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ABSTRACT

We use data from the Medical Expenditure Panel Survey (MEPS) for the years 2004 - 2012 to examine the impact of economic shocks on the family's out-of-pocket health care spending burden. We define this burden as the share of family income devoted to out-of-pocket health care spending. In contrast to static, cross-sectional analyses, our study examines how the within-family change in spending burden over the two-year MEPS observation period responds to losses in family income, insurance, and employment. We also consider the impact of such losses on single-mother and two-parent families. To do so, we apply fractional response and health expenditure models using the correlated random effects (CRE) method to control for time-invariant, unobserved heterogeneity across family units. We find evidence that the change in the out-of-pocket spending burden is sensitive to income shocks, and that income changes rather than changes in health spending per se appears to drive changes in the out-of-pocket burden.

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I. Introduction

An economic shock which compromises a family's economic status can have important implications for its spending on critical goods and services, such as health care. Given the importance of access to health care for a family's health security, a critical issue is whether the family can sustain its health care spending when it experiences a decline in its economic status, and whether it can do so without compromising its consumption of other essential commodities.

More specifically, the implications for the family's health, financial security, and consumption will depend on how the family's responsibility for health care spending changes in response to an economic shock that alters its income and possibly its health insurance status. Such losses may reduce the family's demand for health care, and thus have implication for its health care spending burden. The change in spending burden, defined as the share of family income allocated to health care, will depend on two factors: (1) How the family's total health care spending changes with an economic shock, and (2) how its out-of-pocket health care spending changes in response to the change in its total health care spending. Depending upon the family's health status, the share of family income required to support its out-of-pocket health care spending may increase, decrease, or remain unchanged.[1]

In this paper, we consider how the family's out-of-pocket health care spending burden responds to a change in its income, employment, and health insurance status. While a variety of papers have examined the out-of-pocket spending burden of families, these have largely been

[1] Should the family maintain its health insurance coverage, its out-of-pocket spending and associated spending burden will depend upon whether the family has yet to meet its deductible or has surpassed its deductible requirement.

static cross-sectional analyses. As such, they have not considered the dynamic nature of the within-family change in its out-of-pocket spending burden in response to a change in its economic status. This dynamic change is the focus of our paper, and we apply data from the two-year Medical Expenditure Panel Survey (MEPS) described below to assess the implications for the family's welfare. Finally, we further examine whether the change in its out-of-pocket health care spending burden is differentially borne by single-mother families compared to two-parent families. In earlier work examining the impact of economic shocks on the intra-family allocation of health care spending between adults and children (Monheit, Grafova, and Kumar 2018), we found that the response was largely due to the behavior of single-mother families.

The plan of our paper is as follows. In section II we provide background on the issue of out-of-pocket spending citing research that is particularly relevant for our work. We also devise an analytical framework to help interpret changes in out-of-pocket spending burden. In section III we discuss our data and analytical approach, report results in section IV, and conclusions, implications, and limitations in section V. In general, we find that an economic shock yields an increase in the family's out-of-pocket spending burden, and that this change is driven primarily by the decline in family income rather than by changes in its health care spending *per se*.

II. Background and Analytical Framework

Concern with the financial vulnerability of families confronting rising health care costs and the uncertainty regarding their economic circumstances has stimulated interest in the burden of health care spending borne by families. In part, this reflects both research and media stories highlighting the contribution of out-of-pocket health care spending to family bankruptcies (Himmelstein et al. 2009; Doty et al. 2008; Dranove and Millenston 2006); the extent to which families exceed arbitrary thresholds demarcating catastrophic health care burdens (Galarraga et

al. 2010); and the degree to which health insurance expansions and public policy interventions can address these financial burdens. Most recently, concern has been raised by the reaction of enrollees to the large deductibles in some health insurance plans offered through the Affordable Care Act's health insurance exchanges. Finally, research has been stimulated by methodological issues related to estimating family health care burdens (Goldman and Smith, 2001), service-specific studies of health care burdens (e.g., Zuvekas and Selden 2010; Ringel and Strum 2001), studies examining trends in out-of-pocket health spending (Blumberg et al. 2014), and studies highlighting the adequacy of public and private insurance in protecting against catastrophic health expenditures (Galarraga et al 2010).

By contrast, surprising little work has focused on how the family's out-of-pocket spending and its health care financial burden respond to changes in the family's economic status. Perhaps most importantly, this reflects the limited availability of panel data containing health care spending measures that can be used to assess such a change for specific families over time. Another limitation in the literature is that the existing cross-sectional analyses of changes in the family's health care expenditure burden typically focus on a single measure such as the percent of income allocated to health care without exploring how the underlying factors governing this burden respond to changes in economic status.

Analytical Framework

In assessing and understanding the behavior of a family's out-of-pocket expenditures and its burden on family income, we consider several relevant relationships. Focusing on income shocks, we begin by representing the family's out-of-pocket health care spending burden as OOP/Y where OOP represents family out-of-pocket spending and Y represents family income. Whether this spending burden will increase in response to an income change will depend on the

how out-of-pocket expenditures change relative to the change in income. More specifically, for an economic shock yielding a decline in income and in out-of-pocket spending, the out-of-pocket burden will increase if:

$$\Delta (OOP/Y) > 0 \text{ if } |\Delta OOP|/OOP < |\Delta Y|/Y \qquad (1)$$

That is, if the percent decline in out-of-pocket spending ($\Delta OOP/OOP$) is less than the percent decline in income ($\Delta Y/Y$). Should out-of-pocket spending increase or remain the same in response to an income decline, then the out-of-pocket burden will always increase.

