The Cyclicality of Informal Care

Corina Mommaerts
Yulya Truskinovsky *

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Abstract

As the population of elderly individuals in the United States grows over the coming decades, the demand for long-term care is also expected to rise. Informal caregivers, many of whom are working-age adult children, provide the bulk of long-term care but may also face high opportunity costs of their time. In this paper, we examine the effect of the business cycle on the use of informal (family) elder care. We exploit annual state-level variation in the unemployment rate and measure changes in informal caregiving and receipt using the American Time Use Survey and the Health and Retirement Study. We find that informal care is countercyclical: both informal caregiving and receipt decrease during economic expansions. This effect is driven by care provided by adult children to their parents, and is concentrated in help with chores, errands, transportation, and medication, rather than more intensive personal care. In addition, we find that nursing home residence increases during economic expansions. Given the twin policy concerns about the growing cost of long-term care, much of which is financed by Medicaid, and the retirement security of older workers, quantifying the response of informal care to economic conditions is an important input to the design of future long-term care policy.

*Yulya Truskinovsky: Harvard University, ytruskinovsky@hsph.harvard.edu. Corina Mommaerts: University of Wisconsin - Madison, cmommaerts@wisc.edu. We thank Elizabeth Ananat, Nicole Maestas, and Seth Sanders for comments and guidance. Funding from the National institute on Aging, through Grant Number T32-AG000186 to the National Bureau of Economic Research, is gratefully acknowledged.

1 Introduction

The need for long-term care is a reality of aging. Recent estimates suggest that 70% of Americans will require assistance with basic functions in their lifetimes and that more than half of those age 57-61 will experience a nursing home stay at some point (Hurd, Michaud, and Rohwedder, 2017). As the population of Americans over 65 grows over the coming decades, the demand for long-term care is also expected to rise (Hagen, 2013).

Long-term care is a particularly pressing issue because it can be prohibitively expensive, and few are insured against the possibility of incurring these costs.[1] Indeed, over half of long-term care hours are provided informally, often by family members. However, many informal caregivers are working-age adult children who face heavy demands on their time, and informal caregiving can come with significant opportunity costs (Fahle and McGarry, 2017; Van Houtven, Coe, and Skira, 2013; Ettner, 1996).[2] Survey results suggest that family members take on these responsibilities despite the potentially large costs: eight out of ten Americans say they would feel "very obligated" to provide help if their parents needed it, and half of current informal caregivers felt they had no choice in taking on care responsibilities (Weber-Raley and Smith, 2015). How individuals and families navigate the changing long-term care landscape in the context of these implicit and explicit costs is an increasingly important question for researchers and policy makers.

This paper investigates how (macro)economic conditions drive the decisions families make about long-term care. Specifically, we examine the effect of business cycles on the supply of informal caregiving from adult children and on the composition of long-term care received by the elderly. Business cycles may affect informal care through several channels. First, paid work hours may increase when the economy expands. With more time in the labor force, adult children have less time to devote to caring for their parent. Second, business cycles may affect household wealth, which could impact the affordability of different long-term care options.[3] Third, business cycles may affect the price of formal care: if formal care becomes more costly during an expansion due to, for example, increased labor costs of formal care workers, an individual may turn to family or friends for care instead. Finally, business cycles may impact not only the price but also the quality of formal care. If the quality of the workforce in nursing homes or in other professional caregiving

[1] Only 5% of aggregate long-term care costs are paid for by private insurance while 60% are paid for by Medicaid.

[2] Recent estimates put the dollar value of the opportunity cost of care provided by informal caregivers between $400 and $500 billion dollars annually (Chari, Engberg, Ray *et al.*, 2015).

[3] Exogenous increases in elderly income have been shown to induce the elderly to shift away from nursing homes and informal care towards formal in-home care (Goda, Golberstein, and Grabowski, 2011; Tsai, 2015).

occupations declines during an expansion, individuals may prefer to receive care from family at home.While the first two channels suggest that the supply of informal care should decrease during economic expansions, the second two channels suggest that informal caregiving should instead increase. The overall effect of business cycles on informal care is thus an empirical question.

The implications for families and specifically the well-being of the elderly can be significant. If faced with fewer feasible long-term care options during expansions, the elderly may experience disruptions in their care, delay receiving necessary help, or forego it altogether. This can lead to increased risk of illness or falls, or challenges with medication adherence or nutrition. Indeed, Stevens, Miller, Page *et al.* (2015) show that elderly mortality increases during economic expansions.

To identify the effect of business cycles on informal care and other long-term care outcomes, we exploit annual variation in economic conditions across states and over time. We use the American Time Use Survey (ATUS) from 2003 through 2015 to examine the cyclicality of the *provision* of informal care and the Health and Retirement Study (HRS) from 1995 through 2012 to examine the cyclicality of the *receipt* of informal care. We then use the HRS to additionally consider how other long-term care margins respond to economic conditions. We consider the nature of the care that responds to the business cycle by looking separately at help with Activities of Daily Living (ADLs), which includes help with physical limitations such as bathing, getting out of bed, and feeding, and help with Instrumental Activities of Daily Living (IADLs), which includes help with transportation, grocery shopping, preparing meals, home maintenance, and taking medication. We consider two main measures of economic conditions: the unemployment rate (a standard measure of business cycles) and the employment-to-population ratio (a measure that may better capture changes in labor force participation).

We find that informal care is *counter*cyclical. A one percentage point decrease in the unemployment rate decreases the overall rate of informal caregiving by 0.5 percentage points, an effect that is concentrated among individuals aged 40-64 (0.8 percentage points). We find nearly identical results for the likelihood of *receiving* informal care among the elderly aged 75-84, for whom a one percentage point decrease in the unemployment rate decreases the likelihood of receiving any informal care by 0.87 percentage points.[4] This cyclicality is concentrated among less educated respondents. We find that the margin of informal care that is sensitive to these economic fluctuations is help with IADLs, a less intensive, more deferrable form of caregiving, while help with

[4]We cannot reject that these two coefficients are the same.

ADLs does not consistently react. We find no evidence that these changes in informal care are coupled with, or possibly driven by, changes in the supply of formal caregivers that might occur during downturns. Instead, we find that economic expansions are associated with an increase in the use of formal care, particularly nursing home care, and particularly among those aged 75-84. Finally, we find that during economic expansions, adult children are more likely to provide financial help with long-term care costs, suggesting that families substitute between transfers of time and money.

We show that a simple model of long-term care and family labor supply can generate these results. In our model, an elderly parent requires long-term care and can either receive it on the formal market or informally from her adult child. Each type of care is characterized by its quality and its price, which is an explicit market price for formal care and an implicit opportunity cost for informal care. We show that in this model, informal care hours are a function of the adult child's wage, the quality of formal care, and the price of formal care. We also show that when economic expansions increase the adult child's wage but not the parameters of the formal care market, informal care increases. When economic expansions additionally affect the price or quality of formal care, the effect on informal care becomes ambiguous.

This paper makes four main contributions. First, we provide new evidence on the link between labor supply and informal caregiving by showing that *macro*economic labor conditions, either through directly affecting one's employment opportunities, or through alternative feedback mechanisms (such as wealth effects or quality of care effects), alter informal caregiving decisions. Our results are in line with a literature examining *individual* labor supply opportunities and informal caregiving that finds a negative relationship (Van Houtven, Coe, and Skira, 2013; He and McHenry, 2015; Fahle and McGarry, 2017). More closely related to our paper, Costa-Font, Karlsson, and Øien (2016) find that the Great Recession in Europe significantly increased the availability of informal care.[5] Our paper is the first to look at the effect of more general labor market fluctuations in the United States on a more exhaustive set of outcomes, including informal care provision, informal care receipt, and the supply and demand of formal care.

Second, we contribute new evidence that informal care and formal care may be substitute sources of long-term care.[6] Our results suggest that during economic expansions, those age 74-84

[5] Although it is not a focus of the paper, using the ATUS Aguiar, Hurst, and Karabarbounis (2013) find that in the US about 5% of forgone work hours were allocated towards care for other adults during the Great Recession.

[6] Using different contexts and sources of variation, other work has found evidence of substitution on different margins: The Channeling Demonstration, an experiment that expanded the generosity of publicly-funded home care for low-income elderly in the 1980's, led to small reductions in informal care (Pezzin, Kemper, and Reschovsky, 1996); the

are less likely to receive informal care from their children and more likely to reside in a nursing home, while there is no impact on individuals 85 and over. Given that 13% of those age 85 and older are in nursing homes, compared with only 1% of those age 65-84 (Hagen, 2013), our findings suggest that in this setting the marginal long-term care recipient is younger than the average nursing home resident, and that the increased availability of informal care allows them to delay or avoid entry to a nursing home.

Third, our paper contributes new evidence to the literature on time use and caregiving. Studies that focus on another major source of "informal" care – childcare – typically find that the wage elasticity of time dedicated to childcare is low (Kimmel and Connelly, 2007; Bianchi, 2000; Guryan, Hurst, and Kearney, 2008; Aguiar, Hurst, and Karabarbounis, 2012). In contrast, our findings suggest that caring for other adults is much more elastic, and the model we propose captures how this elasticity has an effect on the labor supply of caregivers. In addition, we are one of the first to use time use diary data from the ATUS as a measure of the supply of informal long-term care. Our symmetric findings from the Health and Retirement Study, a survey designed specifically to measure informal care receipt, allows us to validate the ATUS as a meaningful measure of informal caregiving to the elderly.[7]

Finally, our finding that informal care is countercyclical suggests a mechanism for the literature on the (pro)cyclicality of (elderly) mortality (Ruhm, 2000; Stevens, Miller, Page *et al.*, 2015).[8] Stevens, Miller, Page *et al.* (2015) show that the increased mortality during economic booms for the period 1976-2006 is primarily driven by individuals residing in nursing homes, and argue that the countercyclical quality of health care in nursing homes make nursing home residents particularly susceptible to these fluctuations.[9] Our results suggest an alternative mechanism for elderly mortality effects of business cycles: changes in informal care. In addition, our finding that the composition of nursing home residents and elderly in the community changes as a result

presence of daughters and other family characteristics decreases the probability of receiving formal care (Van Houtven and Norton, 2008; Charles and Sevak, 2005); more lenient Medicaid eligibility decreases coresidence (Mommaerts, 2016), although Gruber and Grabowski argue that these Medicaid changes had no effect on nursing home use; and changes in income generated by the Social Security notch led to a shift away from nursing home care towards in-home care, either formal or informal (Goda, Golberstein, and Grabowski, 2011; Tsai, 2015).

[7]While the HRS also provides measures of caregiving over time, the reference period for the supply of caregiving is over two years (unlike care receipt, which is measured over the previous month), and the HRS sample is only representative for the population over 50.

[8]McInerney and Mellor (2012) find much less pro-cyclicality of elderly mortality; in fact, they argue that for the period 1994-2008 elderly mortality is countercyclical.

[9]On the other hand, Konetzka, Lasater, Norton *et al.* (2017) find that the total number of nurses does not change during downturns, but the composition of nurses shifts "from more expensive registered nurses to less expensive licensed practical nurses." Their findings suggest that nursing home quality *decreases* during downturns.

of macroeconomic conditions suggests that we should interpret the mortality effects inside and outside of nursing homes with caution.

This work has two main policy implications. First, given the large role of social programs (Medicaid in particular) in funding long-term care in the United States as well as the growing concern for the retirement security of future generations, quantifying the elasticity of informal care to economic conditions is an important input to the design of future long-term care policy. Second, our results also have implications for the well-being of caregivers. The extent to which informal caregiving lengthens unemployment spells may have detrimental labor market effects for a (predominantly older, female) population which already faces a challenging labor market (Maestas, 2016; Neumark, Burn, and Button, 2015; Lahey, 2008), so while informal care may be considered a cost-saving mechanism from the perspective of the elderly and social programs, it may have other negative consequences for caregiver well-being.[10]

In the next section, we briefly review long-term care in the United States, and Section 3 proposes a simple model for understanding the various margins of adjustment of long-term care to business cycles. Section 4 describes our data and methodology. Section 5 presents our results on the cyclicality of the provision and receipt of informal care, Section 6 presents the effects on the use of formal care, and Section 7 investigates potential channels for these effects. We conclude in Section 8.

