held bonds.[14] Real values for these holdings by the end of 2008 can be calculated by applying the relevant real interest rate to the cash deposits, and the real change in the relevant price index for stocks and bonds, to up- (or down-) rate the values of the initial holdings. This will give a final value of the portfolio, and the calculated change in wealth is this final value less the initial value of the portfolio.

In the previous paragraph, we described a calculation of the passive change in wealth for *(t-1)* to *(t)*, as based on the fixed portfolio from *(t-1)*. In fact in our empirical work we use portfolio information from *(t-2)*. That is, when we are dealing with changes in wealth (and labour supply) between 2008 and 2010, the portfolio information comes from 2006; portfolio information from 2004 is used when dealing with changes between 2006 and 2008. Taking a second lag ensures that the portfolio measure is not affected by measurement error

[13] The idea that this passive change can be used to deal with this endogeneity, dates back at least to Dynan and Maki (2001).

[14] The list of assets classes used in our empirical application, and the price indices and interest rates that we apply to them, are described in Appendix A of Bottazzi, Trucchi and Wakefield (forthcoming).

from a survey period used in constructing differences of wealth (and labour supply) outcomes. In particular, in this way the portfolio measure will not be contaminated by the same measurement error that affects our measure of changes in observed wealth.[15] We use Δw_t^{fp} to denote our calculated value of the passive part of the change in wealth, and this is the calculated change in the value of the fixed portfolio from *(t-2)*.

A key part of our empirical strategy is to replace Δw_{ht} with Δw_{ht}^{fp} when estimating the relationship between labour supply outcomes and wealth changes described in equation (1). Aside from the endogeneity discussed above, another threat to clean identification could be an omitted variables problem if other factors that affect labour supply (on average) are also correlated with the asset price shock. In this regard a powerful advantage of the first-differenced specification is that it conditions out any household fixed effect. To further mitigate this potential problem we exploit the richness of our dataset and extend the specification (1) to include an "$\boldsymbol{X}$" vector of covariates. We include a rich set of covariates, the details of which are discussed when we present results in the next section.

Given the issues discussed above, the equation to be estimated becomes:

$$\Delta l_{ht} = \alpha + \omega \, \Delta w_{ht}^{fp} + \boldsymbol{X'_{ht}\beta} + \varepsilon_{ht} \qquad (2)$$

note that the labels on some coefficients, and for the error term, are the same in equations (1) and (2): this is for convenience and should not be taken as implying that estimating of the two equations would yield identical results.

For equation (2) to accurately measure the relationship of interest, we would need that the change in the value of the fixed portfolio accurately captures the "passive" part of the change in wealth. It is possible that the measure is not entirely accurate: our observations come at two year intervals and in the period between observations households might take actions that adjust their exposure to asset price changes. If this means that the "passive" effect of changes in asset values on wealth is actually smaller than the values we calculate, then estimation of (2) would yield an underestimate of the size of the effect of wealth

[15] Being free of this contamination is particularly important when implementing the IV estimator described in the next paragraphs. The method of using lags is relatively standard for dealing with endogeneity in differenced panel data models, and is familiar from the literature on estimating log linear approximations to Euler equations (see the discussion of Attanasio and Weber, 1993, p.634, or Banks, Blundell and Tanner, 1998, especially footnote 8).

changes on labour supply. Even if our calculated variable does not capture "passive" changes in wealth entirely accurately, it can be expected to be correlated with actual changes in wealth and is unaffected by active saving decisions and thus unaffected by the influence of labour supply on wealth that we described above. Thus the calculated change in wealth is the ideal "excluded variable" to construct an instrument for actual changes in wealth. This leads us to the following instrumental variables (IV) estimator:

$$\Delta l_{ht} = \alpha^{IV} + \omega^{IV} \widehat{\Delta w_{ht}} + \boldsymbol{X'_{ht}}\boldsymbol{\beta^{IV}} + \varepsilon_{ht}^{IV} \qquad (3)$$

where: $\widehat{\Delta w_{ht}}$ is the predicted change in the relevant measure of wealth based on the following first-stage equation for the observed (reported) change in the value of a household's financial wealth (Δw_{ht}):

$$\Delta w_{ht} = \gamma + \varphi \, \Delta w_{ht}^{fp} + \boldsymbol{X'_{ht}}\boldsymbol{\delta} + \mu_{ht} \qquad (4)$$

In our empirical results in the next section, we present estimates of ω from both equations (2) and (3); equation (2) is the reduced form of the IV estimator described by equations (3) and (4).

These specifications effectively compare labour supply outcomes for those with larger changes in (shocks to) wealth, to outcomes for those with smaller changes. Therefore, our estimates should not pick up the effects of aggregate changes that (equally) affected the labour supply of all agents. To identify effects of wealth shocks we need that, in the absence of the shocks, changes in labour supply outcomes would, conditional on other regressors, have been similar across those that do or do not suffer shocks. As mentioned above, the inclusion of a rich set of covariates can therefore help with identification, as well as precision.

Given the nature of the crucial "Δw_{ht}^{fp}" variable, the key exogenous variation in wealth that we are exploiting is that generated by asset price changes. One way to justify that such changes come as shocks would be to note that asset price movements are highly persistent (permanent), so that the best guess of future prices are current prices and deviations from this are surprises. Furthermore, in our case the biggest source of variation in asset prices comes from the 2007-2008 stock-market crash and it seems reasonable to suppose that price falls in this period were largely unanticipated (especially by individuals who remained in the stock market). Thus the large change in asset prices in 2007-2008 is important for

providing us with variation that is both substantial and exogenous. The idea of using asset price changes as a source of plausibly exogenous variation in wealth has been exploited by researchers in other contexts. To investigate the effect of wealth on consumption, Banks et al (2012) propose an IV strategy similar to that described above and apply it for a sample of older English households; in Bottazzi, Trucchi and Wakefield (2013 and forthcoming) we follow a similar approach with representative data for Italy. Banks et al (2012) also look at other outcomes, notably expectational outcomes. Crawford (2013) finds little effect of wealth shocks on the retirement plans of older people in the England. Schwandt (2017) also exploits variation from asset price changes and finds some effects of wealth shocks on the health among a sample of older Americans.

Descriptive statistics for the constructed change in wealth variable are provided in Table 3.1. More details on the construction of the variable, and on the comparison between actual (reported) and calculated changes in wealth are provided in Bottazzi, Trucchi and Wakefield (forthcoming; see particularly the final part of section III, and online Appendix A).