Next, we note that the change in the out-of-pocket health care spending burden, OOP/Y, can be written as the following product:

$$OOP/Y = TE/Y * OOP/TE \qquad (2)$$

where OOP and Y are defined as before, TE represents total health care spending, TE/Y is the share of family income devoted to health care, and OOP/TE is the share of total health care spending borne out-of-pocket by the family. Thus, to fully assess the behavior of the family's out-of-pocket health care spending burden, we require consideration of how total health care spending responds to an income change and in turn, how out-of-pocket spending responds to a change in total spending. Totally differentiating (2) yields the change in the out-of-pocket burden from time *t* to time *t+1*:

$$\Delta (OOP/Y)_{t+1-t} = \Delta(TE/Y)_{t+1-t} * (OOP|/TE)_{t} + \Delta(OOP/TE)_{t+1-t} * (TE/Y)_{t} \qquad (3)$$

Thus the change in the out-of-pocket spending burden from baseline time *t* to time *t+1* [$\Delta (OOP/Y)_{t+1-t}$] will depend on the change in total spending between time t and time t+1 as a share of income [$\Delta(TE/Y)_{t+1-t}$] weighted by the baseline share of out-of-pocket spending in total health care spending [$(OOP|/TE)_{t}$], plus the change in out-of-pocket spending as a share of total health care spending between time *t* and time *t+1* [$\Delta(OOP/TE)_{t+1-t}$] weighted by total

health care spending as a percent of income at baseline time t $[(TE/Y)_t]$. We use the relationship in (3) to guide our empirical work. More specifically, we estimate fractional response probit models with TE/Y and OOP/TE as outcomes to assess how these components underlying the change in out-of-pocket burden respond to changes in family economic status over observation periods.

III. Data and Empirical Approach

Data

The data for this analysis are from the Medical Expenditure Panel Survey-Household Component (MEPS), a series of two-year panel data sets maintained by the Agency for Healthcare Research and Quality. The MEPS collects data from a nationally representative subsample of households that participated in the prior year's National Health Interview Survey. Respondents to the MEPS are surveyed five times over a period covering two calendar years regarding their own and their family members' demographic characteristics, health status, health care expenditures and utilization, health insurance coverage, income, and employment status. Our analytical data set includes pooled two-year panels from the MEPS covering the period 2004 through 2012.[2]

Since the focus of our analysis is on the family's health care spending burden, we constructed family units and obtained family-level characteristics for each year of our two-year panels based on the characteristics of individual family members, family-level income, the insurance status of each family member, and each parent's employment history. Our sample of families consists of those with all members present for both years of the two-year panel and who

[2] For consistency with our earlier analyses of economic shocks and family health security (Monheit, Grafova, and Kumar, 2018; Grafova, Monheit and Kumar 2018; and Monheit and Grafova, 2018), we rely on data for this period.

are related by marriage or by birth. We excluded families with individuals ages 65 years or older since such families typically have members covered by Medicare. Such families are less likely than families with non-elders to be affected by an economic shock that would compromise their health care spending and their out-of-pocket spending obligations.

We also excluded families with births during the two-year period since such families may have experienced a one-time spike in their health care spending burden associated with pre-natal care and childbirth. Finally, we excluded families with children ages 18 or older in an attempt to represent only nuclear families without children residing outside the household. Such children may have access to other sources of medical care (such as care obtained through a college health plan or through their own employment-related plan) and thus are unlikely to be affected by an economic shock experienced by their parents. These exclusions resulted in a sample size of 43,629 individuals representing 13,821 families. Since we focus on families, we restricted our analysis to married couples with children and single-mother families.[3] These restrictions yielded samples of 5,972 two-parent families with children and 2,999 single-mother families for a total sample size of 8,971 families.

Total health care expenditures in MEPS data represent the sum of direct payments for health care services provided during the year. This includes out-of-pocket payments incurred by the family, and payments by private insurance, Medicaid, Medicare, and other sources. We obtained total and out-of-pocket health care spending for each individual family member and then aggregated these data to obtain total family health care spending and total family out-of-pocket spending. We used these variables to create the share of total family health care spending represented by out-of-pocket spending (OOP/TE), and the share of family income represented by

[3] We did not have adequate sample size to include single-father families in the analysis.

total family health care spending (TE/Y). Note that our measures of total and out-of-pocket spending are restricted to spending directly allocated to the family's medical care and do not include family out-of-pocket contributions to health insurance. Finally, all expenditure variables are expressed in 2012 dollars.

Empirical approach

To assess how the family's health care spending burden responds to an economic shock, we examine the within-family change in the family's out-of-pocket health care spending as a share of family income over the two-year MEPS observation periods. Additionally, given our decomposition of the out-of-pocket burden in (2) above, we also consider how an economic shock is related to the within-family change in the share of income allocated to total health care spending and the share of total health care spending paid out of pocket. Since these measures are proportions which will generally lie within the zero – one bound, we estimate fractional probit models (FRM). [4] We estimate the FRMs using the correlated random effects (CRE) method to control for time-invariant, unobserved heterogeneity across family units (Papke and Wooldridge 2008; Wooldridge 2010).

Following Wooldridge (2010), the FRM takes the following functional form using the probit response function:

$$P(y_{it} = 1 \mid x_{it}, a_{it}, c_i) = \phi(x_{it}, a_{it}, c_i) \text{ for the } i^{th} \text{ family over time periods } t=1, \ldots T.$$

[4] The ratio of family out-of-pocket health care spending to family income can exceed unity as can the ratio of total health spending to family income. To accommodate the fractional response model, we top-coded values of these variables to one if they exceeded unity. For our measure of out-of-pocket burden, only 3.5% of single-mother families and 0.5% of two-parent families had values in excess of unity. For the ratio of total family health care spending to family income, 11.0% of single-mother families and 2.5% of two-parent families had values in excess unity.

Here, y_{it} represents a proportion, for example OOP/Y, the share of family income allocated to out-of-pocket health care spending by family *i*, in year *t*. Following (3) above, we also apply the model to obtain estimates of OOP/TE, the share of total health care spending borne by the family, and TE/Y, the ratio of total health spending to family income to assess what is driving the change in OOP/Y. Additionally, x_{it} represents a vector of explanatory variables describing family characteristics (some of which will vary over time), a_{it} is a vector of economic shocks *i* in time *t*, and c_i represents a vector of unobserved time-invariant family effects.[5] Variables included in this specification are described below. Following applications of the fractional response model in the CRE framework (Papke and Wooldridge, 2008), we include averages of time-varying variables over our two-year observation period to control for possible correlation between c_i and the explanatory variables, and include time-specific dummy variables and time-invariant explanatory variables in the FRM specification.