2 Long Term Care in the United States

Long-term care is a broad term that encompasses assistance provided to individuals with functional or cognitive limitations that allows them to to maintain an "optimal level of functioning" (Family Caregiver Alliance, 2015).[11] This assistance includes help with Activities of Daily Living (ADLs), which are basic self-care tasks such as bathing, toileting, eating, and getting in and out of bed, as well as help with Instrumental Activities of Daily Living (IADLs) such as household chores, grocery shopping and food preparation, managing finances, and medication adherence. Over 70% of 65 year olds will require some assistance with functional limitations in their lifetimes (Hagen, 2013).

Care that is paid for, either directly by the recipient or another entity such as an insurance

[10] Truskinovsky (2017) shows a similar implication of informal care in the context of the effects of public subsidies for grandchild care on the labor supply of older women.

[11] By contrast, *medical care* is provided to treat an acute medical condition.

company, is typically referred to as formal care, and can be provided in an institutional setting, such as a nursing home, or in-home by direct care workers such as home health aides or personal aides. Currently 18% of long-term care recipients are in a nursing home or other type of institution, although the share of formal long-term care received in an institutional setting has been falling over the last decade (Houser, Fox-Grange, and Ujvari, 2015). The quality of formal care is a key concern for policymakers, and certified long-term care facilities are heavily regulated.[12] Labor is the primary input into most long-term care services, and hence staffing levels, staff qualifications, and turnover can have a large impact on the quality of care that nursing home residents receive (Cawley, Grabowski, and Hirth, 2006; Bostick, Rantz, Flesner *et al.*, 2006; Collier and Harrington, 2008; Lin, 2014; Chen and Grabowski, 2015).

In part due to its labor-intensiveness, formal care is expensive, both for individuals and for public program budgets. The average annual cost for a semi-private room in a nursing home was $80,000 in 2011 (Hagen, 2013), and this cost has grown approximately 4.5 percent per year between 2002 and 2012. The average hourly wage for a home health aide in 2011 was $19 (Houser, Fox-Grange, and Ujvari, 2015). Private insurance covers only 5% of these costs on aggregate, while 60% are paid by Medicaid, a means tested public insurance program.[13] The remaining 35% are paid out of pocket. In comparison to other health costs, over 10% of *all* health expenditures for *all* ages went towards long-term care in 2013 (Kaiser Commission on Medicaid and the Uninsured, 2015).

The bulk of long-term care is provided informally by family and friends.[14] Among a nationally representative sample of elderly individuals who have difficulty with at least two ADLs, 46% receive informal care, while 43% receive formal care.[15] While informal care is uncompensated, it can come with significant costs. A large literature has documented a negative relationship between caregiving and various employment outcomes in a range of settings (Van Houtven, Coe, and Skira, 2013; Fahle and McGarry, 2017; Ettner, 1996).[16] A simple calculation of foregone wages places the

[12] Following a troubling study of nursing home quality in 1987, Congress instituted several regulations to improve the quality of care in long-term care facilities as part of the Omnibus Budget Reconciliation Act of 1987 (OBRA 87) (U.S. General Accounting Office [GAO/HEHS], 1999)

[13] Medicaid spending for long-term care exceeds Medicaid spending for children.

[14] While formal and informal care have been shown to be be substitutes (Van Houtven, Norton *et al.*, 2004; Charles and Sevak, 2005) they are also margins where they may be complements. For example, 34% of informal caregivers report their care recipient also received paid help (Hagen, 2013).

[15] Author's calculations from the Health and Retirement Study waves 1-11.

[16] For example, using the HRS and employing individual fixed effects, Van Houtven, Coe, and Skira (2013) find no overall impact of caregiving on the likelihood of working, but find that female caregivers reduce their hours, suffer a wages penalty, and are more likely to transition into retirement.

dollar value of lost wages for informal caregivers at just over $500 billion dollars annually (Chari, Engberg, Ray *et al.*, 2015), though these costs can be significantly higher when accounting for dynamic concerns such as human capital depreciation (Skira, 2015).[17] The the average caregiver is a woman in her 50's, a population that often faces the highest penalties for dropping out of the labor market (Maestas, 2016) and the highest rates of labor market discrimination (Lahey, 2008; Neumark, Burn, and Button, 2015).

In the next section, we propose a model of long-term care that takes into account many of the key factors for families when making decisions about long-term care outlined in this section: whether to use formal or informal care, opportunity costs of time for informal caregivers, and the price and quality of formal care.

3 Conceptual Framework

In this section, we develop a static, unitary model of family labor supply and long-term care decisions that highlights the mechanisms through which wages and the quality and price of formal care may drive the supply of informal care. The model consists of an adult child and an elderly parent who jointly derive utility from total consumption C, leisure L, and the quality of long-term care Q, $U(C, L, Q)$.[18] The elderly parent requires a fixed number of care hours H, which are allocated between hours of informal care supplied by the child h_c and hours purchased on the market (formal care) $H - h_c$ at price P_f per hour. The total quality of care is:

$$Q = g(h_c) + (H - h_c)Q_f$$

in which the quality of formal care, Q_f, is constant per hour, while the quality of informal care is an increasing, concave function g in the number of hours of informal care. This captures the idea that each additional hour of care is more skill-intensive, and informal care quality will be lower for increasingly skill intensive hours.

The adult child can spend her total time L_0 in three different ways: market work h_m for a wage w, informal care h_c, and leisure L. The family budget constraint is then:

$$C + P_f(H - h_c) \leq R + wh_m$$

[17] Other work has shown that informal care can also have negative consequences for caregiver health.

[18] The quality parameter Q is similar in spirit to Blau and Robins (1988), who include care quality in a model of childcare costs and family labor supply.

in which R is the initial resource endowment.

The family maximizes utility subject to the budget constraint, time constraint, and quality of care constraint, which can be parsimoniously written as:

$$\max_{h_c, h_m} U(C, L, Q) \qquad s.t. \quad C + wh_c + wL + P_f \left[\frac{Q - g(h_c)}{Q_f} \right] \leq R + wL_0$$

As in the standard model of labor supply, the marginal rate of substitution between optimal consumption and optimal leisure is equal to the wage:

$$\frac{U_L(C^*, L^*)}{U_C(C^*, L^*)} = w \tag{1}$$

In addition, optimal hours of informal care h_c^* is dictated by the following expression:

$$g'(h_c^*) = w \frac{Q_f}{P_f} \tag{2}$$

which shows that the optimal number of informal care hours is determined by the relative productivity between informal care $g'(h_c)$ and both market work w and formal care Q_f/P_f. Thus, the adult child devotes time to informal care only to the extent that the marginal increase in quality of informal care per cost of time, $g'(h_c)/w$, is equal to the quality of *formal* care per unit cost of formal care.

Equation (2) also gives insight into how changes in the economic environment E may affect informal care and labor supply. Differentiating (2) with respect to E (in which a higher value of E captures more favorable circumstances) gives the following expression for the wage elasticity of informal care:

$$\frac{\partial h_c^*}{\partial E} = \frac{Q_f}{P_f g''(h_c^*)} \frac{\partial w}{\partial E} \tag{3}$$

Since $g'' < 0$, the right hand side of equation (3) is negative if economic expansions manifest as higher wages ($\frac{\partial w}{\partial E} > 0$). Thus, the model predicts that informal care will decrease if economic expansions increase wages. For labor supply, from the main constraint we can rewrite the optimal demand for leisure as $L^* = z(w, \tilde{R})$ where $\tilde{R}$ is potential income, so $\tilde{R} = R + wL_0 - wh_c^* - P_f \left[\frac{Q - g(h_c^*)}{Q_f} \right]$. Differentiating this function with respect to economic conditions gives:

$$\frac{\partial L^*}{\partial E} = \left[z_w + z_{\tilde{R}} \left(L_0 - h_c^* \right) \right] \frac{\partial w}{\partial E} \tag{4}$$

and from the time constraint, $h_m^* = L_0 - h_c^* - L^*$, and equation (3), we get that the wage elasticity of labor supply is:

$$\frac{\partial h_m^*}{\partial E} = \left[-(z_w + z_{\tilde{R}} L_0) + \left(z_{\tilde{R}} h_c^* - \frac{Q_f}{P_f g''(h_c^*)} \right) \right] \frac{\partial w}{\partial E} \tag{5}$$

The first set of terms in the square brackets, $-(z_w + z_{\tilde{R}} L_0)$, capture the standard income and substitution effect of a wage increase for a given level of informal care. The second set of terms, $\left(z_{\tilde{R}} h_c^* - \frac{Q_f}{P_f g''(h_c^*)} \right)$, describe the role of informal care. If leisure is a normal good, then $z_{\tilde{R}} > 0$, and recall that $g'' < 0$, so this set of terms is always positive. Thus, if wages increase in response to economic expansions ($\frac{\partial w}{\partial E} > 0$) then the elasticity of labor supply with respect to economic conditions is higher in a model with trade-offs between work, leisure, and additionally informal care than a model with trade-offs only between work and leisure.

These results assume that the price and quality of formal care are not affected by economic fluctuations. If economic conditions additionally affect the parameters of the formal care market, (e.g. prices or quality), this may also have an impact on the elasticities of informal and formal care.[19] For example, if an economic expansion drives up formal care sector wages and hence the price of formal care (or drives down the quality of formal care), then equation (3) will have additional positive (and negative) terms, making the elasticity of informal care ambiguous (see Appendix B for the mathematical derivations). In addition, equations (4) and (5) will have additional terms. In this case, an economic expansion will have an ambiguous effect on informal care and on the elasticity of labor supply.

In sum, a simple model of labor supply, informal care, and formal care that takes into account differential quality between informal and formal care predicts that economic conditions will affect the decision between formal and informal care. Specifically, the basic model shows that when the economy expands, informal care falls, and that the magnitude of this elasticity depends on the quality and price of formal care. A further consequence of this relationship is an increased sensitivity of labor supply to economic fluctuations relative to a model without informal care. In the next section, we turn to the data and empirical specification to test these theories.

[19] For example, economic conditions may impact the quality of care through staffing. Cawley, Grabowski, and Hirth (2006) show that when the price of direct care workers increases, nursing homes substitute away from labor inputs and towards materials, increasing the morbidity and mortality risk of residents. Konetzka, Lasater, Norton *et al.* (2017) show that during economic downturns, nursing homes substitute away from more expensive labor (e.g. registered nurses) to lower cost labor (licensed practical nurses). They also argue that economic downturns affect nursing home revenue through demand for nursing home services, which could be another pathway through which economic conditions affect the quality of formal care services.

4 Data and Empirical Specification

To examine the effect of macroeconomic conditions on informal care, we use four main datasets: the American Time Use Survey for information on the provision of informal care, the Health and Retirement Study for information on the receipt of informal and formal care, and the Local Area Unemployment Statistics and the Current Population Survey for measures of macroeconomic conditions.[20]

4.1 Caregivers

Our measure of informal caregiving comes from the American Time Use Survey (ATUS). The ATUS, which began in 2003, surveys a nationally representative sample of around 10,000 Americans aged 15 over each year about how they spend their time. Each respondent records their activities for a single 24 hour period in 15 minute intervals, and these activities are then classified into detailed time-use categories. The ATUS also includes basic demographic information about the respondent and their households (but not family members outside the households).