Table 3.1: Descriptive Statistics, Change in Calculated Risky Financial Wealth

	Mean	Median	N
Change in calculated risky fin. wealth			
All	- 1289	0	7143
2008	- 2720	0	3526
2010	105	0	3617
Change in calculated risky fin. wealth (owners of risky wealth only)			
All	- 7624	2	1208
2008	- 15930	- 8061	602
2010	627	221	606

4. Empirical Results

In section 4.1 we present baseline results, first for hours of work and the likelihood of leaving work (subsection 4.1.1) and then for labour earnings (4.1.2). The following section looks at the heterogeneity of effects: subsection 4.2.1 considers retaining only those who hold risky financial assets while 4.2.2 and 4.2.3 look at subsamples defined by age and sex. In section 4.3 we look, to the extent that data allow, at whether effects persist for a sample wave after the period of the wealth shock.

4.1 Baseline results

4.1.1 Hours and participation

We present results for the estimators described in the previous section, for outcome variables that capture total changes in hours worked and in the decision of whether to exit employment.[16] Table 4.1 presents results for the change in hours worked and Table 4.2 presents results with an indicator of whether the agent left work during the two-year period between SHIW surveys as the outcome variable.

Table 4.1: Baseline Results for "Change in Hours of Work"

Dependent Variable: Change in Hours of Work				
	RF	**IV**	**RF**	**IV**
Δ risky financial wealth	**-2.233***	**-2.854***	**-2.102***	**-2.673***
	(1.169)	(1.605)	(1.197)	(1.617)
Couple	8.851	7.595	11.87	10.33
	(17.42)	(17.62)	(18.06)	(18.27)
Δ no. of people in HH	15.67	17.25	19.42	20.85
	(17.92)	(18.02)	(18.18)	(18.25)
Male	-91.43***	-91.39***	-67.79***	-67.75***
	(12.88)	(12.95)	(14.76)	(14.81)
High-school education	13.10	11.50	8.144	6.636
	(14.90)	(15.00)	(15.15)	(15.24)
Post-school education	57.12**	56.31**	45.77**	44.73*
	(23.01)	(23.39)	(22.97)	(23.39)
Regional unemployment rate	8.081*	9.625**	4.797	6.269
	(4.668)	(4.787)	(4.645)	(4.771)
Year 2010	-33.12*	-32.35*	-25.64	-24.77
	(18.66)	(18.74)	(18.61)	(18.70)
Central Italy	-3.580	0.344	-7.994	-4.291
	(18.01)	(18.37)	(18.03)	(18.39)
Southern Italy	-54.94	-62.81*	-44.06	-51.54
	(36.47)	(37.03)	(35.79)	(36.36)
Public sector employee	-24.87	-24.05	-282.0*	28.14
	(19.67)	(19.83)	(146.0)	(26.98)
Self employed	-47.51	-48.21	-41.99	-42.66
	(32.11)	(32.23)	(33.22)	(33.29)
Initial total wealth dummies	Yes	Yes	Yes	Yes
5-year age dummies	Yes	Yes	Yes	Yes
Years of contributions	No	No	Yes	Yes
Constant	-129.9**	-137.5**	-112.5**	-109.5**
	(44.26)	(46.20)	(52.15)	(47.19)
# Observations	7143	7143	6894	6894

Note: *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.
Controls include "initial" *total* wealth dummies, with *total* wealth measured in 2004 for the 2006-08 sample and in 2006 for the 2008-10 sample: a dummy for zero or negative wealth and decile dummies for positive wealth.
Details of the first-stage for the IV regressions in columns 2 and 4 of this Table, are reported in Appendix Table A3.

[16] We also considered entering work as an outcome variable but did not get significant results. Output available on request.

Table 4.2: Baseline Results for "Leave Work"

Dependent Variable: Leave Work				
	RF	**IV**	**RF**	**IV**
Δ risky financial wealth	**0.000634****	**0.000810****	**0.000523***	**0.000665***
	(0.000260)	(0.000403)	(0.000269)	(0.000394)
Couple	0.000467	0.000823	-0.000152	0.000230
	(0.00754)	(0.00754)	(0.00768)	(0.00768)
Δ no. of people in HH	0.00166	0.00122	0.0000935	-0.000261
	(0.00751)	(0.00751)	(0.00761)	(0.00761)
Male	0.0183***	0.0183***	0.00858	0.00857
	(0.00538)	(0.00540)	(0.00571)	(0.00572)
High-school education	-0.0131**	-0.0127**	-0.00854	-0.00816
	(0.00611)	(0.00613)	(0.00603)	(0.00605)
Post-school education	-0.0288**	-0.0286**	-0.0185**	-0.0182**
	(0.00921)	(0.00933)	(0.00902)	(0.00912)
Regional unemployment rate	-0.00173	-0.00217	-0.00133	-0.00170
	(0.00208)	(0.00211)	(0.00203)	(0.00206)
Year 2010	-0.00352	-0.00374	-0.00644	-0.00665
	(0.00673)	(0.00676)	(0.00658)	(0.00660)
Central Italy	0.000703	-0.000410	0.000697	-0.000224
	(0.00723)	(0.00728)	(0.00719)	(0.00723)
Southern Italy	0.0207	0.0230	0.0194	0.0213
	(0.0168)	(0.0170)	(0.0162)	(0.0164)
Public sector employee	0.0482***	0.0480***	0.198**	0.0248**
	(0.00916)	(0.00918)	(0.0697)	(0.0106)
Self employed	0.0307**	0.0309**	0.0261**	0.0263**
	(0.00982)	(0.00990)	(0.00992)	(0.00997)
Initial total wealth dummies	Yes	Yes	Yes	Yes
5-year age dummies	Yes	Yes	Yes	Yes
Years of contributions	No	No	Yes	Yes
Constant	0.0426**	0.0448**	0.0299*	0.0349*
	(0.0171)	(0.0175)	(0.0180)	(0.0180)
# Observations	7143	7143	6894	6894

Note: *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.
Controls include "initial" *total* wealth dummies, with *total* wealth measured in 2004 for the 2006-08 sample and in 2006 for the 2008-10 sample: a dummy for zero or negative wealth and decile dummies for positive wealth.
Details of the first-stage for the IV regressions in columns 2 and 4 of this Table, are reported in Appendix Table A3.

In these tables, the parameter on the main coefficient of interest (the change in wealth) is displayed in bold in the first row of the table. The wealth variable that we use is the change in the value of risky financial wealth, which is wealth that has some exposure to stock-market risk (either because the wealth is directly held in stocks, or because it is wealth held in a wrapper product such as a mutual fund, that includes some exposure to the stock market). This is wealth that was particularly exposed to the stock market fluctuations of 2007-2008 that provide us with a key source of variation.

Both Tables 4.1 and 4.2 present results from four regressions that are in reduced form (RF) and IV (second stage) pairs. For the IV regressions, the instrument is significantly

correlated with the endogenous regressor and the F-test shows that we do not have a problem of weak instruments; details of the first stage regressions for Tables 4.1 and 4.2 are reported in Appendix Table A3. The difference between the two pairs of regressions is the inclusion of a flexible set of indicator variables to capture effects on labour supply behaviour of years of contributions to Italy's public pension (or social security) system. It is potentially important to include such indicators since labour supply decisions are likely to be affected by public sector pension accrual, at least near to retirement age.[17] However, the results in Tables 4.1 and 4.2 show that the inclusion of the years of contributions indicators does not materially affect our main coefficients of interest.