We estimate FRM models for single-mother and two-parent families using the *fractreg* procedure in STATA 15, and obtain marginal effects through STATA's *margins* procedure. We apply MEPS longitudinal sampling weights to these estimates, and to account for the non-random design of MEPS, we cluster standard errors at the MEPS primary sampling unit.[6]

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[5] The CRE approach imposes a strong assumption regarding the dependence between the unobserved family effects c_i and the observed explanatory variables x_{it}. Specifically, this dependence is assumed to follows the conditional normal distribution Mundalk (1978) and Chamberlain (1980) where $c_i \sim$ Normal $(\psi + \bar{x}\zeta)$. As we note, $\bar{x}$ represents a vector of values for the time-varying explanatory variables averaged over our two-year observation period to control for possible correlation between c_i and the explanatory variables.

[6] We derived family weights for our two-year panel file using family weights from the full-year MEPS file corresponding to the second year of each longitudinal file and adjusted these weights for our specific sample. We did this by multiplying by the ratio of the sum of family weights in this second-year file to the sum of family weights for families who remained in the two-year panel in the full-year file. We thank Steven Hill of AHRQ for his advice on this weighting issue.

Family and individual characteristics

In our empirical models, we control for various individual and family-level characteristics. These include parents' age, education (for two-parent families the spouse with the highest education), mother's race/ethnicity, whether either parent is in fair/poor health and whether the either parent has a MEPS priority health condition (we include diabetes, asthma, arthritis, chronic heart disease). Additionally, we include the number of children in the family less than age 5, the number of children between ages 5 and 17, the number of children in fair/poor health, and the family's region of residence.

Economic shocks

To assess the impact of changes in economic status over the two-year observation periods, we fit the above models using measures of family income, employment status, and health insurance status in each panel year. With regard to income changes, we include dummy variables indicating categories of family income relative to the federal poverty line (FPL), specifically, whether the family is classified as high income families (400% of the FPL or more), near-poor (between 100% and 125% of the FPL), low income (125% to less than 200% of the FPL), middle income (200% to less than 400% of the FPL), with poor income (less than the FPL) as the reference group.[7] We use differences in predicted average marginal effects between income groups to assess the impact of an economic shock.

[7] Although we measure continuous income inflated to 2012 dollars, we focus on the poverty level measures for two reasons. First these measures capture any non-linearity in the income/out-of-pocket expenditure relationship. Second, movement across these categories over time represents significant income shocks. For example, moving from the income threshold of four times the FPL in 2012 for a family of four to the threshold for three times the FPL represents an income loss of over $30,000 ($92,200 to $69,150). Such a dramatic shift is not likely to be captured using a continuous measure of income. The disadvantage in using the FPL measure is that we can miss some significant changes within FPL classes.

We characterize the family's employment status during each year of the two-year panel with a set of dummy variables. For single-mother families, these variables indicate whether the mother was continuously employed all year (the reference group consists of those not employed all year or those employed only part year) and for two-parent families, we use similar variables for each parent to indicate whether both parents were employed all year (the reference group consists of families in which one parent but not both parents were employed all year or families in which both parents were without employment for the entire year or were only employed part year). Finally, we also account for changes in the family's health insurance status over each year of the two-year panel. We do this with dummy variables indicating whether all family members were insured during the year or whether at least one but not all family members lacked coverage all year (families with all members uninsured are the reference group). In our fractional response models, the derived marginal effects of each set of these economic status dummy variables convey the within-family change in economic circumstances over the two-year panel observation period.

Our models also account for time periods encompassing the Great Recession (December 2006 to June 2009) through the use of several dummy variables indicating the two-year time periods in which families in specific MEPS panels were observed. Families whose two-year observation period occurred during the 2004 - 2006 period were designated with the dummy variable PRE1 and PRE2 indicating that they were in the first or second year MEPS panels in pre-recession period. Those whose two-year observation periods spanned the years 2006 - 2008 were designated with the dummy variables ONSETP1 and ONSETP2 indicating that they were in the first or second year of the recession's onset; those whose two-year observation periods fell primarily in the recession period (2008 - 2010) were designated with the dummy variable REC1

and REC2; while those observed during the 2010 - 2012 post-recession period were designated with dummy variables POST1 and POST2. The difference in the estimated year-specific coefficients and marginal effects (e.g., REC2 – REC1) represents the *within-family change* in outcomes between the first and second years of these time periods. However, the key test for these time period variables is to determine whether the change in outcomes over the two-year onset, recession, and post-recession time periods differs significantly from the change in outcomes over the pre-recession two-year period (e.g., whether (REC2 – REC1) – (PRE2 – PRE1).

IV. Findings

Characteristics of single mother and two-parent families

In Table 1, we present selected characteristics of our single-mother and two-parent families based upon data from individuals in the first year of each MEPS panel. We find that mean and median total health care spending for single-mother families are considerably lower than those for two-parent families, reflecting both differences in family size and in the use of health care services. Similarly, we also find that mean and median out-of-pocket spending for single-parent families to be considerably lower than those for two-parent families. As regards the out-of-pocket burden, we find that the mean burden for single-mother families (6.85% of family income) is more than twice that of two-parent families (2.93%), while by contrast, median family burden is about a third higher for two-parent families (1.34% of family income) compared to single-mother families (1.08%). The difference between mean and median burden reflects the highly skewed nature of the out-of-pocket spending distribution, similar to that observed for total health care spending by each family type.

We also observe that single-mother families are at a significant disadvantage with regard to their economic status. Average family income for single-mother families is just a third (36.2%) of that for two-parent families, reflecting the presence of a working spouse in the latter families (where nearly 90% of fathers are employed). Over two-thirds (69.8%) of single mothers have low incomes or are poor or near-poor compared to only 22.5% of two-parent families. Only 27% of single-mother families are middle income and 11.5% are high income. By contrast, over a third of two-parent families are middle income and 40.9% of these families are high income.