We construct three measures of caregiving: ADL care, IADL care, and any care. Individuals are defined as providing ADL care if any of the activities they list are classified as "Caring for another adult inside or outside the household", which include bathing, dressing, feeding and providing medical care. Individuals are defined as providing IADL care if any of the activities they list are classified as "Helping another adult inside or outside the household", which consist of housekeeping and maintenance, grocery shopping and food preparation, and help with transportation and medication. Finally, individuals are defined as providing any care if they provide either ADL care or IADL care.

Our sample consists of all ATUS respondents aged 18 and over from 2003 through 2015 for a total of over 160,000 observations. In our analyses of informal care, we drop individuals who report their occupation as low-skilled caregiver (such as personal aide, home health aide, or a nurse's aide), but include them in subsequent analyses of the supply of formal care.

Table 1 reports summary statistics for this ATUS sample. 12.7% of respondent report providing any type of care to another adult, of which the majority (9.2% overall) went to non-household members. Almost 11% of all caregiving is help with IADLs care, while just under 3% is help with

[20] We use both the raw HRS data files and the RAND HRS data files. The HRS (Health and Retirement Study) is sponsored by the National Institute on Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan. The RAND HRS Data file is an easy to use longitudinal data set based on the HRS data. It was developed at RAND with funding from the National Institute on Aging and the Social Security Administration.

ADLs. While the majority of IADL care is provided to individuals outside the household, the majority of ADL care is providing to individuals within the household, reflecting that this more intensive caregiving is likely for a co-resident spouse or parent. Demographically, the sample is 56% female, 69% white, 53% is married, and the average age is 48. Just under 40% have a high school education or less, 63% are employed, and 32% are out of the labor force at the time of the survey. 1.4% report their occupation as a low skill caregiver.

Table 1: Summary statistics, American Time Use Survey

	Mean (SD)
All Care	
Any	0.127
For household member	0.047
For non-household member	0.092
Help with IADLs	
Any	0.108
For household member	0.030
For non-household member	0.082
Help with ADLs	
Any	0.027
For household member	0.017
For non-household member	0.010
Demographic Charactersitics	
Female	0.562
Age	48.4 (16.8)
White	0.690
Hispanic	0.131
Married	0.533
HS or less	0.397
Any children under 18	0.437
Employed	0.634
Unemployed	0.044
Not in labor force	0.321
Employed as adult careworker	0.014
Person-year observations	161,067

Note: Table reports means of a sample of individuals aged 18 and over from the pooled 2003-2015 American Time Use Survey. All care outcomes are calculated based on reported time use in a single 24 hour period. Help with Instrumental Activities of Daily Living (IADLs) is defined as help with housekeeping and maintenance, grocery shopping and food preparation, and help with transportation and medication. Help with Activities of Daily Living (ADLs) is defined as help with bathing, dressing, feeding, and providing medical care. "All Care" is defined as providing help with either IADLs or ADLs.

4.2 Care Receivers

For our analysis on the *receipt* of long-term care, we use data from the Health and Retirement Study, a nationally representative longitudinal survey of individuals over age 50 that began in 1992 and continues biennially. The survey contains detailed questions about health, care receipt, wealth, income, and demographic and family information. Our sample consists of individuals aged 65 and over from 1995 to 2012.[21] We construct four measures of informal care: whether the respondent received any informal care, any informal care from children, any ADL care from children, and any IADL care from children. We define informal care as care received outside of an institution that was uncompensated, ADL care as help with dressing, walking, bathing, eating, getting in/out of bed, and toileting, and IADL care as help with meal preparation, grocery shopping, making phone calls, taking medication, and managing money. We also construct three measures of formal care: whether the respondent received any formal care (defined as any care that was paid), and whether the respondent resides in a nursing home, and whether the respondent received formal (paid) care in their home. All outcomes, with the exception of nursing home status, are asked in reference to the previous month.

Table 2 reports summary statistics for this sample. In many of our analyses, we narrow the focus to a subset of individuals who report having difficulty performing two or more ADLs because we expect them to be more likely to need care, and Table 2 reports summary statistics for this subsample as well.[22] In the overall sample, 22% have difficulty with at least one ADL, and 14% have difficulty with at least one IADL. 20% receive some form of long-term care, with 7% receiving some form of formal care. 10% receive informal care, and similarly to what we saw in the ATUS sample, children are twice as likely to provide IADL care as ADL care. Almost 13% of the sample owns a long-term care insurance policy, while 10% of the sample is on Medicaid, and 2% receive financial assistance from their children to pay for care. Average age in the full sample is 75, 57% is female, 40% are single and they have on average 3.3 children. 32% have do not have a high school degree.

The sample having difficulty with two or more ADLs is more likely to report receiving care in any category. 86% of this sample receives care, and nearly a quarter are in a nursing home. Besides having higher care needs, this sample appears older and more socioeconomically disadvantaged.

[21] Our sample begins in 1995 instead of 1992 because the relevant care outcomes were not included in the survey until 1995.

[22] This definition also lines up with most long-term care insurance policies, which only pay out benefits to individuals who demonstrate difficulty with two or more ADLs.

Table 2: Summary statistics, Health and Retirement Study

	Mean (SD)	
	Full Sample	*2+ADLs*
Health and Care Need		
Any ADL difficulty	0.22	1.00
Any IADL difficulty	0.14	0.59
Any cognitive impairment	0.12	0.32
In fair or poor health	0.33	0.75
Care Outcomes		
Receives any informal care	0.10	0.46
Receives any formal care	0.07	0.43
In a nursing home	0.04	0.24
Formal home care	0.04	0.19
Receives help with ADLs	0.13	0.76
Receives help with IADLs	0.17	0.74
ADL help from kids	0.04	0.26
IADL help from kids	0.09	0.39
Long-Term Care Financing		
Owns an LTC insurance policy	0.13	0.07
Children help with care costs	0.02	0.06
Medicaid	0.10	0.30
Demographic Characteristics		
Age	75.1 (7.5)	80.0 (8.8)
Female	0.57	0.66
Single	0.40	0.60
Number of children	3.32 (2.28)	3.28 (2.53)
Less than high school	0.32	0.60
White	0.83	0.77
Hispanic	0.08	0.12
Person-year observations	89021	11002

Note: Table shows means of a sample of individuals aged 65 and over from the pooled 1995-2012 Health and Retirement Study (HRS). Column (1) contains this full sample, and column (2) restricts the sample to individuals who report difficulty with at least two Activities of Daily Living. All care variables correspond to the previous month. The nursing home variable is whether the individual currently resides in a nursing home. ADLs include walking across a room, dressing, bathing, eating, getting in and out of bed, and using the toilet. IADLs include using a map, using a telephone, managing money, taking medications, shopping for groceries, and preparing hot meals.

Average age in this subsample is 80, 66% are female, and 60% are single.

4.3 Macroeconomic Conditions

We use two measures of macroeconomic conditions. Our main measure is the state-level annual unemployment rate, compiled from the Local Average Unemployment Statistics (LAUS), which is produced by the Bureau of Labor Statistics (BLS).Additionally, we construct state-level annual employment-to-population ratios from the CPS, defined as the share of the non-institutionalized population age 16 and over that is employed.

While the unemployment rate is a standard measure of macroeconomic conditions that has been used in many related studies Ruhm (2000); Stevens, Miller, Page *et al.* (2015); McInerney and Mellor (2012), the employment-to-population ratio may pick up additional interesting employment fluctuations that may be pertinent for our analyses. For example, older workers may transition out of the labor force during an economic downturn, and the unemployment rate does not fully capture changes in their employment status. Figure 1, which plots the seasonally adjusted monthly unemployment rate and the employment-to-population ratio from 1990 and 2016, shows that the two indicators track each other closely. However, the employment to population ratio may better capture movements in and out of the labor force: while the unemployment rate in Figure 1 falls dramatically between 2010 and 2015, the employment to population ratio shows a much more gradual recovery, reflecting that many workers may have left the labor force in the aftermath of the Great Recession.

4.4 Empirical Specification

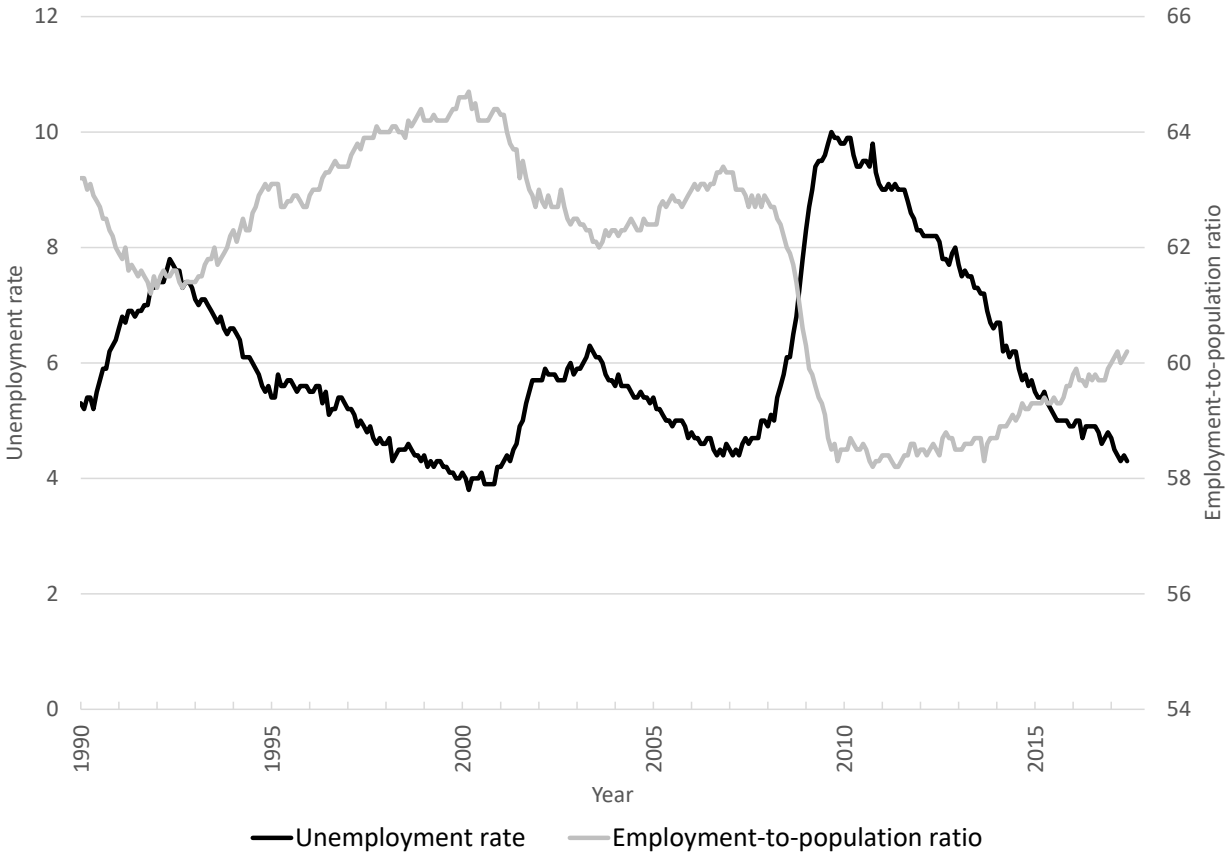
To identify the effect of macroeconomic conditions on informal caregiving, we follow the standard approach in the literature on the cyclicality of health that exploits differences in economic conditions across states and over time (Ruhm, 2000). Our main set of regressions take the following form:

$$Y_{ijt} = \alpha_t + S_j + t * S_j + \beta X_{ijt} + \gamma E_{jt} + \varepsilon_{ijt}$$

in which Y_{ijt} is an outcome variable of interest for individual i in state j in year t. α_t and S_j are time and state fixed effects, respectively, $t * S_j$ is a state linear time trend, and X_{ijt} is a vector of demographic controls.[23] E_{jt} is a measure of state j's economic conditions (e.g. the state unemploy-

[23] In addition to individual-level controls, we also control for the share of a state's population that is aged 18-64 and over 65. This addresses the concern that economic conditions may be correlated with outcomes through changes in

Figure 1: Trends in the national unemployment rate and employment-to-population ratio



Note: Figure shows the annual national seasonally-adjusted unemployment rate for non-institutionalized individuals aged 16 and over in black (with values corresponding to the left-hand y-axis) and the annual national seasonally-adjusted employment-to-population ratio for non-institutionalized individuals aged 16 and over in gray (with values corresponding to the right-hand y-axis). Each line is plotted against the year on the x-axis. Data come from the Current Population survey.

ment rate) in month t, and γ is the coefficient of interest. This approach controls for potentially confounding determinants of informal care that (a) vary uniformly across states over time by including year fixed effects and (b) time-invariant determinants of informal care that differ across states by including state fixed effects.