In Table 4.1, the coefficient of interest is remarkably stable at between -2.2 and -3, and is always significantly different from 0 at the 10% level. Given that the variable is measured in thousands of (2010) euros, this can be interpreted as indicating that, for every 1000 euro of increase in wealth, annual hours decrease by, on average, 2 or 3 hours per year. To assess whether this effect is substantial, one needs to set the coefficient in the context of actual changes in wealth.

Our data span the 2007 – 08 stock market crash and, as described in section 2, the average (calculated) change in risky financial wealth in our sample is a loss of around 1300 euros. Our estimated coefficients suggest that an agent who suffered a loss in wealth of this magnitude would increase their labour supply by between 2.7 and 3.7 hours per year.[18] This average loss in wealth comes across the 2006 – 2008 sample, a period of substantial stock market losses, and the 2008 – 2010 sample during which asset values were much more stable. Considering the earlier period in isolation, average wealth losses are slightly more than 2700 euros, and our estimates indicate that an individual suffering such a loss in wealth would increase their labour supply by between 5.7 and 7.8 hours per year. The values considered so far take averages across those with and without exposure to stock market risk. For those with stock wealth, the average change in the value of risky wealth across the

[17] The indicators that we include are designed to capture flexibly the difference between individuals who have few years of contributions and so are far from pension eligibility, and individuals who have larger numbers of years of contributions and so are close to receiving a generous pension. In particular, we use indicators for groups of years of contributions that are particularly narrow once years of contributions are 30 or more, and we also interact these with an indicator for being a public-sector employee since public and private sectors have, at times, been treated differently.

[18] These numbers are arrived at by multiplying the mean change in wealth (1.289 thousand euros) by the smallest and largest coefficients from the first row of Table 4.1.

sample period is approximately 7600 euro; for the 2006 – 2008 subsample the median loss is approximately 8000 euro and the mean loss almost 16000. For individuals experiencing losses of these magnitudes, our estimates point to increases in labour supply of 16 – 22 hours (for the 7600 euro loss), or 33 to 45 hours (for losses of around 16000 euro). In other words, on average, the mean losses in risky wealth observed in our sample would have led to individuals increasing their labour supply by between one part-time working week and one full-time working week. Given that mean annual hours in our sample (around 970 hours for the whole sample or 1140 hours across those who own risky assets) approximately correspond to a full year working part-time, we find these changes in hours to be non-trivial.

The changes in hours may be driven by lots of workers making modest adjustments to hours, or may (partly) be the result of some workers choosing to participate rather than to quit their jobs or otherwise stay out of work. To look at whether there is an effect from wealth to labour market exits, we turn to the results for "leave work" in Table 4.2. The coefficients in the first row of the table are all significant at the 5% or 10% level. These point estimates suggest that a 1000 euro increase in wealth is associated with an increase in the probability of leaving work of between 0.05 percentage points and 0.08 percentage points. Combining these estimates with the average changes in wealth experienced in our sample of individuals with risky wealth, we arrive at predicted effects of a 0.4 to 0.6 percentage point reduction in the likelihood of leaving work for an individual who suffered a wealth loss of around 7600, or of around 0.8 to 1.3 percentage points if we consider an individual who suffered the loss of 16000 euros. Given that the baseline likelihood of leaving work in our sample is around 5 percentage points (across a two-year observation period), these predicted effects amount to a 10 to 20 percent change and again seem economically important.

Aside from the change in wealth, a few of the other regressors reported in the Tables are consistently statistically significant. In the main the correlations are unsurprising. More educated individuals show more positive changes in hours and are less likely to leave work: since our sample starts at age 25, we are observing these individuals as they progress up the career path. Being male is negatively associated with the change in hours, and increases the likelihood of leaving work, but these patterns are both consistent with men participating more and working longer hours, and so having greater scope to reduce hours and leave

work. The sector of employment dummies (public sector employee and self-employed), both have positive and significant coefficients in the leave work regressions, but the "public sector employee" dummy must be carefully interpreted once years of contributions indicators are included, since the contributions indicators are interacted with the public-sector variable.

A set of potentially important regressors are the indicators for the level of household wealth. Being wealthier might, all else equal, encourage reduced labour supply (an income effect) and temper precautionary responses to shocks, and is also correlated with exposure to risky assets.[19] In order to avoid an omitted variable bias whereby the effect of the level of wealth on labour supply adjustments is attributed to the coefficient on the change in risky wealth, the results presented in the body of the paper always come from specifications that include indicators for having zero financial wealth and of financial wealth decile group (among those with positive wealth). These variables are based on the value of total financial wealth, lagged by two survey periods (i.e. four years).[20] Results with and without these wealth dummies are reported in Appendix Tables A4 and A5 and show that including the wealth indicators does affect our coefficients of interest somewhat in the change in hours regression,[21] but the indicators are less important (and significant) in the "leave work" regressions. The sensitivity of our results to the financial wealth indicators is related to the fact that our sample includes a large amount of heterogeneity in wealth. If we restrict our sample to include only agents that held the risky financial assets that were exposed to the asset-price shock, we get a sample that is much more homogeneous in terms of wealth levels. Appendix Table A6 shows our main coefficient of interest across the specifications considered in Tables A4 and A5, for such a sample of risky-asset owners. In this subsample, the size and significance of our estimates is much less sensitive to controlling for the wealth level. Section 4.2.1 provides a fuller discussion of results for the risky-asset owner subsample.

[19] In our data around 14% of agents have exposure to risky financial wealth, but this proportion is almost 40% among the decile group with the most financial wealth. This also means that average reported losses in wealth at the time of the financial crisis are much larger in the wealthiest group than in the whole sample.
[20] Using total financial wealth means that the wealth groups are not based on the same wealth used to construct our main variable of interest, and lagging by two periods ensures the measure of wealth is not taken from the same survey of the differenced outcome variable for the regression.
[21] Coefficients on the wealth dummies (available on request) indicate larger increases in hours for those in lower wealth groups.

We have found our results to be robust to a number of other changes to our specification. Coefficients are not substantially affected by restricting the sample to those who were in work when we first observed them, or to owners of risky assets who were in work, though the reduction in sample size does affect significance. We have also experimented with adding an indicator for (lagged) home-ownership, and with controlling for the (reported) change in house value, alongside our main wealth variables, and found that neither addition noticeably affected our main results (the effect of adding the change in house value variable can be seen in Appendix Tables A4, A5 and A6). Similarly, adding a measure of risk preference to the regressors has almost no impact on our main results (see Table 4.3 of Bottazzi et al 2017). Finally, we explored adding controls for having a permanent contract, living in an "urban" area[22], and sharing the home with young dependents, or with at least one elderly person, or with someone who is in poor health: adding these regressors separately or all together did not have a substantial effect on our main coefficients of interest.[23]

We thus take our baseline results as providing robust evidence that the wealth shock had a significant impact on labour supply. The estimates indicate that the average wealth losses experienced in 2007-08 by those with risky financial wealth led to an increase in labour supply of between one part-time and one full-time working week per year, and a fall in the probability of leaving work of between 0.5 and 1 percentage point.