These differences in economic status by family type are also reflected in differences in mother's education and race/ethnicity. We find that half of mothers in two-parent families graduated from college compared to only a fifth of those in single-mother families (51.9% to 19.4%, respectively). Given earnings disparities between whites and other racial/ethnic groups, the differences in economic status between single-mother families and two-parent families may also reflect the significantly higher proportion of white mothers in the latter families.

We also find that single-mother households are less likely to have very young children compared to two-parent families (27.9% compared to 34.9%), and that the health status of children and mothers in single-parent families is inferior to that in two-parent families. On average, the number of children in fair/poor health in single-mother families is nearly three times that in two-parent families (0.11 compared to 0.04), and the likelihood that a mother in a single-mother family will be in fair/poor health in nearly twice that found in two-parent families 22.5% compared to 11.9%). Finally, we find that single-mothers are more likely to have MEPS priority health conditions than married mothers, specifically with regard to diabetes (5.05% compared to 3.05%), asthma (13.45% compared to 8.50%) and arthritis (14.81% compared to 11.30%).

Econometric results: economic shocks and out-of-pocket expenditure burden

In Table 2 we present estimates from the FRM/CRE models of the impact of economic shocks on the within-family change in its out-of-pocket expenditure burden over a two-year period. Results are provided for single-mother and two-parent families. These estimates represent average marginal effects presented both as percentage point and percent changes in the family's out-of-pocket burden in response to changes in family economic status. To obtain the percent change in burden for each economic status and time period category, we compute the ratio of the percentage point change to the first-year measure of burden associated with each category.

Holding the effects of changes in parents' employment and family insurance status constant, we find that income shocks experienced by both single-mother and two-parent families generally result in relatively small but statistically significant percentage point increases in out-of-pocket spending burdens (columns 2 and 4). For example, for single-mother families, a loss of economic status from high-income to lower-income categories (i.e., high income to middle, low, or poor income) yields percentage point increases in out-of-pocket burden of between roughly two and five percentage points . We also find small percentage point increases in out-of-pocket burden for shifts among other income categories, with the most pronounced results from shifts to incomes below the federal poverty line. Finally, we observe similar increases in burden for income losses experienced by two-parent families, with the largest increases in burden for families shifting from high income to poor income (a 7.07 percentage point increase) and from middle income to poor income (a 5.20 percentage point increase).

With regard to health insurance and employment shocks, we also find some evidence that losses of health insurance result in small percentage point increases in burden for two-parent

families. However, we find no effect for single-parent families, and find no impact of employment losses for either family type. Finally, we observe very small percentage point declines in burden across time periods associated with the Great Recession, but no change in burden over each time period compared to the pre-recession period.

In columns 3 and 6, we translate these percentage point changes in out-of-pocket burden into *percent* changes over the two-year observation period. To do so, we use base-year levels of out-of-pocket burden for each of the rows to compute the percentage change (e.g., the mean out-of-pocket burden for families with high income in the first year of the two-year panel). While the percentage point changes reported above are small in terms of their absolute values, they represent substantial percent increases in out-of-pocket burden over the respective baseline levels of burden. For example, shifts from high-income to low-income, near-poor, and poor income status result in percent increases in out-of-pocket burden well in excess of 100% for both single-mother and two-parent families. We also find that shifts among other income categories yield substantial percent increases in burden. Finally, the statistically significant increase in burden for two-parent families experiencing a loss of insurance for all family members yields a 62.8% increase in burden. By contrast, the relatively small percentage point decreases in burden for time periods associated with the Great Recession also translate into comparatively small percent decreases.

What's Driving the Change in Out-of-Pocket Burden?

As noted in equation 3 above, the change in out-of-pocket spending burden will depend upon changes in total health care spending as a share of income and in out-of-pocket health care spending as a share of total health care spending. Using this insight, we estimated FRM models for out-of-pocket spending as a percent of total spending (OOP/TE) and for total health care

spending as a share of income (TE/Y). Estimates revealed no change in OOP/TE in response to economic shocks (results available upon request). As discussed next, TE/Y did respond to economic shocks for both family types. We display these results in Table 3.

As the table reveals, income losses yield increases in TE/Y. For the substantial reductions in income that we measure, the effects are especially strong (well over a 100% increase in columns 3 and 4 for shifts from high income to low, near-poor and poor economic status), and are found for both single and two-parent families. Shifts in income among lower-income strata are generally considerably smaller in magnitude. Additionally, while we find no statistically significant effects of an insurance loss on TE/Y for single-mother families, a loss of insurance for all members or for some members in two-parent families yields statistically significant increases in TE/Y (corresponding to a 40.6% increase and 30.7% increase respectively). Finally, we find some evidence that for two-parent families, the second year of the pre-recession, onset, and Great Recession periods yields very small declines in the share of health care spending as a percent of family income.

We also examined expenditure models for out-of-pocket and total health care spending to assess whether these measures were sensitive to economic shocks and thus were prominent contributors to the change in family out-of-pocket burden. Since nearly all families incurred some out-of-pocket spending (100% of all single-parent families and 95% of two-parent families), we estimate a generalized linear expenditure model (GLM) which takes the following form:

$$E[c_{it}|\, x_{it},\, a_{it}] = \mu = f(x_{it},\, a_{it})$$

Where $E[c_{it}|\, x_{it},\, a_{it}]$ and μ represent mean family expenditures for family i at time t conditional on family characteristics x_{it}, and economic shocks, a_{it}. The GLM model employs a link function

which relates the conditional mean E[c_{it}/ x_{it}, a_{it}] to the vector of explanatory variables, and a logarithmic link is typically used in expenditure studies to address the skewness of the health spending distribution. The GLM model also requires specification of a variance function for the conditional mean, and we applied the modified Park's test to select the variance function. We further applied the Hosmer-Lemeshow test to assess the goodness of fit of the model.[8] On this basis, our estimated expenditure models employ a Poisson variance function, and we use a logarithmic link function as is commonly employed in expenditure estimation to address the skewness of the total and out-of-pocket spending distributions. We further applied the CRE framework to the expenditure models by including average values of the time-varying explanatory variables, thereby obtaining estimates of the within-family change in health care spending over our two-year observation period**.** Finally, we use STATA's *margins* command to obtain average marginal effects: the change in predicted expenditures due to changes in our economic shock variables.