5 Effect of Macroeconomic Conditions on Informal Care

5.1 Caregivers

We first use the American Time Use Survey (ATUS) to establish the effect of macroeconomic conditions on the likelihood of providing informal care between 2003 and 2015. Table 3 reports results from our main specification using both annual measures of economic conditions: the unemployment rate and the employment-to-population ratio. Column (1) shows that a one percentage point increase in the annual unemployment rate increases the likelihood of informal caregiving by 0.5 percentage points. Given that the average rate of informal care in the sample is 13.3%, this constitutes a 3.6 percent change in the likelihood of providing any informal care.[24] Columns (2) and (3) examine the effects by type of care and show that the 0.5 percentage point increase in overall informal care is predominantly driven by help with IADLs: a one percentage point increase in the unemployment rate increases IADL care (Column (3)) by 0.37 percentage points, while the increase in ADL care is 0.22 percentage points and only marginally significant.

The second row of Table 3 reports the results using the annual employment-to-population ratio. We find that a one percentage point increase in the employment-to-population ratio reduces informal caregiving by 0.5 percentage points, a virtually identical effect (recall that the employment-to-population ratio moves in the opposite direction to the unemployment rate so a positive coefficient on the unemployment rate is equivalent to a negative coefficient on the employment-to-population ratio). The employment-to-population ratio also starkly highlights that the overall effect is again driven by changes in IADL care: a one percentage point increase in the employment-to-population ratio decreases IADL care by 0.44 percentage points and has a small and insignificant impact on ADL care.

To better understand the demographic composition of caregivers who are affected by business cycles, we repeat the analysis splitting the sample by age group: 18-39, 40-64, and 65 and over. The

demographic characteristics of the state.

[24] AARP estimates that approximately 14.2% of Americans have provided care to an adult over 50 in the last 12 months, very similar to the mean we find in the ATUS (Weber-Raley and Smith, 2015).

Table 3: Effect of macroeconomic conditions on informal caregiving

	(1) Any Care	(2) ADL Care	(3) IADL Care
Annual unemployment rate	0.0048**	0.0022*	0.0037**
	(0.0021)	(0.0013)	(0.0016)
Annual emp/pop ratio	-0.0049**	-0.0015	-0.0044**
	(0.0020)	(0.0011)	(0.0018)
Observations	161067	161067	161067
Mean dependent variable	0.127	0.0304	0.111

Note: The sample includes individuals aged 18 and over in the 2003-2015 American Time Use Survey (ATUS) who do not report an occupation related to long-term care. Each cell reports results from a separate linear probability model. The main coefficient of interest is the state annual unemployment rate in the first row and the annual employment-to-population ratio in the second row (both derived from the Current Population Survey). The dependent variable in each column is an indicator for providing (1) any kind of care (ADL or IADL care) to another adult, (2) Activities of Daily Living (ADL) care to another adult, and (3) Instrumental Activities of Daily Living (IADL) care to another adult. ADL care is defined as performing any activities that are classified as "caring for another adult inside or outside the household," which include bathing, dressing, feeding, and providing medical care. IADL care is defined as performing any activities that are classified as "helping another adult inside or outside the household," which include housekeeping and maintenance, grocery shopping and food preparation, and help with transportation and medication. All specifications are weighted using individual-level weights and control for a quadratic in age, gender, education, marital status, race and ethnicity, share of the state population aged 18-64 and aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

average informal caregiver is 50 years old, and we expect the age group with the highest potential to be caregivers, those 40 to 64, to be most sensitive to the business cycle.[25] Table 4 reports the results of this breakdown.[26] The first panel shows that there is no effect of macroeconomic conditions on informal caregiving among 18-39 year olds. In contrast, the second panel shows that most of the overall effect is concentrated among those age 40-64: a one percentage point increase in the unemployment rate increases the likelihood of any caregiving by 0.8 percentage points. As in the full sample, these effects are driven by help with IADLs. Finally, the third panel reveals that among those 65 and older, ADL care, rather than IADL care, increases during economic downturns: a one percentage point increase in the unemployment rate increases the likelihood of providing ADL care in this subsample by 0.65 percentage points. There is no significant change in the likelihood of providing IADL care.[27]

These results show that informal caregiving to adults is countercyclical, and that marginal type

[25] Average caregiver age varies somewhat by race and ethnicity, but still falls into the 40-64 age group. The average age is 53.4 for white non-Hispanic caregivers, 45.2 for black caregivers, 44 for Hispanic caregivers and 47 for Asian American caregivers (Weber-Raley and Smith, 2015).

[26] We only report results for the unemployment rate, but the effects of the employment-to-population ratio are very similar and are reported in an appendix.

[27] By contrast, there is no significant change in providing either type of care by those age 65 and over when we use the employment-to-population ratio as a measure of macroeconomic conditions.

Table 4: Effect of unemployment rate on informal caregiving by age

	(1) Any Care	(2) ADL Care	(3) IADL Care
Age <40	0.0002	0.0010	0.0001
	(0.0035)	(0.0018)	(0.0031)
Observations	55326	55326	55326
Mean dependent variable	0.132	0.0176	0.120
Age 40-64	0.0080***	0.0015	0.0072***
	(0.0026)	(0.0018)	(0.0022)
Observations	74129	74129	74129
Mean dependent variable	0.137	0.0361	0.111
Age 65+	0.0064	0.0065***	0.0024
	(0.0041)	(0.0023)	(0.0034)
Observations	31612	31612	31612
Mean dependent variable	0.127	0.0448	0.0920

Note: The sample includes individuals aged 18 and over in the 2003-2015 American Time Use Survey (ATUS) who do not report an occupation related to long-term care. Each cell reports results from a separate linear probability model. The first panel reports estimates from the subsample of individuals under age 40, the second from a subsample aged 40-64, and the third from a subsample aged 65 and over. The main coefficient of interest is the state annual unemployment rate (derived from the Current Population Survey). The dependent variable in each column is an indicator for providing (1) any kind of care (ADL or IADL care) to another adult, (2) Activities of Daily Living (ADL) care to another adult, and (3) Instrumental Activities of Daily Living (IADL) care to another adult. ADL care is defined as performing any activities that are classified as "caring for another adult inside or outside the household," which include bathing, dressing, feeding, and providing medical care. IADL care is defined as performing any activities that are classified as "helping another adult inside or outside the household," which include housekeeping and maintenance, grocery shopping and food preparation, and help with transportation and medication. All specifications are weighted using individual-level weights and control for a quadratic in age, gender, education, marital status, race and ethnicity, share of the state population aged 18-64 and aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

of care that is sensitive to economic fluctuations is help with IADLs for caregivers age 40-65 and help with ADLs for caregivers age 65 and over.[28] We hypothesize that this difference could be because caregivers 65 and older are caring for spouses or for much older parents who have more intensive care needs. The average caregiver who is 65 or older is caring for an 80 year old family member (Weber-Raley and Smith, 2015).[29]

In the next subsection, we use the Health and Retirement Study to see whether the countercyclicality of informal care appears on the *recipient* side of informal care, before moving onto effects on other long-term care markets (e.g. the supply and demand of *formal* care).

5.2 Care Recipients

The results in the previous subsection reveal that the likelihood of providing informal care is sensitive to the business cycle, and heterogeneity across age groups suggests that this care is concentrated among individuals who are most likely to have a parent or other older relative who requires such care. In this subsection, we turn to the effects of macroeconomic conditions on the likelihood of receiving care among the elderly using the 1995-2012 waves of the Health and Retirement Study (HRS).[30]

Table 5 shows the results for the full HRS sample of individuals age 65+. As in the previous subsection, we report effects from both the annual unemployment rate and the annual employment-to-population ratio. Column (1) shows that, for both economic indicators, the likelihood of receiving any informal care (defined as any care while not in a nursing home and not purchased, irrespective of who provides it) is virtually zero, suggesting no impact of macroeconomic conditions on overall informal care. However, since informal care is commonly provided not only by adult children but also spouses and other relatives, this overall measure of informal care may mask important effects of changes in receipt from other types of informal caregivers. In Columns (2) through (4), the dependent variable is restricted to informal care provided by adult

[28] We contrast this result with another type of informal caregiving observable in the ATUS: care to children. Appendix Table 1 reports the effect of economic conditions on three childcare outcomes: any care to children, care to children in the same household, and care to children outside the household, separately among households with children (Columns (2), (5), and (8)) and without children (Columns (3), (6), and (9)). In stark contrast with our finding that care to adults is countercyclical, we find virtually no impact of changing macroeconomic conditions on time dedicated to childcare, despite cross-sectional analyses suggesting that hours of childcare and wages are correlated (Kimmel and Connelly, 2007; Guryan, Hurst, and Kearney, 2008; Aguiar, Hurst, and Karabarbounis, 2013).

[29] Limiting the sample to those over 70 results in a somewhat smaller (0.5 percentage points) and no longer statistically significant coefficient on the unemployment rate. Results available upon request.

[30] The HRS collects information about both the receipt and provision of informal care. Questions about the receipt of informal care are asked in reference to the previous month, and so are well-suited to look at annual changes in economic conditions. Questions about informal caregiving are asked only in reference to the previous two years.

children, and to match the analysis on caregivers, we examine three care outcomes: any care (Column (2)), any ADL care (Column (3)), and any IADL care (Column (4)). These columns reveal that a one percentage point increase in the unemployment rate increases the likelihood that individuals receive any informal care from their children by 0.24 percentage points, and an increase in the employment-to-population ratio reduces this likelihood by a very similar 0.3 percentage points. For both specification, the effect is again concentrated among IADL care.