4.1.2 Change in Labour Income

If adjustments in labour supply are effective as a means to offset shocks to financial resources, we would expect the behavioural responses found in the previous subsection to also be reflected in earnings. Looking at labour earnings as an outcome provides a means to investigate this directly. Table 4.3 presents results for our baseline sample, but with the change in (net of tax) labour income as the dependent variable.

[22] A centre of residence with at least 40 000 residents.
[23] Results available on request.

Table 4.3: Results for "Labour Income"

	RF	IV	RF	IV
Dependent Variable: Change in Labour Income				
Δ Risky Financial Wealth	- 54.07 ** *(25.44)*	- 63.28 ** *(25.15)*	- 52.12 ** *(25.66)*	- 60.70 ** *(25.09)*
Years of contributions	No	No	Yes	Yes
# Observations	5938	5938	5785	5785

Note: *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level. Controls are as reported in Table 4.1. The smaller sample size relative to that table is a result of needing data on earnings.

The results indicate that for every thousand euros of loss in wealth, labour earnings were increased by between 52 and 63 euro per year. This short-run marginal propensity to earn of minus five to six per cent is similar in magnitude to the response to lottery wins found by Picchio et al (2017), though a little larger than the short-run responses identified by Cesarini et al (2017).[24] We can relate these earnings estimates to the results reported in Table 4.1. Our baseline estimates for hours correspond to an earnings response of about 38 euros per year.[25] This value is within the confidence bands of the estimates in Table 4.3, but is slightly lower than the point estimates. The difference could be due to the wealth shock leading to workers increasing work effort (supplying more overtime or pushing for promotions, for example), as well as their hours.

4.2 Heterogeneity

4.2.1 Holders of "Risky" Financial Assets

As mentioned in Section 4.1, our baseline sample includes both households with and without exposure to risky financial wealth. Households that do not hold risky assets provide information that helps to identify coefficients on variables other than the main change in risky financial wealth variable. To check that including these households does not substantially alter our estimates of our main coefficient of interest, we ran our regressions

[24] The Picchio et al (2017) study reports an immediate 5% response when the largest prizes are excluded from the estimation sample, while Cesarini et al find an MPE of around minus 1% which is almost constant in each of the first ten years after the prize win, adding up to a lifetime response of 15 to 17% that is inferred using a structural model. The case studied by Imbens et al (2017) is somewhat different since the lottery prizes are paid out in installments of 20 years, and they find responses to the annual payments of around minus 11% in each of the first six years after the prize win.

[25] The average hourly wage among workers in our sample is around 15 euros; multiplying this by 2.5 (approximately the mid-point of the hours responses reported in Table 4.1) gives 37.5 euros per year.

on the subsample of households that have exposure to risky financial wealth.[26] Table 4.4 reports the results for the change in hours and leave work specifications, for this subsample.

Table 4.4: Robustness: Sample including only holders of Risky financial wealth

	RF	IV	RF	IV
Dependent Variable: Change in Hours of Work				
Δ Risky Financial Wealth	- 3.249 ** *(1.605)*	- 3.690 * *(2.008)*	- 3.360 ** *(1.655)*	- 3.875 * *(2.114)*
Dependent Variable: Leave Work				
Δ Risky Financial Wealth	0.000993 *** *(0.000376)*	0.001128 ** *(0.00055)*	0.001052 *** *(0.000380)*	0.001213 ** *(0.000584)*
Years of contributions	No	No	Yes	Yes
# Observations	1208	1208	1186	1186

Note: *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level. Controls are as reported in Table 4.1.

The results in Table 4.4 are similar to those in Tables 4.1 and 4.2. Indeed, the effects are slightly stronger, both in terms of point estimates and significance, when we use the subsample. As with our main results, the results in Table 4.4 are based on regressions that include dummies for financial wealth decile group; Appendix Table A.6 shows that in this subsample the coefficient of interest is not substantially affected (and significance is not changed) if the wealth level dummies are dropped. We interpret the results from analysis of this subsample as indicating that results based on our full sample certainly do not exaggerate estimates of the main coefficients of interest. In the remainder of the paper we stick to the broader sample and the more conservative estimates.

4.2.2 Older Individuals

There are reasons to think that the labour supply of older individuals might be particularly responsive to the wealth shock we investigate. Older households tend to have more financial wealth and so are more likely to have been substantially exposed to the wealth shock that is important for our estimation strategy. Workers with established employment are also those who are more likely to have some flexibility to adjust their hours

[26] Precisely, the subsample is those who have a non-zero value for the change in the value of the fixed portfolio that is the crucial variable to identify our IV and reduced form (OLS) estimators. This means that the sample is of those who held risky assets at the relevant lag (usually, of 2 survey periods).

of work, and who might be considering whether to leave jobs and enter retirement. Table 4.5 therefore reports results for the subsample of those aged 50 to 69.

The results for OLS regressions are very much in line with those reported in Tables 4.1 and 4.2, while the results for the IV specifications suggest slightly stronger effects (at least in terms of point estimates) in the older sample. In our exactly identified system, the bigger difference between the reduced form and the IV for this older sample reflects that the correlation at the first stage is less strong (with a coefficient of around 0.5 instead of 0.8). However, this is not a reflection of a weak instrument: the F-test gives a value in excess of 20 for this older subsample (full first stage results available on request).

Table 4.5: Older subsample, ages 50 - 69

	RF	IV	RF	IV
Dependent Variable: Change in Hours of Work				
Δ Risky Financial Wealth	- 2.507 *	- 5.130 *	- 2.337 *	- 4.814
	(1.373)	*(2.869)*	*(1.407)*	*(2.953)*
Dependent Variable: Leave Work				
Δ Risky Financial Wealth	0.000692 **	0.001416 *	0.000571	0.001176
	(0.000338)	*(0.000762)*	*(0.00035)*	*(0.000779)*
Years of contributions	No	No	Yes	Yes
# Observations	4476	4476	4346	4346

Note: *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level. Controls are as reported in Table 4.1.

While the results for this older sample are in line with, or stronger than, the results for our baseline sample, we get much weaker patterns of coefficients, and usually insignificant results, for younger subsamples (results available on request). It is therefore clear that older working age, or early retirement age, individuals, are important in driving our main results. This is indicative that part of the effects that we find reflect some workers postponing retirement. In the context of a tight labour market in which the retention of older workers may have restricted opportunities for young adults to find work (cf. Boeri, Garibaldi and Moen, 2016; and, Bertoni and Brunello, 2017), the effect of the wealth shock on the labour market attachment of older workers is potentially important.