Results for both out-of-pocket spending and total spending outcomes revealed small and generally statistically insignificant within-family changes in these outcomes in response to changes in our income, employment, and health insurance measures (displayed in appendix tables A and B). These findings, along with our lack of findings for out-of-pocket spending as a share of total spending (OOP/TE noted above) and statistically significant increases in total spending as a share of family income (TE/Y) reported in Table 3, suggest that over our short-run observation period, families appear to absorb income shocks and maintain their out-of-pocket

[8] Park's test involves regressing the log of the squared residuals from a designated expenditure function on the predicted values of expenditures. The Hosmer-Lemshow test involves regressing the residuals from the expenditure model on the deciles of predicted expenditures. An insignificant joint-F test of the coefficients indicates that the model fits the data well.

and total health care spending. As a result, the change in out-of-pocket burden in response to economic shocks is largely driven by the decline in family income underlying such changes in economic status rather than changes in out-of-pocket and total spending *per se*.

V. Summary and Conclusion

In this paper, we have considered how the family's out-of-pocket health care spending burden responds to economic shocks, specifically with regard to changes in the family's income, health insurance, and employment status. Our study was motivated by consideration of how the family's health security – in terms of its out-of-pocket spending responsibility in relationship to its income – is affected by changes in its economic status. Our work departs from previous analyses that have considered the magnitude of the family's out-of-pocket spending burden in a static, point-in-time framework and do not differentiate burden estimates by family type. By contrast, our study examines the within-family change in overall spending burden when the family's economic status is compromised and provides estimates for both single-mother and two-parent families. Our use of two-year observation periods from the Medical Expenditure Panel Survey for the period 2004 to 2012 thus provides a more dynamic perspective on the family's welfare as regards its out-of-pocket spending obligation.

To examine the change in out-of-pocket spending burden, we decomposed this metric into two components: the change in out-of-pocket spending as a share of total health care spending and the change in total health care spending as a share of family income. We found no response of the former measure to economic shocks, but found substantive responses of the latter to income shocks for both single-mother and two-parent families. Additionally, as displayed in Appendices A and B, we found little evidence that out-of-pocket or total health care spending responds to economic shocks in either family type, inferring that the change in out-of-pocket

burden is largely driven by the change in family income. Our findings thus reinforce the need for measures that protect families from broad changes in their economic status, especially from those driven by family income changes. Minimizing the consequences of large income shifts can help to ensure that the increased share of income to support out-of-pocket health care spending does not compromise the family's ability to obtain other essential goods and services.

Finally, we note that our study has a specific limitation. Since we can only observe the change in income and out-of-pocket spending burden over a two-year period, we cannot determine whether the changes we observe and estimates obtained are likely to be transitory or more permanent in nature. Additionally, sample size limitations preclude our identifying whether families in particular economic and health-related circumstances are more likely to be subject to economic shocks that substantially change their out-of-pocket burden. A more in-depth understanding of these dimensions of changes in economic status may prove essential in devising more efficient policy interventions that target families most likely to need financial support when they experience an economic shock. Finally, our impact on burden is obtained using fairly large changes in income based on multiples of the federal poverty line. As we note, these changes are of a substantively important magnitude and thus very likely to elicit a change in health care burdens in response to income shifts. However, in using such large income intervals, we may be missing important income changes *within* each of the poverty line intervals. Thus, additional work looking at alternative measures of income status would be useful in assessing whether smaller changes have important implications for family health care burdens.

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Table 1. Descriptive Statistics: Family Characteristics at Baseline: Mean Values (standard errors)		
	Single-Mother Families (N=2993)	Two-Parent Families (N=5967)
Mean family health care spending	5895.40 (296.05)	9190.50 (226.83)
Median family health care spending	2624.08	5021.77
Mean out-of-pocket spending	984.30 (74.82)	1885.95 (45.24)
Median out-of-pocket spending	306.34	1098.04
Mean out-of-pocket burden	6.85% (2.07)	2.93% (0.11)
Median out-of-pocket burden	1.08%	1.34%
Mother's age in years	36.1 (0.22)	38.9 (0.13)
Father's age in years	--	41.1 (0.13)
Family income (2012 dollars)	$33,690 (919)	$93,021(1380)
Percent < 125% FPL	39.6 (1.18)	10.1 (0.48)
Percent 125% to 199% FPL	21.9 (0.99)	12.4 (0.50)
Percent 200% to 399% FPL	27.0 (1.09)	36.4 (0.82)
Percent > 400% FPL	11.5 (1.00)	41.0 (0.93)
Parent's education:		
Percent < high school	15.6 (0.73)	5.50 (0.31)
Percent high school graduate	34.3 (1.15)	19.3 (0.69)
Percent some college	30.9 (1.12)	23.3 (0.77)
Percent college & beyond	19.4 (0.99)	51.9 (1.01)
Percent families with all insured	57.8 (1.22)	75.0 (0.76)
Mother's Race/Ethnicity		
Percent White, non-Hispanic	48.7 (1.41)	71.7 (0.86)
Percent Black, non-Hispanic	30.5 (1.32)	6.2 (0.38)
Percent Hispanic	16.6 (1.01)	14.8 (0.70)
Percent other race/ethnicity	4.2 (0.47)	7.4 (0.42)
Percent with children <= age 4	27.9 (1.08)	34.9 (0.76)
Percent with children > age 5	85.6 (0.88)	86.2 (0.51)
Number of children in fair/poor health	0.11 (0.008)	0.04 (0.003)
Percent of mothers in fair/poor health	22.5 (1.08)	11.9 (0.48)
Percent of mothers with diabetes	47.5 (0.49)	2.93 (0.28)
Percent of mothers with arthritis	14.9 (0.87)	11.2 (0.52)
Percent of mothers with asthma	13.5 (0.83)	8.32 (0.44)
Percent of mothers with chronic heart disease	0.86 (0.21)	0.52 (0.11)
Percent of fathers in fair/poor health	- - - -	12.1 (0.51)
Percent of mothers employed all year	65.6 (1.18)	63.4 (0.75)