Table 5: Effect of macroeconomic conditions on informal care receipt

	Everyone				2 or more ADLs			
	(1) Any informal care	(2) Informal care by children	(3) ADL care by children	(4) IADL care by children	(5) Any informal care	(6) Informal care by children	(7) ADL care by children	(8) IADL care by children
Unemp rate	0.0004	0.0024*	0.0016	0.0025*	0.0077	0.0134*	0.0060	0.0115
	(0.0012)	(0.0013)	(0.0011)	(0.0013)	(0.0063)	(0.0071)	(0.0075)	(0.0078)
Emp/pop ratio	-0.0004	-0.0028***	-0.0009	-0.0031***	0.0024	-0.0118**	-0.0069	-0.0092
	(0.0016)	(0.0010)	(0.0007)	(0.0012)	(0.0075)	(0.0056)	(0.0055)	(0.0062)
Observations	87486	87299	87289	87298	10778	10752	10752	10751
Mean dep. var.	0.182	0.104	0.042	0.093	0.756	0.470	0.271	0.413

Note: The sample includes individuals aged 65 and over in the pooled 1995-2012 Health and Retirement Study (HRS). Each cell reports results from a separate linear probability model. The main coefficient of interest is the state annual unemployment rate in the first row and the annual employment-to-population ratio in the second row (both derived from the Current Population Survey). Columns (1) through (4) report results for the full sample, and Columns (5) through (8) report results for the sub-sample of individuals who reported having difficulty with at least two Activities of Daily Living (ADLs), defined as dressing, walking, bathing, eating, getting in and out of bed, and toileting. The dependent variable in Columns (1) and (5) is an indicator for whether the individual received any informal care in the past month, defined as care received outside an institution that was uncompensated. The dependent variable in Columns (2) and (6) is an indicator for whether the individual received any informal care by any of their children, in Columns (3) and (7) is an indicator for whether the individual received any informal care by any of their children for ADLs, and in Columns (4) and (8) is an indicator for whether the individual received any informal care by any of their children for Instrumental Activities of Daily Living (IADLs), defined as meal preparation, grocery shopping, making phone calls, taking medication, and managing money. All specifications control for 5-year age intervals, gender, education, marital status, race and ethnicity, number of children, share of the state population aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The majority of HRS respondents aged 65 and over do not need long-term care. To target the subsample of individuals who are most likely to have long-term care needs, we repeat the analysis from Columns (1)-(4) in Columns (5)-(8) but restrict the sample to individuals aged 65 and older who report difficulty with two or more ADL limitations.[31] While only 18.2% of the full sample reports receiving any informal care, over 75% of the restricted sample does. We see largely the same pattern as with the full sample. The coefficients from this analysis are considerably larger (a one percentage point increase in the unemployment rate results in a 1.34 percentage point increase in the receipt of informal care from children, mostly driven by IADL care), although they are

[31] This is a common eligibility criteria that private long-term care insurance companies and government programs use to determine need.

noisier given the smaller sample size of just under 11,000 observations.

Conditional on ADL limitations, age may be an important factor in determining long-term care need: younger individuals are less likely to need care and more likely to have alternative sources of care (e.g. from spouses), while older individuals are more likely to have skill-intensive care needs and to be in formal care settings. This is largely the story in the first three panels of Table 6.[32] There is very little effect of macroeconomic conditions on informal care receipt from children for individuals age 65-74. Interestingly, a one percentage point increase in the unemployment rate *decreases* the likelihood of informal care among this age group by 0.42 percentage points, but the null results in Columns (2)-(4) imply that this decrease in informal care is not driven by changes in care from children. Results in the subsample with 2 or more ADL difficulties follow largely the same pattern, though less precisely.

Table 6: Effect of unemployment rate on informal care receipt, by age

	Everyone				2 or more ADLs			
	(1) Any informal care	(2) Informal care by children	(3) ADL care by children	(4) IADL care by children	(5) Any informal care	(6) Informal care by children	(7) ADL care by children	(8) IADL care by children
Age 65-74	-0.0042***	0.0002	0.0002	0.0002	-0.0187	0.0134	0.0084	0.0051
	(0.0013)	(0.0012)	(0.0010)	(0.0012)	(0.0172)	(0.0136)	(0.0132)	(0.0117)
Obs	46466	46368	46368	46368	3293	3290	3290	3290
Mean DV	0.0994	0.0444	0.0193	0.0373	0.6395	0.3213	0.2155	0.2553
Age 75-84	0.0087***	0.0060**	0.0029*	0.0050*	0.0401***	0.0409***	0.0100	0.0327**
	(0.0022)	(0.0026)	(0.0017)	(0.0030)	(0.0117)	(0.0119)	(0.0113)	(0.0144)
Obs	29530	29486	29484	29486	3843	3843	3843	3843
Mean DV	0.1815	0.0967	0.0406	0.0856	0.6016	0.3539	0.2428	0.2985
Age 85+	-0.0018	0.0034	0.0051	0.0066	-0.0078	-0.0074	-0.0037	0.0042
	(0.0045)	(0.0041)	(0.0036)	(0.0041)	(0.0099)	(0.0097)	(0.0113)	(0.0087)
Obs	11490	11464	11462	11463	3642	3635	3635	3634
Mean DV	0.3155	0.2209	0.0930	0.2071	0.4830	0.3447	0.2242	0.3189

Note: The sample includes individuals aged 65 and over in the pooled 1995-2012 Health and Retirement Study (HRS). Each cell reports results from a separate linear probability model. The first panel reports estimates from the subsample of individuals aged 65-74, the second from the subsample of individuals aged 75-84, the third from the subsample of individuals aged 85 and over. The main coefficient of interest is the state annual unemployment rate (derived from the Current Population Survey). Columns (1) through (4) report results for the full sample, and Columns (5) through (8) report results for the sub-sample of individuals who reported having difficulty with at least two Activities of Daily Living (ADLs), defined as dressing, walking, bathing, eating, getting in and out of bed, and toileting. The dependent variable in Columns (1) and (5) is an indicator for whether the individual received any informal care in the past month, defined as care received outside an institution that was uncompensated. The dependent variable in Columns (2) and (6) is an indicator for whether the individual received any informal care by any of their children, in Columns (3) and (7) is an indicator for whether the individual received any informal care by any of their children for ADLs, and in Columns (4) and (8) is an indicator for whether the individual received any informal care by any of their children for Instrumental Activities of Daily Living (IADLs), defined as meal preparation, grocery shopping, making phone calls, taking medication, and managing money. All specifications control for 5-year age intervals, gender, education, marital status, race and ethnicity, number of children, share of the state population aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[32] Results of the effects of the employment-to-population ratio are very similar and are reported in appendix tables.

For respondents age 75-84, there is a large and significant increase in the likelihood of receiving any informal care: a one percentage point increase in the unemployment rate raises the likelihood of any informal care by 0.87 percentage points. This coefficient is nearly identical to the 0.8 percentage point increase in care*giving* from ATUS respondents age 40-65 in Section 5.1 (in fact, we cannot reject that these two coefficients are the same). As in Table 5, this effect comes in large part from an increase in informal care from children, and is larger for IADL care from children. Also in line with the main results, the effects for the more disabled subsample are several orders of magnitude larger. Finally, we see no effects for those aged 85 and over, suggesting that they need a type of care that is not affected by economic conditions (such as more time intensive and less deferrable ADL care).

In sum, we find that the elderly receive more informal care during economic downturns. This additional care is predominantly provided by adult children, and for help performing IADLs as opposed to ADLs, suggesting that less skill-intensive and more deferrable types of care co-move with the business cycle while more skill-intensive, personal care is inframarginal. Perhaps consistent with this idea is the finding that the effects are concentrated among individuals who are 75-84 and not younger ages (who are less likely to need any care) nor older ages (who are more likely to be very frail and need more comprehensive care). These results are also consistent with our findings that care*givers* are more likely to respond on the less-intensive care margin. The nearly identical effects we find in two different nationally representative datasets, covering overlapping but different time periods, serve as evidence of the robustness of our findings. In the next section we look at the impacts of economic conditions on formal care.

6 Effect of Macroeconomic Conditions on Formal Care

The previous section showed that rates of informal care, particularly from children, increase during economic downturns. Another important source of care, however, is formally-provided care, either in one's home or in a facility such as a nursing home. Given that individuals may purchase more formal care when informal sources are unavailable, or conversely turn to a family member when formal care becomes too expensive (or is low quality), the finding that informal care is sensitive to macroeconomic conditions suggests that formal care may also be sensitive to macroeconomic conditions.

In this section we explore if the increase in informal care in response to macroeconomic condi-

tions in Section 5 is mirrored by a decrease in the receipt of formal care. Formal care and informal care have been shown to be substitutes in certain contexts (Charles and Sevak, 2005; Van Houtven, Norton *et al.*, 2004; Van Houtven and Norton, 2008; Mommaerts, 2016), suggesting that use of formal care decreases as use of informal care increases. In addition, economic downturns could have wealth effects for the elderly and their families, causing them to substitute costly formal care with a lower-cost alternative. If, however, there is no substitution between sources of long-term care or if families are not sensitive to price or quality changes in formal care options in this context, we would see no changes in the use of formal care during economic downturns.

Table 7: Effect of unemployment rate on receipt of formal care

	Everyone			2 or more ADLs		
	(1) Any formal care	(2) Nursing home resident	(3) Any formal in home	(4) Any formal care	(5) Nursing home resident	(6) Any formal in home
Full sample	-0.0007	-0.0003	-0.0004	-0.0029	-0.0033	0.0001
	(0.0012)	(0.0011)	(0.0008)	(0.0056)	(0.0062)	(0.0048)
Observations	87487	87487	87487	10779	10779	10779
Mean dep. var.	0.0740	0.0389	0.0351	0.4306	0.2418	0.1888
Age 65-74	0.0014	0.0016**	-0.0003	0.0029	0.0087	-0.0065
	(0.0012)	(0.0007)	(0.0008)	(0.0128)	(0.0097)	(0.0117)
Observations	46467	46767	46467	3294	3294	3294
Mean dep. var.	0.0233	0.009	0.0142	0.235	0.101	0.1345
Age 75-84	-0.0044*	-0.0031*	-0.0013	-0.0187	-0.0163*	-0.0024
	(0.0022)	(0.0017)	(0.0017)	(0.0148)	(0.0095)	(0.0145)
Observations	29530	29530	29530	3843	3843	3843
Mean dep. var.	0.074	0.037	0.0370	0.402	0.214	0.1874
Age 85+	0.0023	-0.0014	0.0035	0.0157	0.0011	0.0146
	(0.0042)	(0.0047)	(0.0043)	(0.0117)	(0.0127)	(0.0119)
Observations	11490	11490	11490	3642	3642	3642
Mean dep. var.	0.2804	0.1659	0.1146	0.6381	0.3987	0.2394

Note: The sample includes individuals aged 65 and over in the pooled 1995-2012 Health and Retirement Study (HRS). Each cell reports results from a separate linear probability model. The first panel reports estimates from the full sample, the second from the subsample of individuals aged 65-74, the third from the subsample of individuals aged 75-84. The main coefficient of interest is the state annual unemployment rate, and for the full sample also the state annual employment-to-population ratio (both derived from the Current Population Survey). Columns (1) through (3) report results for the full sample, and Columns (4) through (6) report results for the sub-sample of individuals who reported having difficulty with at least two Activities of Daily Living (ADLs), defined as dressing, walking, bathing, eating, getting in and out of bed, and toileting. The dependent variable in Columns (1) and (4) is an indicator for whether the individual received any formal care in the past month, defined as any care that was paid. The dependent variable in Columns (2) and (5) is an indicator for whether the individual resides in a nursing home, and the dependent variable in Columns (3) and (6) is an indicator for whether the individual received any in-home care that was paid (i.e. not in an institution). All specifications control for 5-year age intervals, gender, education, marital status, race and ethnicity, number of children, share of the state population aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To examine the effect of macroeconomic conditions on formal care, we again use the HRS sample and focus on three outcomes: (1) whether the individual received any formal care in the previous month (defined as receiving any paid care or currently residing in a nursing home), (2) whether the individual currently resides in a nursing home, and (3) whether the individual receives paid care in their home.[33] Table 7 reports the effects of the unemployment rate on these formal care outcomes.[34] The first panel shows that for both the overall sample and the subsample reporting 2 or more ADL limitations, macroeconomic conditions have no effect on the likelihood that an individual receives formal care either at home or in a nursing home. The next three panels break up the sample into the same age groups as in Table 6, and show that the formal care results are remarkably consistent with the informal care results. Working from the bottom up, we again see no effect of macroeconomic conditions for the 85+ group. For 75-84 year olds, the group which saw the largest effects on informal care, we see corresponding (though imprecisely estimated) reductions in nursing home care. For the full sample, a one percentage point increase in the unemployment rate reduces the likelihood of receiving any formal care by 0.44 percentage points, and the likelihood of being in a nursing home by 0.31 percentage points. For the more disabled population, we see a nearly two percentage point decline in the receipt of formal care, driven primarily by nursing home care. We see no effects on the likelihood of receiving formal care at home. In contrast, for the youngest group there is a slight *increase* in nursing home residency, which mirrors the paradoxical decrease in informal care in Section 5.