4.2.3 Men and Women

Table 4.6 shows how our estimates vary if we split our baseline sample in to subsamples of men and women. The point estimates for both men and women are similar to our baseline results, though with reduced sample sizes significance levels are reduced. If there is a difference between the two samples it is that point estimates are slightly stronger for women when we consider the leave work margin, though even here we cannot reject equal responses across genders. The similar responses for men and women may seem at odds with received wisdom that women's labour supply is relatively more responsive to financial incentives (see Keane, 2011), but it is worth noting that papers that exploit lotteries in order to estimate the income effect that we aim to identify also find no evidence that women respond more strongly than men (see Cesarini et al, 2017; Picchio et al, 2017; and, Imbens et al, 2001).[27]

Table 4.6: Labour supply for women and men

	RF	**IV**	**RF**	**IV**
Subsample: Females				
Dependent Variable: Change in Hours of Work				
Δ risky financial wealth	-1.778 *(1.295)*	-2.233 *(1.708)*	-1.970 *(1.370)*	-2.467 *(1.830)*
Dependent Variable: Leave Work				
Δ risky financial wealth	0.000754 * *(0.000388)*	0.000947 *(0.000602)*	0.000756 * *(0.000409)*	0.000947 *(0.000627)*
Years of contributions	No	No	Yes	Yes
# Observations	3837	3837	3668	3668
Subsample: Males				
Dependent Variable: Change in Hours of Work				
Δ risky financial wealth	-2.595 *(1.905)*	-3.333 *(2.650)*	-2.181 *(1.930)*	-2.801 *(2.607)*
Dependent Variable: Leave Work				
Δ risky financial wealth	0.000636 * *(0.000364)*	0.000817 *(0.000573)*	0.000408 *(0.000375)*	0.000525 *(0.000533)*
Years of contributions	No	No	Yes	Yes
# Observations	3306	3306	3226	3226

Note: *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level. Controls are as reported in Table 4.1.

[27] The Picchio et al (2017) paper reports some specifications in which men appear to have stronger earnings responses to a win than women, but the difference vanishes after year 0 (the year of the win) and seems to be related to including a few very big lottery wins in the sample.

Having seen similar responses from men and women, it is natural to ask whether this involves members of the same families responding similarly to the wealth shock, or whether men respond in some households, and women in others. While a full structural analysis of this complementarity of labour supply within the household is beyond the scope of this paper, we can attempt to provide some descriptive evidence. Table 4.7 shows the results of adding to our baseline specifications regressors measuring the relevant labour supply outcomes of the respondent's spouse, and interaction of these with the wealth change. That is, in the hours of work specification we add as regressors the change in hours of work of the spouse, and the interaction of this with the change in risky wealth; in the leave work regressions the added regressors are based on the indicator of whether the spouse left work. Since adding these variables weakens our IV strategy (both in terms of having convincing excluded variables and of weak instrument tests), we run the reduced form regressions.

Table 4.7: Family labour supply

	RF	**RF**	**RF**	**RF**
Dependent Variable: Change in Hours of Work				
Δ Risky Financial Wealth	- 2.628 **	- 2.441 *	- 2.355 *	- 2.219
	(1.300)	*(1.350)*	*(1.331)*	*(1.377)*
Partner's Change in Hours of Work	- 0.0264	- 0.0292	- 0.00352	- 0.00569
	(0.0253)	*(0.0258)*	*(0.0244)*	*(0.0250)*
Partner's Change in Hours of Work * Δ Risky Financial Wealth		-0.00173		- 0.00125
		(0.00124)		*(0.00119)*
Dependent Variable: Leave Work				
Δ Risky Financial Wealth	0.000528 *	0.000528 *	0.000424	0.000431
	(0.000282)	*(0.000284)*	*(0.000292)*	*(0.000295)*
Partner Leaves Work	- 0.0131	- 0.0131	- 0.00922	- 0.00951
	(0.0129)	*(0.0130)*	*(0.0130)*	*(0.0130)*
Partner Leaves Work * Δ Risky Financial Wealth		- 0.000011		- 0.000274
		(0.00121)		*(0.00116)*
Years of contributions	No	No	Yes	Yes
# Observations	5762	5762	5569	5569

Note: *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level. Controls are as reported in Table 4.1.

The results in Table 4.7 show that adding the spousal variables, or these variables plus the relevant interaction term, does not have a large effect on our main estimated coefficient on interest (that on the wealth change). [28] The negative sign of the interaction terms in second and final columns of the table suggest that labour supply responses to the wealth shock are stronger among individuals that have a spouse whose labour supply also responded. In the change in hours regression, the interaction variable will tend to have the same sign as the negative wealth change (since the hours response is typically positive), and so the negative coefficient on the interaction reinforces the negative coefficient on the wealth change. In the leave work regressions, the negative coefficient on the interaction indicates that those whose partner left work after the wealth shock are more likely than others to also leave work: thus, the "response" of being less likely to exit after the shock is stronger for those whose partner also did not exit. While these point estimates suggest some within-couple complementarity in labour supply responses to the resource shocks, the results should be interpreted with caution since the exercise is descriptive and the coefficients on the interaction terms are not significant. We feel that a fuller investigation of the issue would require more data and/or a more structural empirical strategy.

4.3 Persistence of Effects

The results presented so far identify how labour supply responds to the change in wealth in the period immediately following the shock. It is of interest to also look, to the extent that data allow, at whether these short-run effects persist. We can investigate this for those members of our 2006-08 sample who we also observe in 2010. From our rolling panel dataset we have almost 3000 observations for which we observe long "two-wave" (2006 – 2010) differences.

For this sample, Table 4.8 presents results for our baseline hours of work and leave work specifications. The first two columns provide results for the 2006-10 differences; in the case of the leave work indicator, this long difference is an indicator of having left work in either of the intervals 2006-08 or 2008-10. The middle columns of the table are our baseline (2006-08) specifications but for the reduced sample, and the final two columns show results

[28] Adding the regressor is a change in the specification and it also brings a reduction in sample size as we now have a sample of couples with data for the hours of work of both members.

with 2008-10 differences as the dependent variable. Since the regressors that we use are consistent across the columns, the coefficients in the first two columns are the sum of the coefficients in the analogous columns for the 2-year differences.