Table 1 (continued)	Single-Mother Families (N=2993)	Two-Parent Families (N=5967)
Percent of fathers employed all year	- - - -	89.8 (0.005)
Percent of fathers in fair/poor health	- - - -	12.1 0.51)
Percent of fathers with diabetes	- - - -	4.4 (0.31)
Percent of fathers with arthritis	- - - -	9.9 (0.57)
Percent of fathers with asthma	- - - -	6.1 (0.36)
Percent of fathers with chronic heart disease	- - - -	1.13 (0.16)

Table 2. Within-family change in out-of-pocket health care spending burden (OOP/Y) in single-mother and two-parent families: Percentage point and percent change in response to selected economic shocks.

	Single-mother families (N=2945)		Two-parent families (N=5932)	
Economic Shock	Percentage point change (std.error)	Percent change	Percentage point change (std.error)	Percent change
Income shock: change from				
High income to middle income	1.47** (0.63)	65.0%	1.87*** (0.26)	117.6%
High income to low income	2.51** (0.87)	111.1%	3.20*** (0.33)	201.2%
High income to near-poor income	3.23** (1.06)	133.6%	4.51*** (0.48)	283.6%
High income to poor income	5.02*** (1.03)	222.1%	7.07*** (0.65)	444.7%
Middle income to low income	1.04* (0.59)	37.67%	1.33*** (0.20)	50.6%
Middle income to near-poor income	1.76** (0.82)	63.8%	2.64*** (0.39)	95.3%
Middle income to poor income	3.55*** (0.75)	128.6%	5.20*** (0.53)	100.4%
Low income to near-poor income	0.72 (0.64)	22.5%	1.31*** *0.33)	45.8%
Low income to poor income	2.51*** (0.53)	78.7%	3.87*** (0.46)	74.0%
Near poor to poor income	1.79*** (0.68)	59.3%	2.56*** (0.43)	48.9%
Health insurance shock: change from				
All members insured to no members insured	0.25 (1.04)	6.74%	1.59** (0.68)	62.8%
Some members insured to some members insured	0.11 (0.98)	2.68%	1.35 (0.62)	46.9%
Employment shock: change from				
Parents employed all year to not employed all year	0.60 (0.72)	19.6%	0.54 (0.31)	0.57%
Pre-recession period (PRE2 – PRE1)	-1.00** (0.42)	-4.1%	-0.04 (.012)	-0.15%

Table 2 (continued)				
	Single-mother families (N=2455)		Two-parent families (N=5932)	
Economic Shock	Percentage point change (std.error)	Percent change	Percentage point change (std.error)	Percent change
	Single-mother families		Two-parent families	
Onset of recession (ONSET2-ONSET1)	-1.04*** (0.39)	-4.5%	-0.14 (0.15)	-0.59%
During the recession (REC2-REC1)	-0.85** (0.43)	-3.09%	-0.32*** (0.12)	-1.21%
Post-recession period (POST2 – POST1)	-0.49 (0.56)	-2.1%	-0.30 (0.20)	-1.29%
Two-year change during:				
Onset period vs. pre-recession period	-0.04 (0.56)	0.17%	0.09 (0.19)	0.38%
Recession period vs. pre-recession period	0.15 (0.60)	0.55%	0.27 (0.17)	1.02%
Post-recession period vs. pre-recession period	1.49** (0.72)	6.42%	0.25 (0.24)	1.08%

Source: Authors' estimates from MEPS longitudinal files, 2004–2012. * Statistically significant at $p < 0.10$; ** at $p < 0.05$; *** at $p < 0.01$

Model specifications include the following set of family characteristics: For single-mother families, mother's age and education; mother's race/ethnicity; whether the mother is in fair/poor health; whether the mother has a selected MEPS priority health condition (diabetes, asthma, arthritis, chronic heart disease); the number of children in fair/poor health; number of children < age 5; number of children ages 5–17; and the region in which the family resides. Characteristics of two-parent families include mother's age and race/ethnicity; highest education obtained by a parent; whether a mother or father is in fair/poor health; whether a mother or father has a selected MEPS priority condition; the number of children in fair/poor health; number of children < age 5; number of children ages 5–17; and the region in which the family resides. In both specifications. Economic shocks are based upon changes over our two-year observation period in family income categories defined as a percent of the federal poverty line; in parent's employment status; and in family insurance status. We use differences in predicted average marginal effects between income categories, family insurance status and family employment status to assess the impact of a realized income shock. Dummy variables associated with the Great Recessionindicate whether the family is observed in the first or second year of the pre-recession period (PRE1 or PRE2), onset of the recession (ONSET1 or ONSET2), recession (REC1 or REC2), or post-recession period (POST1 or POST2). Differences in the estimated marginal

effects for these dummy variables are used to assess the change in outcomes of interest between the first and second year of each time period.

Baseline (first year) measures of ***out-of-pocket burden*** (mean total family out-of-pocket health care spending as a percent of family income): ***For single-mother families***: high income (2.26); middle income (2.76); low income (3.19); near poor (3.02); poor income (5.52). In the first year of the pre-recession period (24.3%); first year of the onset period (23.3%); first year of the recessionary period (27.5%); first year of the post-recession period (23.2%); In the first year for all family members insured (3.7%); some but not all family members insured (4.1%); mother employed all year (2.3%). ***For two-parent families***: high income (1.59); middle income (2.63); low income (3.20); near poor (2.86); poor income (5.23). In the first year of the pre-recession period (26.7%); first year of the onset period (23.7%); first year of the recessionary period (26.4%); first year of the post-recession period (23.2%). In the first year for all family members insured (2.5%); some but not all family members insured (2.9%); parents employed all year (2.6%).