We also examine the effects of macroeconomic conditions on the likelihood that the elderly report getting any help, irrespective of the source. In Table 8 we report the results for any care, and separately for ADL care and IADL care, for the full sample and for the subsample that reports difficulties with two or more ADLs. As with the other outcomes, we report results for respondents 65 and older, and then break the sample into three age groups. As with the effects of informal and formal care, we find the impacts on receiving any care are concentrated among those age 75-84. We find this age group is 0.44 percentage points more likely to report receiving any care (Column (1)), and that this care is driven by help with IADLs (Column (3)). For the sample with two or more ADL limitations, a one percentage point increase in the unemployment rate increases likelihood of receiving any care increases by 2.43 percentage points.

[33] The nursing home variable captures respondents who are in a nursing home or other health facility that provides all of the following services for its residents: dispensing of medication, 24-hour nursing assistance and supervision, personal assistance, and room & meals.

[34] Effects of the employment-to-population ratio are very similar and are reported in an appendix.

Table 8: Effect of unemployment rate on receipt of any care

	Everyone			2 or more ADLs		
	(1) Any care	(2) Any ADL care	(3) Any IADL care	(4) Any care	(5) Any ADL care	(6) Any IADL care
Full Sample	0.0003	-0.0004	0.0015	0.0062	0.0053	0.0056
	(0.0014)	(0.0013)	(0.0014)	(0.0047)	(0.0057)	(0.0068)
Observations	87487	87486	87487	10779	10779	10779
Mean dep. var.	0.2053	0.1281	0.1818	0.8567	0.7617	0.7603
Age 65-74	-0.0022	-0.0017	-0.0003	-0.0129	-0.0064	-0.0117
	(0.0014)	(0.0013)	(0.0015)	(0.0104)	(0.0149)	(0.0161)
Observations	46467	46467	46467	3294	3294	3294
Mean dep. var.	0.1138	0.0653	0.0942	0.7741	0.6591	0.6339
Age 75-84	0.0044**	0.0004	0.0043*	0.0243**	0.0133	0.0193
	(0.0020)	(0.0022)	(0.0022)	(0.0098)	(0.0101)	(0.0132)
Observations	29530	29530	29530	3843	3843	3843
Mean dep. var.	0.2296	0.1365	0.2024	0.8574	0.7580	0.7549
Age 85+	-0.0006	0.0044	0.0012	0.0025	0.0085	0.0047
	(0.0053)	(0.0045)	(0.0060)	(0.0057)	(0.0080)	(0.0072)
Observations	11490	11489	11490	3642	3642	3642
Mean dep. var.	0.5127	0.3606	0.4833	0.9305	0.8583	0.8803

Note: The sample includes individuals aged 65 and over in the pooled 1995-2012 Health and Retirement Study (HRS). Each cell reports results from a separate linear probability model. The first panel reports estimates from the full sample, the second from the subsample of individuals aged 65-74, the third from the subsample of individuals aged 75-84, the fourth from the subsample of individuals aged 85 and over. The main coefficient of interest is the state annual unemployment rate (derived from the Current Population Survey). Columns (1) through (3) report results for the full sample, and Columns (4) through (6) report results for the sub-sample of individuals who reported having difficulty with at least two Activities of Daily Living (ADLs), defined as dressing, walking, bathing, eating, getting in and out of bed, and toileting. The dependent variable in Columns (1) and (4) is an indicator for whether the individual received any care from any source in the past month. The dependent variable in Columns (2) and (5) is an indicator for whether the individual received any ADL care, and the dependent variable in Columns (3) and (6) is an indicator for whether the individual received any IADL care. All specifications control for 5-year age intervals, gender, education, marital status, race and ethnicity, number of children, share of the state population aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In sum, we find that individuals are less likely to reside in nursing homes when the unemployment rate increases. This effect is concentrated among 75-84 year olds, an age group which has low rates of nursing home residence on average. We see no change in the likelihood of using paid help in this age group or in the sample overall.[35] While the decrease in formal care among 75-84 year olds corresponds to the increase in informal care in the same age group that we document in the previous section, we also find that those age 75-84 are more likely to receive help, irrespective of the source, during economic downturns, especially help with IADLs. Taken together, these results suggest that while there may be some substitutions between formal and informal care, not all care provided by children is being replaced with care from other sources.

7 Mechanisms

The analysis in the previous two sections demonstrates the reduced form impact of macroeconomic conditions, which we proxy with the unemployment rate and the employment-to-population ratio, on long-term care outcomes. In this section, we examine heterogeneity by educational attainment, and the effects of macroeconomic conditions on some measures of the *supply* of formal care to provide suggestive evidence of the mechanisms through which these effects occur.

7.1 Heterogeneity by educational attainment

Two mechanisms through which macroeconomic conditions may affect informal care are the opportunity cost of time of potential caregivers and wealth effects of potential care recipients. To investigate these channels, we examine the effects separately by educational attainment of caregivers and care recipients. Potential caregivers with low levels of education are more likely to face reduced employment opportunities during economic downturns (Hoynes, Miller, and Schaller, 2012). At the same time, potential care recipients with low levels of education are less likely to experience wealth shocks (as they hold low wealth stock to begin with), while those with high levels may be more prone to wealth shocks. Hence, we expect both low-educated caregivers to be most sensitive to the opportunity cost of time channel, and high-educated care recipients to be more sensitive to the wealth channel.

Table 9 reports results from the caregiver sample on the likelihood of providing care, split by

[35] In contrast, (Van Houtven and Norton, 2008) find that both paid home health and nursing home use declines when informal care is an available alternative.

whether the caregiver has no college degree (Panel 1) or is a college graduate (Panel 2). The effects of macroeconomic conditions are concentrated among potential caregivers with lower education: a one percentage point increase in the unemployment rate increases the likelihood of providing any care by 1.2 percentage points, or a 9% increase from a baseline of 13.2%. Consistent with our main findings, we see larger effects for IADL care (0.86 percentage points, reported in Column (3)) than ADL care (0.45 percentage points, reported in Column (2)). Panel 2 of Table 9 reports results for the subsample with at least a college degree. While the average rates of caregiving in this sample do not differ noticeably from that of the low-education sample (13.4% compared with 13.2%), there is no impact of macroeconomic conditions on caregiving.

Table 9: Effect of unemployment rate on informal caregiving by education

	(1) Any Care	(2) ADL Care	(3) IADL Care
Low Education	0.0119***	0.0045**	0.0086***
	(0.0033)	(0.0019)	(0.0029)
Observations	63651	63651	63651
Mean dependent variable	0.132	0.0338	0.107
High Education	-0.0004	0.0004	0.0003
	(0.0025)	(0.0014)	(0.0021)
Observations	97416	97416	97416
Mean dependent variable	0.134	0.0277	0.114

Note: The sample includes individuals aged 18 and over in the 2003-2015 American Time Use Survey (ATUS) who do not report an occupation related to long-term care. Each cell reports results from a separate linear probability model. The first panel reports estimates from the subsample of individuals who did not graduate college, the second from the subsample of individuals who are college graduates. The main coefficient of interest is the state annual unemployment rate (derived from the Current Population Survey). The dependent variable in each column is an indicator for providing (1) any kind of care (ADL or IADL care) to another adult, (2) Activities of Daily Living (ADL) care to another adult, and (3) Instrumental Activities of Daily Living (IADL) care to another adult. ADL care is defined as performing any activities that are classified as "caring for another adult inside or outside the household," which include bathing, dressing, feeding, and providing medical care. IADL care is defined as performing any activities that are classified as "helping another adult inside or outside the household," which include housekeeping and maintenance, grocery shopping and food preparation, and help with transportation and medication. All specifications are weighted using individual-level weights and control for a quadratic in age, gender, education, marital status, race and ethnicity, share of the state population aged 18-64 and aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10 presents the results of a similar heterogeneity analysis for informal care receipt in the HRS. We present the results for the full sample of respondents age 65 and over and report only the effects of the unemployment rate. The increase in informal care from children that we observed in the main results is concentrated among respondents who did not graduate high school, while informal care receipt among individuals with at least a high school diploma does not appear to

respond to economic conditions.[36] A one percentage point increase in the unemployment rate increases the likelihood that the elderly with low levels of education receive any informal care by 0.47 percentage points (Column (1)), and any informal care from children by 0.72 percentage points (Column (2)). Again similar to the pattern for caregivers, we see a larger increase in IADL care (0.82 percentage points) compared with ADL care (0.31 percentage points).[37]

Table 10: Effect of unemployment rate on informal care receipt, by education

	(1) Any informal care	(2) Informal care by children	(3) ADL care by children	(4) IADL care by children
Low Education	0.0047*	0.0072**	0.0031*	0.0082***
	(0.0027)	(0.0031)	(0.0016)	(0.0027)
Observations	28179	28128	28127	28128
Mean dep. var.	0.2372	0.1427	0.0624	0.1290
High Education	-0.0018	0.0001	0.0010	-0.0004
	(0.0012)	(0.0012)	(0.0012)	(0.0012)
Observations	59307	59190	59187	59189
Mean dep. var.	0.1167	0.0579	0.0237	0.0506

Note: The sample includes individuals aged 65 and over in the pooled 1995-2012 Health and Retirement Study (HRS). Each cell reports results from a separate linear probability model. First panel reports the results from the subsample of individuals who did not graduate high school, and the second from the subsample of individuals with who graduated high school. The main coefficient of interest is the state annual unemployment rate (derived from the Current Population Survey). The dependent variable in Columns (1)-(4) relate to informal care received in the past month. in Columns (5)-(7) relate to formal care received in the past month, and columns (8)-(10) relate to any care received in the last month. Activities of Daily Living (ADLs) are defined as dressing, walking, bathing, eating, getting in and out of bed, and toileting. Instrumental Activities of Daily Living (IADLs) are defined as meal preparation, grocery shopping, making phone calls, taking medication, and managing money. All specifications control for 5-year age intervals, gender, education, marital status, race and ethnicity, number of children, share of the state population aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We show that the changes in informal care that we describe in the main section are concentrated among caregivers and recipients with lower levels of education, suggesting that these families rely on care that is more sensitive to economic conditions and are less able to smooth over shocks to the long-term care market. We also argue that this points to the opportunity cost of

[36] We choose high school as the breakpoint in the sample of care recipients and college as the breakpoint in the sample of caregivers because of the this splits the sample similarly.

[37] Disability is closely associated with education: conditional on age, individuals with less than a high school education are more than twice as likely to have difficulty with ADLs as high school graduates, and white non-hispanics reporting lower rates than other groups (Hagen, 2013). In the HRS, the subsample with low levels of education is also more likely to have higher levels of disability - for example 30% of the low education group receives any care, compared with 16% of the high education sample. Although we explicitly control for level of disability in all of the regressions using the HRS, these heterogeneity analyses may still be capturing additional variation in disability level as well as educational attainment.

time as a dominant mechanism behind the reduced form relationship between macroeconomic conditions and changes in long-term care that we document.[38]

7.2 Supply of formal care

We next directly address the possibility that the *supply* of professional low-skill care workers responds to macroeconomic conditions. Table 11 shows the effect of the unemployment rate and the employment-to-population ratio on two measures of formal care supply: (1) whether a respondent in the ATUS is employed as a direct care worker (home health aide, nurses aide, etc.),[39] and (2) a state's population share employed in a caregiving profession from the Occupation and Employment Survey (OES), conducted by the BLS.