Table 4.8: Persistence of effect

	RF	IV	RF	IV	RF	IV
	2006-10		2006-08		2008-10	
Dependent Variable: Change in Hours of Work						
Δ Risky Financial Wealth 2006-08	- 3.083**	- 3.509**	- 3.670**	- 4.177**	0.587	0.669
	(1.091)	*(1.428)*	*(1.314)*	*(1.780)*	*(1.234)*	*(1.417)*
# Observations	2870					
Dependent Variable: Leave Work						
Δ Risky Financial Wealth 2006-08	0.000521	0.000593	0.000642**	0.000731*	- 0.000121	- 0.000138
	(0.000614)	*(0.000713)*	*(0.000314)*	*(0.000408)*	*(0.000538)*	*(0.000611)*
# Observations	2870					

Note: *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level. Controls are as reported in Table 4.1, though the wave (2010) indicator is (necessarily) dropped and years of contributions are not included.

The results for the change in hours indicate that the effects identified in our baseline specifications are persistent. The coefficients for the 2006-10 change are significant and only slightly smaller in magnitude than the short-run (2006-08) response to the wealth shock, due to a small but not significant reversal in 2008-10. The coefficients across the leave work regressions point to a similar story, though in this case only the coefficient for the short-run effect is significant. We thus interpret the evidence as indicating that the short-run effects identified in our baseline regressions are not immediately fully reversed. Such persistence is in line with the findings of Cesarini et al (2017) and Picchio et al (2017), although it is perhaps less obvious that the effects we find should persist since the responses we identify often involve workers that are approaching retirement age increasing their labour supply.

5. Conclusions

We have looked at whether shocks to asset values lead to labour supply adjustments, using Italian data. We used asset price shocks to provide a measure of wealth changes that is exogenous to households' saving and labour supply behaviour.

Our results suggest that wealth losses led to some increases in hours worked, and reductions in numbers leaving jobs. The magnitude of these effects could be substantial for those suffering larger wealth shocks (although such shocks are concentrated among relatively few owners of risky assets). For example, when combined with the mean losses in risky wealth among holders of such wealth, our point estimates suggest average increases in labour supply of between one part-time working week and one full-time working week. Looking at the extensive margin for the same group, we found a decrease of between 0.5 and 1 percentage point (or 10 and 20 percent) in the likelihood of leaving work. Using labour income as our outcome variable, we find a marginal propensity to earn of between (minus) 5 and 6 percent. Our baseline findings measure short-run responses to the wealth shock, but we also show evidence of at least some persistence in these responses.

Examining population subgroups allows us to investigate heterogeneity in effects. In terms of age, we find that older subgroups are important in driving our results as the clearest responses come from those of older working-age and around retirement age. We find little evidence that the labour supply of men and women responds differently to the wealth shock, and suggestive evidence that one member of a couple responding to the shock may be associated with stronger responses from the spouse.

The evidence in this paper indicates that households use labour-supply, as well as the spending and saving margin, to smooth out shocks. Since shocks can be aggregate in nature, this may have important macroeconomic implications. Increases in labour supply may smooth out the adverse impact of a negative shock. On the other hand, it is also possible that, in a tight labour market situation, older workers staying in employment may reduce job opportunities for their younger counterparts. Such aggregate impacts remain a topic for further work.

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Appendix

Appendix Table A1: Descriptive statistics, independent variables (Regression sample, ages 25 – 69)

Variable	Mean	Standard Deviation
Δ risky financial wealth (€ 000s)	-1.289	(7.783)
(I) Couple	0.853	(0.354)
Δ no. of people in HH	-0.078	(0.452)
(I) Male	0.463	(0.499)
Age	52.843	(9.582)
(I) Low Education	0.522	(0.497)
(I) Mid Education (completed high school)	0.378	(0.485)
(I) High Education (some post school)	0.100	(0.299)
Regional Unemployment Rate	8.135	(3.866)
(I) Year 2010	0.506	(0.500)
(I) Northern Italy	0.447	(0.497)
(I) Central Italy	0.185	(0.388)
(I) Southern Italy	0.367	(0.482)
(I) Public sector employee	0.165	(0.371)
(I) Self employed	0.118	(0.322)
(I) Zero (lagged) total financial wealth	0.126	(0.332)
(Lagged) total financial wealth (€)	24 058.87	(47 670.39)
(I) Risk averse == 3	0.384	(0.486)
(I) Risk averse == 4	0.419	(0.493)
Sample size	**7 143**	
Years of contributions to pension system	21.559	(13.363)
Sample size	**6 894**	

Notes: (I) denotes a 0/1 indicator variable, so the "mean" is a proportion of the sample.

Appendix Table A2: Descriptive statistics, independent variables (50+ sample)

Variable	Mean	Standard Deviation
Δ risky financial wealth (€ 000s)	-1.428	(8.539)
(I) Couple	0.848	(0.359)
Δ no. of people in HH	-0.126	(0.482)
(I) Male	0.487	(0.500)
Age	58.960	(5.600)
(I) Low Education	0.581	(0.493)
(I) Mid Education (completed high school)	0.319	(0.466)
(I) High Education (some post school)	0.100	(0.300)
Regional Unemployment Rate	8.140	(3.836)
(I) Year 2010	0.511	(0.500)
(I) Northern Italy	0.440	(0.496)
(I) Central Italy	0.192	(0.394)
(I) Southern Italy	0.368	(0.482)
(I) Public sector employee	0.157	(0.364)
(I) Self employed	0.100	(0.300)
(I) Zero (lagged) total financial wealth	0.129	(0.335)
(Lagged) total financial wealth (€)	27 469.48	(50 967.99)
(I) Risk averse == 3	0.372	(0.483)
(I) Risk averse == 4	0.438	(0.496)
Sample size	**4 476**	
Years of contributions to pension system	25.409	(13.692)
Sample size	**4 346**	

Notes: (I) denotes a 0/1 indicator variable, so the "mean" is a proportion of the sample.

Appendix Table A3: First-stage regressions (for specifications in columns 2 and 4 of Tables 4.1 and 4.2)

Dependent Variable: Change in (reported) value of risky financial wealth (€ 000s)				
Regressor	**Coefficient**	***(s.e.)***	**Coefficient**	***(s.e.)***
Δ calculated risky fin. wealth (€ 000s)	0.783 ***	*(0.213)*	0.786 ***	*(0.215)*
Couple	- 0.440	*(0.566)*	- 0.575	*(0.596)*
Δ no. of people in HH	0.553	*(0.487)*	0.533	*(0.504)*
Male	0.014	*(0.588)*	0.016	*(0.656)*
High-school education	- 0.561	*(0.525)*	- 0.564	*(0.545)*
Post-school education	- 0.286	*(1.375)*	- 0.388	*(1.420)*
Regional unemployment rate	0.541 ***	*(0.163)*	0.551 ***	*(0.169)*
Year 2010	0.270	*(0.508)*	0.326	*(0.524)*
Central Italy	1.375 *	*(0.743)*	1.385 *	*(0.754)*
Southern Italy	- 2.759 **	*(1.242)*	- 2.796 **	*(1.283)*
Public sector employee	0.285	*(0.765)*	0.517	*(1.008)*
Self employed	- 0.248	*(1.389)*	- 0.249	*(1.434)*
Five-year age bands	Yes		Yes	
Initial total wealth dummies	Yes		Yes	
Years of contributions	No		Yes	
Sample size	**7 143**		**6 894**	

Notes: *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.
Value of F-test for excluded instruments: 13.49 (first specification) and 13.42 (second specification).