Table 3. Within-family change in total health care spending as a share of family income (TE/Y) for single-mother and two-parent families: Percentage point and percent change in response to selected economic shocks.

	Single-mother families (N=2455)		Two-parent families (N=5932)	
Economic Shock	Percentage point change (std.error)	Percent change	Percentage point change (std.error)	Percent change
Income shock: change from				
High income to middle income	4.35** (2.15)	52.0%	4.64*** (0.63)	66.2%
High income to low income	9.42*** (2.63)	110.4%	9.18*** (0.92)	131.0%
High income to near-poor income	11.50*** (2.80)	134.8%	12.17*** (1.15)	181.2%
High income to poor income	19.01*** (2.85)	222.9%	16.87*** (1.29)	240.7%
Middle income to low income	5.07** (1.66)	38.7%	4.54 (0.78)	35.2%
Middle income to near-poor income	7.15*** (1.90)	54.6%	7.52*** (1.03)	58.3%
Middle income to poor income	14.66*** (1.94)	111.9%	12.23*** (1.20)	94.8%
Low income to near-poor income	2.08 (1.46)	11.2%	2.99*** (0.93)	19.8%
Low income to poor income	9.59*** (1.35)	51.7%	7.69*** (1.03)	50.9%
Near poor to poor income	7.53*** (1.56)	31.0%	4.70*** (1.09)	25.3%
Health insurance shock: change from				
All members insured to no members insured	1.65 (3.34)	5.9%	5.80** (2.49)	40.6%
Some members insured to no members insured	1.85 (3.17)	8.3%	4.39* (2.38)	30.7%
Employment shock: change from				
Parents employed all year to not employed all year	1.64 (1.44)	10.0%	0.55 (0.85)	64.5%
Pre-recession period (PRE2 – PRE1)	-1.22 (1.13)	-4.9%	-0.72* (0.41)	-5.4%

Table 3 (continued)	Single-mother families (N=2455)		Two-parent families (N=5932)	
Economic Shock	Percentage point change (std.error)	Percent change	Percentage point change (std.error)	Percent change
Onset of recession (ONSET2-ONSET1)	-1.07 (0.97)	-4.2%	-1.52*** (0.46)	-11.2%
During the recession (REC2-REC1)	-2.02** (1.01)	-8.0%	-1.16** (0.46)	-8.6%
Post-recession period (POST2 – POST1)	-1.69 (1.20)	-6.7%	-0.64 (0.51)	-5.0%
Two-year change during:				
Onset period vs. pre-recession period	0.16 (1.44)	0.65%	-.80 (0.61)	-6.0%
Recession period vs. pre-recession period	-0.79 (1.26)	-3.2%	-0.44 (0.62)	-3.6%
Post-recession period vs. pre-recession period	-1.69 (1.20)	-6.8%	0.08 (0.65)	0.65%

Source: Authors' estimates from MEPS longitudinal files, 2004–2012. * Statistically significant at $p < 0.10$; ** at $p < 0.05$; *** at $p < 0.01$

Model specifications are described in notes to Table 2.

Baseline (first year) measures of ***mean total family health expenditures as a percent of family income***: For single-mother families: high income (8.5%); middle income (13.1%); low income (18.5%); near poor (24.3%); poor income (39.8%). In the first year of the pre-recession period (16.4%); first year of the onset period (25.3%); first year of the recessionary period (25.0%); first year of the post-recession period (25.1%); In the first year for all family members insured (27.9%)a; some but not all family members insured (22.4%); parents employed all year (16.4%). For two-parent families: high income (7.0%); middle income (12.9%); low income (15.1%); near poor (18.6%); poor income (27.2%). In the first year of the pre-recession period (13.4%); first year of the onset period (13.6%); first year of the recessionary period (13.5%); first year of the post-recession period (12.7%). In the first year for all family members insured (13.3%); some but not all family members insured (14.3%); parents employed all year (12.3%).

Appendix A. Within-family change in out-of-pocket family health care spending in single-mother and two-parent families: Percentage point and percent change in response to selected economic shocks.				
	Single-mother families (N=2455)		Two-parent families (N=5932)	
Economic Shock	Change in spending (std.error)	Percent change	Change in spending (std.error)	Percent change
Income shock: change from				
High income to middle income	$79.65 (147.93)	4.64%	$105.26 (141.69)	4.92%
High income to low income	-157.42 (179.52)	-9.16%	-3.38 (157.66)	-0.16%
High income to near-poor income	-1.07 (233.55)	-0.001%	182.85 (199.16)	8.55%
High income to poor income	-270.10 (159.45)	-15.7%	-85.89 (263.77)	-4.02%
Middle income to low income	-237.07 (130.17)	-19.0%	-105.78 (117.84)	-6.17%
Middle income to near-poor income	-80.72 (185.65)	-6.49%	73.58 (171.04)	4.29%
Middle income to poor income	-349.75** (162.85)	-28.0%	-195.15 (240.48)	-11.38%
Low income to near-poor income	156.35 (161.34)	18.57%	179.37 (161.55)	14.52%
Low income to poor income	-112.68 (128.53)	-13.38%	89.37 (230.17)	7.24%
Near poor to poor income	-269.03* (159.45)	-44.0%	-268.73 (253.44)	-33.68%
Health insurance shock: change from				
All members insured to no members insured	403.24 (351.92)	47.27%	386.03 (365.09)	20.67%
Some members insured to no members insured	221.38 (341.01)	27.13%	238.25 (346.75)	23.65%
Employment shock: change from				
Parents employed all year to not employed all year	31.81 (113.36)	40.43%	142.66 (182.16)	8.67%
Pre-recession period (PRE2 – PRE1)	-147.25 (101.22)	-15.22%	-81.69 (70.39)	-4.97%