We find a small and marginally significant increase in the likelihood of being a professional low-skill care worker in the ATUS of 0.09 percentage points for a one percentage point increase in the unemployment rate, from a base rate of 1.4%. However, we find no significant effects of the employment-to-population ratio on this outcome, nor effects of either measure on the share of the population reported as professional caregivers. Thus, we interpret our results as suggesting there is little to no effect of macroeconomic conditions on the overall supply of professional caregivers. If anything, these results suggest a slight increase in the supply of low-skilled formal care during economic downturns.

We also examine the price of formal care in Column (3) of Table 11, proxied by average hourly wages of professional low-skill care workers, also from the OES. We find a small and marginally significant negative effect of 0.4 percent with a one percentage point increase in the unemployment rate, indicating that the price of formal care labor inputs falls during economic downturns.[40]

Thus we find little supporting evidence that the overall supply of formal care workers changes significantly in response to the business cycle. We do find some evidence that the price of inputs into formal care, specifically the wages of formal care workers, falls during downturns. The direction of these effects suggests that some forms of formal care become cheaper and more available during economic downturns, so this margin is unlikely to be driving the informal care results that

[38] We report the results of macroeconomic conditions on the likelihood of receiving any formal care separately by education in Appendix Table 5. While none of the effects appear statistically significant, the coefficient for nursing home residence among the low education subsample (Panel 1) is similar to the the results reported in Column 2 of Table 7 for 75-84 year olds. A one percentage point increase in the unemployment rate leads to an imprecisely estimated 0.26 percentage point decrease in the likelihood of being in a nursing home.

[39] Unlike the previous ATUS analyses, we do not drop professional care workers from the sample here.

[40] This result provides suggestive evidence that the sign of $\frac{\partial P_f}{\partial w}$ is positive.

Table 11: Effect of unemployment rate on supply and price of formal care

	(1) Professional careworker, ATUS	(2) Professional careworker (pop share) OES	(3) Log wage (hourly) OES
Unemployment rate	0.000864*	0.000074	-0.00445*
	(0.000432)	(0.000115)	(0.002530)
Emp/pop ratio	-0.000431	-0.000197	0.00515
	(0.000455)	(0.000129)	(0.003574)
Observations	163301	663	663
Mean dependent variable	0.0137	0.0116	9.80

Note: Each cell reports results from a separate linear probability model. The main coefficient of interest is the state annual unemployment rate in the first row and the state annual employment-to-population ratio in the second row (both derived from the Current Population Survey). The sample in Column (1) includes individuals aged 18 and over in the 2003-2015 American Time Use Survey (ATUS), the dependent variable is an indicator of whether the individual reported being employed as a home health aide, nurse's aide, or similar long-term care occupation, and both specifications are weighted using individual-weights and control for a quadratic in age, gender, education, marital status, race and ethnicity, share of the state population aged 18-64 and aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. The data in Columns (2) and (3) consist of state-level profession characteristics from the Occupation and Employment Survey (OES) from 2003-2015. The dependent variables are the state share of the population employed in a caregiving profession and the log average wage in caregiving professions, respectively. All specifications are weighted by the state population and control for state-level demographic characteristics, including the share female, the share married, the share aged 18-39, 40-64, and 65 and over, the share in five education categories, the share in five race and ethnicity categories, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

we report.

7.3 Long-term care financing

Finally, we briefly examine the effect of macroeconomic conditions on the source of financing for long-term care. Table 12 reports the effect of the unemployment rate on five long-term care financing outcomes: 1) if the respondent had any paid help (excluding help received in a nursing home), 2) if the respondent's children helped pay for long-term care costs, 3) if insurance helped pay for long-term costs, 4) if the respondent paid for any long-term care out of pocket, and 5) if the respondent is on Medicaid. As before, we present results for both the full sample and the subsample reporting two or more ADL difficulties.

We find no strong evidence of changes in insurance status or likelihood of receiving paid help at home (mirroring the results from Table 7). Additionally, respondents are no more or less likely to use insurance to pay for long-term care, or to pay for long-term care out of pocket. Instead, Column (2) indicates that during economic downturns respondents are less likely to report getting financial help from their children to pay for long-term care. A one percentage point increase in the unemployment rate reduced the likelihood that the elderly get help from their children to pay for long-term care by 0.18 percentage points in the full sampl. Coupled with the results from Section 5, we cautiously interpret this as suggestive of some intra-family substitution between transfers of time and money from children to their parents: during economic expansions, adult children may be less likely to help their parents with IADLs, but more likely to finance their care.

8 Conclusion

Long-term care is a growing policy issue in the United States. Understanding how individuals and markets respond to economic conditions is a key input to the design of optimal long-term care policy. This paper makes a step forward by examining how informal care, and to a lesser extent the formal care counterpart, react to changes in macroeconomic conditions.

We find that informal care is countercyclical. We examine both caregiving and care receipt, and show very similar effects among a relevant population. Specifically, a one percentage point increase in the unemployment rate leads to a 0.8 percentage point increase in the likelihood of providing care among 40-64 year olds in the American Time Use Survey and a 0.87 percentage point increase in the likelihood of receiving informal care among 75-84 year olds in the Health and

Table 12: Effect of unemployment rate on the financing of long-term care

	(1) Any paid helpers	(2) Any kids help w/costs	(3) Any ins help w/costs	(4) Any costs out of pocket	(5) Medicaid
Unemp rate	-0.0006	-0.0018**	-0.0010	-0.0002	0.0019
	(0.0008)	(0.0007)	(0.0007)	(0.0008)	(0.0011)
Observations	87487	87363	87487	87487	86642
Mean dep. var.	0.0382	0.0121	0.0167	0.0202	0.1015

Note: The sample includes individuals aged 65 and over in the pooled 1995-2012 Health and Retirement Study (HRS). Each cell reports results from a separate linear probability model. The main coefficient of interest is the state annual unemployment rate in the first row and the annual employment-to-population ratio in the second row (both derived from the Current Population Survey). The dependent variable in Columns (1) is an indicator for whether the individual paid any in-home helpers in the past month, the dependent variable in Columns (2) is an indicator for whether any of the individual's children helped with long-term care costs, the dependent variable in Columns (3) is an indicator for whether any insurance helped with long-term care costs, the dependent variable in Columns (4) is an indicator for whether the individual (or their spouse) paid out of pocket for any care in the last month, and the dependent variable in Columns (5) is an indicator for whether the individual reports being enrolled in Medicaid. All specifications control for 5-year age intervals, gender, education, marital status, race and ethnicity, number of children, share of the state population aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Retirement Study. We find that the type of care that is most sensitive to economic conditions is help with Instrumental Activities of Daily Living, which includes help with home maintenance, grocery shopping and food preparation, medication adherence and transportation. We also analyze the composition of formal care among the elderly, distinguishing between care received from a paid caregiver at home and care received in a nursing home. For the 75-84 year olds for whom we saw an effect on informal care, we also see a decrease in the likelihood of being in a nursing home in the same age group. However, we also find that the elderly report receiving more care overall during economic downturns. Finally, we find that changes in macroeconomic conditions lead to children to substitute between time and money transfers to their elderly parents.

Although we are not able to distinguish between the various channels, we are able to directly observe some measures of the supply and price of formal care through the wages of direct care workers and find no evidence that this is driving our results. Additionally, the results are concentrated among the low-educated elderly, who are less likely to have the resources to pay for long-term services out of pocket and are more likely to rely on either informal care or public insurance, as well as low-educated caregivers, who are more likely to see their employment opportunities affected by the unemployment rate.

A potentially fruitful next step in this line of research is to further understand the welfare impacts of our findings for both the elderly and their caretakers. For the elderly, our results shed

light on a potential mechanism behind the procyclical relationship between elderly mortality and business cycles, which has been documented elsewhere. For caregivers, informal care provides a productive use of time during economic downturns, but may have long-lasting deleterious effects on their labor market prospects. Future research to assess the magnitudes of these welfare consequences will be important factors for understand and evaluating long-term care policy.

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Appendix A Additional Tables

Appendix Table 1: Effect of unemployment rate on care to children

	To any children			To children in household			To children out of household		
	Full sample (1)	w/children in household (2)	No children in household (3)	Full sample (4)	w/children in household (5)	No children in household (6)	Full sample (7)	w/children in household (8)	No children in household (9)
	Panel 1: Any care								
Unemployment rate	-0.0009	-0.0011	0.0016	-0.0022	-0.0016	0.0000	-0.0002	-0.0031**	0.0016
	(0.0016)	(0.0032)	(0.0012)	(0.0015)	(0.0032)	(0.0000)	(0.0008)	(0.0013)	(0.0012)
Emp/pop ratio	0.0008	0.0007	-0.0005	0.0013	0.0013	-0.0001	0.0006	0.0023	-0.0005
	(0.0017)	(0.0029)	(0.0015)	(0.0013)	(0.0030)	(0.0001)	(0.0010)	(0.0015)	(0.0015)
Mean dependent variable	0.259	0.605	0.0541	0.221	0.594	0.000126	0.0475	0.0366	0.0540
	Panel 2: Total minutes of care								
Unemployment rate				-0.0569	0.1446	0.0064	-0.1516	-0.3258*	-0.0507
				(0.2533)	(0.6475)	(0.0092)	(0.1194)	(0.1800)	(0.1577)
Emp/pop ratio				-0.1113	-0.5501	-0.0207	0.2047	0.2134	0.2011
				(0.2046)	(0.5528)	(0.0138)	(0.1384)	(0.1307)	(0.2144)
Mean dependent variable				25.91	69.58	0.0214	4.469	1.853	6.019
Observations	161067	70242	90825	161067	70242	90825	161067	70242	90825

Note: The sample includes individuals aged 18 and over in the 2003-2015 American Time Use Survey (ATUS). Each cell reports results from a separate linear probability model. The dependent variable in each column of the first panel is whether the individual provides care to children, and the dependent variable in each column of the second panel is the total (unconditional) number of minutes of care. For each panel, each column distinguishes to whom the care is directed and among individuals who have children in the household and among individuals who do not have children in the household. Also for each panel, the main coefficient of interest is the state annual unemployment rate in the first row and the annual employment-to-population ratio in the second row (both derived from the Current Population Survey). All specifications are weighted using individual-level weights and control for a quadratic in age, gender, education, marital status, race and ethnicity, share of the state population aged 18-64 and aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 2: Effect of employment to population ratio on informal caregiving by age

	(1) Any Care	(2) ADL Care	(3) IADL Care
Age <40	-0.0041	-0.0014	-0.0035
	(0.0031)	(0.0015)	(0.0029)
Observations	55326	55326	55326
Mean dependent variable	0.132	0.0176	0.120
Age 40-64	-0.0064**	-0.0012	-0.0056**
	(0.0025)	(0.0015)	(0.0025)
Observations	74129	74129	74129
Mean dependent variable	0.137	0.0361	0.111
Age 65+	-0.0025	-0.0024	-0.0030
	(0.0035)	(0.0022)	(0.0031)
Observations	31612	31612	31612
Mean dependent variable	0.127	0.0448	0.0920

Note: The sample includes individuals aged 18 and over in the 2003-2015 American Time Use Survey (ATUS) who do not report an occupation related to long-term care. Each cell reports results from a separate linear probability model. The first panel reports estimates from the subsample of individuals under age 40, the second from a subsample aged 40-64, and the third from a subsample aged 65 and over. The main coefficient of interest is the state employment to population ratio (derived from the Current Population Survey). The dependent variable in each column is an indicator for providing (1) any kind of care (ADL or IADL care) to another adult, (2) Activities of Daily Living (ADL) care to another adult, and (3) Instrumental Activities of Daily Living (IADL) care to another adult. ADL care is defined as performing any activities that are classified as "caring for another adult inside or outside the household," which include bathing, dressing, feeding, and providing medical care. IADL care is defined as performing any activities that are classified as "helping another adult inside or outside the household," which include housekeeping and maintenance, grocery shopping and food preparation, and help with transportation and medication. All specifications are weighted using individual-level weights and control for a quadratic in age, gender, education, marital status, race and ethnicity, share of the state population aged 18-64 and aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 3: Effect of the employment to population ratio on informal care receipt, by age