Appendix Table A4: Baseline Results for "Change in Hours of Work"

Dependent Variable: Change in Hours of Work

	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Δ risky financial wealth	**-2.233***	**-2.854***	**-2.102***	**-2.673***	**-1.188**	**-1.511**	**-2.250***	**-2.973***
	(1.169)	(1.605)	(1.197)	(1.617)	(1.075)	(1.375)	(1.200)	(1.730)
Couple	8.851	7.595	11.87	10.33	1.817	0.993	11.809	10.065
	(17.42)	(17.62)	(18.06)	(18.27)	(16.955)	(17.060)	(18.058)	(18.315)
Δ no. of people in HH	15.67	17.25	19.42	20.85	15.116	16.256	19.432	21.020
	(17.92)	(18.02)	(18.18)	(18.25)	(18.105)	(18.206)	(18.197)	(18.292)
Male	-91.43***	-91.39***	-67.79***	-67.75***	-92.434***	-92.507***	-68.540***	-68.929***
	(12.88)	(12.95)	(14.76)	(14.81)	(12.804)	(12.808)	(14.765)	(14.833)
High-school education	13.10	11.50	8.144	6.636	13.598	12.571	8.320	6.747
	(14.90)	(15.00)	(15.15)	(15.24)	(14.320)	(14.437)	(15.155)	(15.243)
Post-school education	57.12**	56.31**	45.77**	44.73*	50.842**	50.528**	44.712*	42.938*
	(23.01)	(23.39)	(22.97)	(23.39)	(22.512)	(22.632)	(22.967)	(23.468)
Regional unemployment rate	8.081*	9.625**	4.797	6.269	8.820*	9.651**	4.655	6.209
	(4.668)	(4.787)	(4.645)	(4.771)	(4.512)	(4.618)	(4.655)	(4.788)
Year 2010	-33.12*	-32.35*	-25.64	-24.77	-34.904*	-34.431*	-25.406	-24.298
	(18.66)	(18.74)	(18.61)	(18.70)	(18.311)	(18.352)	(18.627)	(18.743)
Central Italy	-3.580	0.344	-7.994	-4.291	-1.294	0.232	-8.749	-5.074
	(18.01)	(18.37)	(18.03)	(18.39)	(17.954)	(18.115)	(18.052)	(18.420)
Southern Italy	-54.94	-62.81*	-44.06	-51.54	-53.682	-58.177	-43.027	-50.740
	(36.47)	(37.03)	(35.79)	(36.36)	(35.629)	(35.939)	(35.850)	(36.481)
Public sector employee	-24.87	-24.05	-282.0*	28.14	-26.025	-25.670	-283.087*	-29.058
	(19.67)	(19.83)	(146.0)	(26.98)	(19.555)	(19.612)	(146.000)	(27.006)
Self employed	-47.51	-48.21	-41.99	-42.66	-48.159	-51.889	-41.152	-41.402
	(32.11)	(32.23)	(33.22)	(33.29)	(32.776)	(31.690)	(33.165)	(33.230)
Wealth (lagged) dummies	Yes	Yes	Yes	Yes	No	No	Yes	Yes
5-year age dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Years of contributions	No	No	Yes	Yes	No	No	Yes	Yes
Δ housing wealth	No	No	No	No	No	No	Yes	Yes
Constant	-129.9**	-137.5**	-112.5**	-109.5**	-48.159	-52.433	-111.379**	-109.460**
	(44.26)	(46.20)	(52.15)	(47.19)	(32.776)	(33.425)	(52.155)	(47.292)
N	7143	7143	6894	6894	7290	7290	6894	6894

Appendix Table A5: Baseline Results for "Leave Work"

Dependent Variable: Leave Work

	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Δ risky financial wealth	**0.000634****	**0.000810****	**0.000523***	**0.000665***	**0.000497****	**0.000631***	**0.000553****	**0.000731***
	(0.000260)	(0.000403)	(0.000269)	(0.000394)	(0.000232)	(0.000342)	(0.000275)	(0.000429)
Couple	0.000467	0.000823	-0.000152	0.000230	0.002081	0.00243	-0.000141	0.000288
	(0.00754)	(0.00754)	(0.00768)	(0.00768)	(0.00704)	(0.00705)	(0.00768)	(0.00768)
Δ no. of people in HH	0.00166	0.00122	0.0000935	-0.000261	0.00111	0.0006377	0.0000920	-0.000299
	(0.00751)	(0.00751)	(0.00761)	(0.00761)	(0.00744)	(0.00744)	(0.00761)	(0.00761)
Male	0.0183***	0.0183***	0.00858	0.00857	0.0190***	0.0191***	0.00874	0.00883
	(0.00538)	(0.00540)	(0.00571)	(0.00572)	(0.00532)	(0.00533)	(0.00571)	(0.00573)
High-school education	-0.0131**	-0.0127**	-0.00854	-0.00816	-0.0148**	-0.0144**	-0.00857	-0.00819
	(0.00611)	(0.00613)	(0.00603)	(0.00605)	(0.00581)	(0.00584)	(0.00603)	(0.00605)
Post-school education	-0.0288**	-0.0286**	-0.0185**	-0.0182**	-0.0289***	-0.0287***	-0.0183**	-0.0178*
	(0.00921)	(0.00933)	(0.00902)	(0.00912)	(0.0087)	(0.00881)	(0.00903)	(0.00914)
Regional unemployment rate	-0.00173	-0.00217	-0.00133	-0.00170	-0.00184	-0.00218	-0.00130	-0.00169
	(0.00208)	(0.00211)	(0.00203)	(0.00206)	(0.00203)	(0.00206)	(0.00203)	(0.00206)
Year 2010	-0.00352	-0.00374	-0.00644	-0.00665	-0.00352	-0.00371	-0.00649	-0.00676
	(0.00673)	(0.00676)	(0.00658)	(0.00660)	(0.00661)	(0.00663)	(0.00659)	(0.00661)
Central Italy	0.000703	-0.000410	0.000697	-0.000224	0.000166	-0.000804	0.000853	-0.000505
	(0.00723)	(0.00728)	(0.00719)	(0.00723)	(0.00708)	(0.00713)	(0.00719)	(0.00724)
Southern Italy	0.0207	0.0230	0.0194	0.0213	0.0240	0.0259	0.0192	0.0211
	(0.0168)	(0.0170)	(0.0162)	(0.0164)	(0.0165)	(0.0166)	(0.0162)	(0.0164)
Public sector employee	0.0482***	0.0480***	0.198**	0.0248**	0.0460***	0.0459***	0.199***	0.0246**
	(0.00916)	(0.00918)	(0.0697)	(0.0106)	(0.00902)	(0.00904)	(0.0698)	(0.0106)
Self employed	0.0307**	0.0309**	0.0261**	0.0263**	0.0302**	0.0306**	0.0259***	0.0260***
	(0.00982)	(0.00990)	(0.00992)	(0.00997)	(0.00960)	(0.00966)	(0.00991)	(0.00997)
Wealth (lagged) dummies	Yes	Yes	Yes	Yes	No	No	Yes	Yes
5-year age dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Years of contributions	No	No	Yes	Yes	No	No	Yes	Yes
Δ housing wealth	No	No	No	No	No	No	Yes	Yes
Constant	0.0426**	0.0448**	0.0299*	0.0349*	0.0318**	0.0336**	0.0297*	0.0349*
	(0.0171)	(0.0175)	(0.0180)	(0.0180)	(0.0130)	(0.0132)	(0.0180)	(0.0180)
N	7143	7143	6894	6894	7290	7290	6894	6894