Appendix A (continued)	Single-mother families (N=2455)		Two-parent families (N=5932)	
Economic Shock	Percentage point change (std.error)	Percent change	Percentage point change (std.error)	Percent change
Onset of recession (ONSET2-ONSET1)	-236.84*** (92.38)	-25.08%	-104.03 (94.63)	-5.97%
During the recession (REC2-REC1)	-194.21** (98.79))	-23.06%	-272.73*** (87.39)	-17.28%
Post-recession period (POST2 – POST1)	-86.15 (125.73)	-13.21%	-158.92 (135.48)	-10.89%
Two-year change during:				
Onset period vs. pre-recession period	-85.58 (134.38)	-8.76%	-22.34 (118.52)	-1.36%
Recession period vs. pre-recession period	-46.96 (143.29)	-4.80%	-191.04* (111.45)	-11.62%-
Post-recession period vs. pre-recession period	61.11 (162.23)	6.25%	-77.23 (153.39)	-4.70%

Source: Authors' estimates from MEPS longitudinal files, 2004–2012. * Statistically significant at $p < 0.10$; ** at $p < 0.05$; *** at $p < 0.01$

Model specifications are described in notes to Table 2.

Baseline (first year) measures of ***mean out-of-pocket family health expenditures***: For single-mother families: high income ($1717.88); middle income ($1249.66); low income ($841.99); near poor ($611.13); poor income ($428.78). In the first year of the pre-recession period ($967.57); first year of the onset period ($944.18); first year of the recessionary period ($842.04); first year of the post-recession period ($652.18). In the first year for all family members insured ($853.14); some but not all family members insured ($816.14); parents employed all year ($944.40). For two-parent families: high income ($2131.91); middle income ($1714.60); low income ($1234.92); near poor ($797.89); poor income ($721.32). In the first year of the pre-recession period ($967.57); first year of the onset period ($944.18); first year of the recessionary period ($842.04); first year of the post-recession period ($652.18). In the first year for all family members insured ($853.14); some but not all family members insured ($816.11); parents employed all year ($944.40).

Appendix B. Within-family change in total family health care spending in single-mother and two-parent families: Percentage point and percent change in response to selected economic shocks.				
	Single-mother families (N=2455)		Two-parent families (N=5932)	
Economic Shock	Change in spending (std.error)	Percent change	Change in spending (std.error)	Percent change
Income shock: change from				
High income to middle income	$1064.48 (1084.83)	15.25%	-$206.32 (505.86)	-2.21%
High income to low income	1115.65 (1203.03)	16.0%	312.54 (836.18)	3.35%
High income to near-poor income	977.07 (1381.25)	14.28%	119.30 (2454.71)	1.28%
High income to poor income	2438.47 (1511.89)	34.93%	1346.68 (1729.09)	14.45%
Middle income to low income	51.17 (528.49)	0.85%	518.86 (768.50)	5.81%
Middle income to near-poor income	-87.41 (775.35)	-1.46%	325.61 (2455.71)	3.64%
Middle income to poor income	1374.00 (849.06)	22.88%	1140.36 (1653.96)	12.76%
Low income to near-poor income	-138.58 (643.55)	-2.31%	-193.25 (2406.28)	-2.91%
Low income to poor income	1322.82** (663.86))	22.01%	1659.23 (1788.17)	24.98%
Near poor to poor income	1461.40* (775.88)	25.49%	1465.98 (3694.99)	20.75%
Health insurance shock: change from				
All members insured to no members insured	-716.32 (1219.70)	-10.37%	-6890.71*** (2551.19)	-70.29%
Some members insured to no members insured	-63.61 (1158.80)	-1.19%	-7654.24*** (2426.62)	
Employment shock: change from				
Parents employed all year to not employed all year	398.67 (738.83)	7.71%	-1114.70 (1126.09)	-13.59%
Pre-recession period (PRE2 – PRE1)	-887.61** (394.43)	-14.90%	-1271.26** (541.16)	-14.70%

Appendix B (continued)	Single-mother families (N=2455)		Two-parent families (N=5932)	
Economic Shock	Change in spending (std.error)	Percent change	Change in spending (std.error)	Percent change
Onset of recession (ONSET2-ONSET1)	-22.38 (471.74)	-0.34%	-1570.68 (668.76)	-18.44%
During the recession (REC2-REC1)	438.88 (951.78)	7.15%	-901.22 (405.22)	-11.31%
Post-recession period (POST2 – POST1)	-830.55 (565.93)	-14.58%	-511.21 (487.85)	-6.61%
Two-year change during:				
Onset period vs. pre-recession period	-1351.33** (617.70)	-22.70%	-299.42 (886.98)	-3.49%
Recession period vs. pre-recession period	1326.50 (1048.77)	22.29%	370.04 (669.66)	4.32%
Post-recession period vs. pre-recession period	57.07 (691.24)	0.96%	760.05 (724.74	8.87%

Source: Authors' estimates from MEPS longitudinal files, 2004–2012. * Statistically significant at $p < 0.10$; ** at $p < 0.05$; *** at $p < 0.01$

Model specifications are described in notes to Table 2.

Baseline (first year) measures of mean total family total health care spending as a percent of family income: For single-mother families: high income ($6861.56); middle income ($6005.61); low income ($6009.14); near poor ($5734.26); poor income($6193.06). In the first year of the pre-recession period ($5957.27); first year of the onset period ($6545.66); first year of the recessionary period ($6318.87); first year of the post-recession period ($5696.32); In the first year for all family members insured ($6907.71); some but not all family members insured ($5353.81); mother employed all year ($5169.99). For two-parent families: high income ($9320.11); middle income ($8937.09); low income ($6642.33); near poor ($7065.14); poor income ($5832.11). In the first year of the pre-recession period ($8645.11); first year of the onset period ($8517.69); first year of the recessionary period ($7969.08); first year of the post-recession period ($7733.34). In the first year for all family members insured ($9803.83); some but not all family members insured ($5542.45); parents employed all year ($8200.37).