	Everyone				2 or more ADLs			
	(1) Any informal care	(2) Informal care by children	(3) ADL care by children	(4) IADL care by children	(5) Any informal care	(6) Informal care by children	(7) ADL care by children	(8) IADL care by children
Age 65-74	0.0013	-0.0005	0.0010	-0.0011	0.0216	-0.0006	0.0012	0.0034
	(0.0017)	(0.0011)	(0.0010)	(0.0009)	(0.0149)	(0.0122)	(0.0114)	(0.0107)
Obs	46466	46368	46368	46368	3293	3290	3290	3290
Mean DV	0.0994	0.0444	0.0193	0.0373	0.6395	0.3213	0.2155	0.2553
Age 75-84	-0.0037	-0.0060***	-0.0027**	-0.0045**	-0.0129	-0.0354***	-0.0148	-0.0255**
	(0.0028)	(0.0020)	(0.0014)	(0.0022)	(0.0138)	(0.0094)	(0.0095)	(0.0100)
Obs	29530	29486	29484	29486	3843	3843	3843	3843
Mean DV	0.1815	0.0967	0.0406	0.0856	0.6016	0.3539	0.2428	0.2985
Age 85+	0.0007	-0.0046	-0.0054	-0.0085*	0.0095	0.0029	-0.0038	-0.0053
	(0.0061)	(0.0043)	(0.0034)	(0.0046)	(0.0117)	(0.0091)	(0.0087)	(0.0094)
Obs	11490	11464	11462	11463	3642	3635	3635	3634
Mean DV	0.3155	0.2209	0.0930	0.2071	0.4830	0.3447	0.2242	0.3189

Note: The sample includes individuals aged 65 and over in the pooled 1995-2012 Health and Retirement Study (HRS). Each cell reports results from a separate linear probability model. The first panel reports estimates from the subsample of individuals aged 65-74, the second from the subsample of individuals aged 75-84, the third from the subsample of individuals aged 85 and over. The main coefficient of interest is the state annual employment to population ratio (derived from the Current Population Survey). Columns (1) through (4) report results for the full sample, and Columns (5) through (8) report results for the sub-sample of individuals who reported having difficulty with at least two Activities of Daily Living (ADLs), defined as dressing, walking, bathing, eating, getting in and out of bed, and toileting. The dependent variable in Columns (1) and (5) is an indicator for whether the individual received any informal care in the past month, defined as care received outside an institution that was uncompensated. The dependent variable in Columns (2) and (6) is an indicator for whether the individual received any informal care by any of their children, in Columns (3) and (7) is an indicator for whether the individual received any informal care by any of their children for ADLs, and in Columns (4) and (8) is an indicator for whether the individual received any informal care by any of their children for Instrumental Activities of Daily Living (IADLs), defined as meal preparation, grocery shopping, making phone calls, taking medication, and managing money. All specifications control for 5-year age intervals, gender, education, marital status, race and ethnicity, number of children, share of the state population aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 4: Effect of the employment to population ratio on receipt of formal care

	Everyone			2 or more ADLs		
	(1) Any formal care	(2) Nursing home resident	(3) Any formal in home	(4) Any formal care	(5) Nursing home resident	(6) Any formal in home
Full sample	0.0010	0.0005	0.0005	0.0052	-0.0009	0.0064
	(0.0009)	(0.0009)	(0.0007)	(0.0051)	(0.0053)	(0.0047)
Observations	87487	87487	87487	10779	10779	10779
Mean dep. var.	0.0740	0.0389	0.0351	0.4306	0.2418	0.1888
Age 65-74	-0.0004	-0.0012*	0.0008	0.0054	-0.0077	0.0130*
	(0.0009)	(0.0006)	(0.0007)	(0.0096)	(0.0074)	(0.0073)
Observations	46467	46767	46467	3294	3294	3294
Mean dep. var.	0.233	0.009	0.0142	0.235	0.101	0.1345
Age 75-84	0.0021	0.0027*	-0.0006	0.0166	0.0100	0.0066
	(0.0020)	(0.0014)	(0.0013)	(0.0112)	(0.0093)	(0.0087)
Observations	29530	29530	29530	3843	3843	3843
Mean dep. var.	0.074	0.037	0.0370	0.402	0.214	0.1874
Age 85+	0.0023	0.0007	0.0015	-0.0116	-0.0100	-0.0016
	(0.0041)	(0.0050)	(0.0039)	(0.0080)	(0.0103)	(0.0095)
Observations	11490	11490	11490	3642	3642	3642
Mean dep. var.	0.2804	0.1659	0.1146	0.6381	0.3987	0.2394

Note: The sample includes individuals aged 65 and over in the pooled 1995-2012 Health and Retirement Study (HRS). Each cell reports results from a separate linear probability model. The first panel reports estimates from the full sample, the second from the subsample of individuals aged 65-74, the third from the subsample of individuals aged 75-84, the fourth from the subsample of individuals aged 85 and over. The main coefficient of interest is the state annual employment-to-population ratio (derived from the Current Population Survey). Columns (1) through (3) report results for the full sample, and Columns (4) through (6) report results for the sub-sample of individuals who reported having difficulty with at least two Activities of Daily Living (ADLs), defined as dressing, walking, bathing, eating, getting in and out of bed, and toileting. The dependent variable in Columns (1) and (4) is an indicator for whether the individual received any formal care in the past month, defined as any care that was paid. The dependent variable in Columns (2) and (5) is an indicator for whether the individual resides in a nursing home, and the dependent variable in Columns (3) and (6) is an indicator for whether the individual received any in-home care that was paid (i.e. not in an institution). All specifications control for 5-year age intervals, gender, education, marital status, race and ethnicity, number of children, share of the state population aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 5: Effect of unemployment rate on formal or any care receipt, by education

	Formal Care			Any Care		
	(1) Any formal care	(2) Nursing home resident	(3) Any formal in home	(4) Any care	(5) Any ADL care	(6) Any IADL care
Low Education	-0.0014	-0.0026	0.0012	0.0036	-0.0013	0.0072***
	(0.0029)	(0.0015)	(0.0024)	(0.0028)	(0.0026)	(0.0020)
Observations	28179	28179	28179	28179	28179	28179
Mean dep. var.	0.1051	0.0550	0.0501	0.3067	0.1894	0.2771
High Education	-0.0004	0.0004	-0.0009	-0.0015	-0.0001	-0.0013
	(0.0012)	(0.0011)	(0.0011)	(0.0015)	(0.0011)	(0.0017)
Observations	59308	59308	59308	59308	59307	59308
Mean dep. var.	0.0592	0.0313	0.0280	0.1570	0.0990	0.1365

Note: The sample includes individuals aged 65 and over in the pooled 1995-2012 Health and Retirement Study (HRS). Each cell reports results from a separate linear probability model. First panel reports the results from the subsample of individuals who did not graduate high school, and the second from the subsample of individuals with who graduated high school. The main coefficient of interest is the state annual unemployment rate (derived from the Current Population Survey). The dependent variables in Columns (1)-(3) relate to formal care received in the past month, and columns (5)-(16) relate to any care received in the last month. Activities of Daily Living (ADLs) are defined as dressing, walking, bathing, eating, getting in and out of bed, and toileting. Instrumental Activities of Daily Living (IADLs) are defined as meal preparation, grocery shopping, making phone calls, taking medication, and managing money. All specifications control for 5-year age intervals, gender, education, marital status, race and ethnicity, number of children, share of the state population aged 65 and over, as well as state, year, and linear time trends by state. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B Extended model

In this appendix we extend the model in Section 3 to allow economic fluctuations to additionally affect the price and quality of formal care: $P_f(E)$ and $Q_f(E)$. This may be true if, for example, an expansion drives up labor demand in the formal care sector, which raises formal care sector wages, which in turn raises prices, or $\frac{\partial P_f}{\partial E} > 0$. The direction effect of an expansion on the quality of formal care is less obvious, but if, for example, it is harder to hire good workers during economic expansions, then the quality of formal care may decrease during expansions: $\frac{\partial Q_f}{\partial E} < 0$.

If these effects are present, then equation (3) contains additional terms:

$$\frac{\partial h_c^*}{\partial E} = \frac{1}{P_f g''(h_c^*)} \left[Q_f \frac{\partial w}{\partial E} + w \frac{\partial Q_f}{\partial E} - \frac{w Q_f}{P_f} \frac{\partial P_f}{\partial E} \right] \tag{6}$$

The first term in the bracket is the direct effect of an economic expansion on informal care (i.e. equation (3)), and recalling that $g'' < 0$, this effect is negative. The second and third terms are the indirect effects through the quality and price of formal care, respectively. If $\frac{\partial Q_f}{\partial E} < 0$ and $\frac{\partial P_f}{\partial E} > 0$, then both of these terms exert a positive effect on the elasticity of informal care with respect to economic conditions. Thus, while the basic model in Section 3 shows that there is an unambiguously negative effect of economic expansions on informal care, when we extend the model to include indirect effects through the parameters of the formal care market, the overall relationship becomes ambiguous.

Similarly, this extended model modifies the elasticity of labor supply with respect to economic conditions. Recalling that $\tilde{R} = R + wL_0 - wh_c^* - P_f \left[\frac{Q - g(h_c^*)}{Q_f} \right]$, the analogs for equations (4) and (5) are thus:

$$\frac{\partial L^*}{\partial E} = \left[z_w + z_{\tilde{R}} (L_0 - h_c^*) \right] \frac{\partial w}{\partial E} - z_{\tilde{R}} \left(\frac{\partial P_f}{\partial E} - \frac{P_f}{Q_f} \frac{\partial Q_f}{\partial E} \right) \left(\frac{Q - g(h_c^*)}{Q_f} \right) \tag{7}$$

and

$$\begin{aligned} \frac{\partial h_m^*}{\partial E} = & \left[-(z_w + z_{\tilde{R}} L_0) + \left(z_{\tilde{R}} h_c^* - \frac{Q_f}{P_f g''(h_c^*)} \right) \right] \frac{\partial w}{\partial E} \\ & + \left(z_{\tilde{R}} \left[\frac{Q - g(h_c^*)}{Q_f} \right] + \frac{w Q_f}{P_f^2 g''(h_c^*)} \right) \frac{\partial P_f}{\partial E} \\ & - \left(z_{\tilde{R}} \frac{P_f}{Q_f} \left[\frac{Q - g(h_c^*)}{Q_f} \right] + \frac{w}{P_f g''(h_c^*)} \right) \frac{\partial Q_f}{\partial E} \end{aligned} \tag{8}$$

where the latter equation is the elasticity of labor supply with respect to economic conditions.[41] For the elasticity of labor supply, the terms on the first line are the same as in Section 3: the first set of terms capture the standard income and substitution effects for a given amount of informal care, and the second set of terms capture the increase in the elasticity due to a trade-off between market work and informal care, holding fixed the parameters of the formal care market. The terms on the second line represent the impact of a change in prices on the elasticity of labor supply. The first set of terms captures a resource effect due to the price increase, which has a positive effect on labor supply elasticity, while the second set of terms captures the modification of the trade-off between informal care and labor supply when E affects P_f. This set of terms is negative because,

[41] If economic conditions additionally affected wealth R, equation (8) would additionally contain the term $+z_{\tilde{R}} \frac{\partial R}{\partial E}$.

intuitively, the cost-savings benefit of informal care, P_f, is decreasing compared to the opportunity cost of wage income w. Similarly, the terms on the third line represent the impact of a change in formal care quality on the wage elasticity of labor supply. Overall, for both the price effects and quality effects, since the first and second set of terms are opposite-signed, the impact of these effects on the wage elasticity of labor supply is ambiguous.