Appendix Table A6: Sample with only Risky Asset Holders

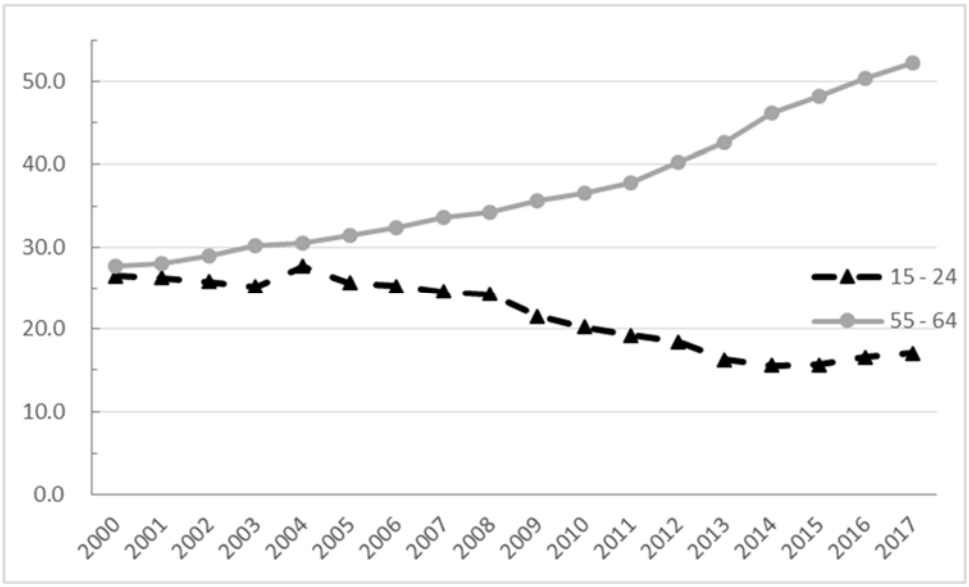
Dependent Variable: Change in Hours of Work

	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Δ risky financial wealth	- 3.249 **	- 3.690 *	- 3.360 **	- 3.875 *	-2.753 **	-3.287 *	-3.470 **	-4.111 *
	(1.605)	*(2.008)*	*(1.655)*	*(2.114)*	(1.301)	(1.719)	(1.660)	(2.246)
Wealth (lagged) dummies	Yes	Yes	Yes	Yes	No	No	Yes	Yes
5-year age dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Years of contributions	No	No	Yes	Yes	No	No	Yes	Yes
Δ housing wealth	No	No	No	No	No	No	Yes	Yes
N	1208	1208	1186	1186	1222	1222	1186	1186

Dependent Variable: Leave Work

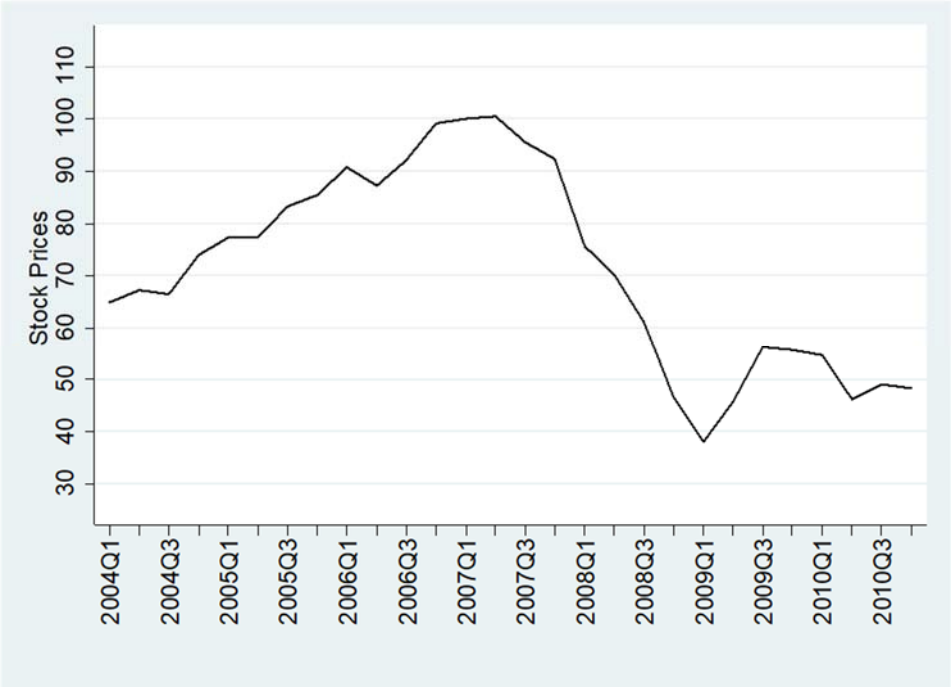
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Δ risky financial wealth	0.000993 ***	0.001128 **	0.001052 ***	0.001213 **	0.000787 ***	0.000940 **	0.001028 ***	0.001218 **
	(0.000376)	*(0.00055)*	*(0.000380)*	*(0.000584)*	(0.000293)	(0.000460)	(0.000382)	(0.000608)
Wealth (lagged) dummies	Yes	Yes	Yes	Yes	No	No	Yes	Yes
5-year age dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Years of contributions	No	No	Yes	Yes	No	No	Yes	Yes
Δ housing wealth	No	No	No	No	No	No	Yes	Yes
N	1208	1208	1186	1186	1222		1186	1186

Appendix Figure A1:
Employment rates for Older Individuals and Youth, Italy 2000 – 2017.



Source: OECD (data extracted 11 Jan 2019 from OECD.stat)

Appendix Figure A2:
Evolution of FTSEMIB stockmarket index: 2004 - 2010.



Notes: 2007 Q1 = 100. **Source:** FTSE via datastream (rebased to 2007 Q1 by the authors).