The Design of Deductibles in Family Health Insurance Plans

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Abstract

Health insurance plans often bundle multiple household members into a single family contract. How should cost sharing be allocated across family members? We study this in the context of deductibles, which can be aggregated across family members or applied to each member separately. We document that most employer-sponsored plans offer aggregate deductibles, while exchange plans offer a form of per-person deductibles. A model calibrated using claims data finds that aggregate deductibles provide better risk protection, but per-person deductibles are more effective against moral hazard. Overall, per-person deductibles generate around $50-$150 in annual welfare gain to families.

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1 Introduction

Health insurance contracts in the United States frequently cover multiple family members. Roughly half of privately insured households, and over 70 percent of households with multiple adults and children, are covered under a family contract. Such a contract must specify not only the amount of premiums and cost sharing families face, but how that cost sharing is allocated across the family members it covers, such as whether spending counts toward a common threshold or member-specific thresholds. However, this latter design choice is largely unexplored. A large body of work characterizes the level and timing of cost sharing in considerable detail (e.g., Manning et al., 1987; Aron-Dine et al., 2015; Brot-Goldberg et al., 2017), but does so almost entirely for individual coverage. Where families do enter the literature, it is typically as the unit making a plan choice (e.g., Handel, 2013) or as a mechanism for selection (Sinaiko et al., 2017; Nguyen, 2022), rather than as a group facing an interdependent cost-sharing schedule. This paper studies the nature and welfare consequences of how cost sharing is allocated across members, focusing on the structure of deductibles in particular.

We begin by documenting four facts about family health plans that warrant further attention to the structure of deductibles in family plans. First, family contracts are widespread and often cover many people: about half of privately insured households hold one, rising to over 70 percent among households with multiple adults and children, and more than a quarter of family plans cover four or more individuals. Second, the way cost sharing is allocated within these contracts varies sharply across markets. Among employer-sponsored plans, 64% use an aggregate deductible that applies to the family's combined spending, with a median of $3,600. On the federal exchange, by contrast, 93% of family plans use an embedded structure, pairing a median per-person deductible of $3,000 with a median family threshold of $6,500. Third, we provide suggestive evidence that family deductibles do not vary with family size, but instead are typically two (or sometimes three) times the size of the analogous per-person deductible. Finally, we show that health spending is only weakly correlated within families: pairwise correlations in annual expenditure ventiles across household members range from 0.12 to 0.19.

To quantify the welfare impacts of these design choices, we develop and calibrate a model of family health insurance in which households face health risk and choose medical and non-medical consumption under alternative deductible structures. The model nests uniform aggregate family deductibles, under which total family spending counts toward a common threshold and does not vary with the number of family members, an aggregate family deductible that can vary with family size, and per-person deductibles, under which each covered member faces an individual threshold. Insurers set deductibles subject to a zero-profit condition, and household welfare depends on both risk protection and the behavioral consequences of cost sharing.

The aggregation of deductibles in family plans can matter for several reasons. First, while aggregate deductibles are larger in size than per-person deductibles, they provide better risk protection because the variance of out-of-pocket costs is lower with aggregate deductibles than per-person deductibles (Keeler et al., 1977). Second, aggregation across individuals can interact with (ex-post) moral hazard. Under aggregate deductibles, the marginal price of health care drops for *all* family members once the aggregate deductible is reached, while under per-person deductibles the marginal price only drops for the family members who have reached their own deductible. On the other hand, per-person deductibles are smaller in size than aggregate deductibles, which could lead to more moral hazard as it is easier to reach one's deductible. Finally, if deductibles are uniform across family sizes, per-person deductibles are no longer a *mean*-preserving spread because there can be redistribution between differently-sized families, which distorts the relative risk protection and moral hazard values of the two types of deductibles. These three mechanisms pull in different directions, and thus the ultimate welfare gain of per-person deductibles is an empirical question.

We calibrate the model using administrative health claims and compare per-person and aggregate deductibles in environments with and without moral hazard, and under deductibles that can and cannot vary with family size. The analysis delivers two main results. First, when only considering risk protection (i.e., no moral hazard) and deductibles are specific to family size, families are willing to pay $278 for an aggregate deductible over a per-person deductible, because aggregate deductibles better insure against the case in

which every family member has a large health shock. Second, this result reverses once we introduce moral hazard: per-person deductibles then generate an average welfare gain of $140 relative to aggregate deductibles. The same reversal appears when deductibles are constrained to be uniform across family sizes: willingness to pay for the aggregate plan is $281 without moral hazard, while with moral hazard per-person deductibles generate a welfare gain of $49. Overall, while aggregate deductibles offer better risk protection, per-person deductibles can increase welfare when moral hazard is present.

This paper builds on a literature about how insurance contracts should treat multiple risks. A classic result in this literature is that, absent incentive problems, a risk-averse buyer prefers a single deductible on aggregate losses to separate deductibles on each loss (Arrow, 1963; Gollier and Schlesinger, 1995). Keeler et al. (1977) apply this logic to families, showing that out-of-pocket spending is less variable under an aggregate deductible that applies to all family members than under per-person deductibles. Building on these ideas, some work has studied the implications for adverse selection and moral hazard. Fluet and Pannequin (1997) and Crocker and Snow (2011) explore theoretical effects of "bundling" risks, while Nguyen (2022) and Solomon (2024) study empirically how bundling shapes selection in health and long-term care insurance, respectively. Cohen (2006) and Klosin and Solomon (2024) study optimal contract "scope" under ex-ante moral hazard both theoretically and empirically (for automobile and crop insurance, respectively), and Hong and Mommaerts (2024) study the impact of ex-post moral hazard on the scope of health insurance contracts over time. We study analogous ex-post moral hazard forces, but across individuals rather than over time.

We also contribute to the broader literature that studies cost sharing and moral hazard in health insurance, beginning with the RAND Health Insurance Experiment and continuing through more recent work on nonlinear, dynamic incentives in deductible contracts (Manning et al., 1987; Aron-Dine et al., 2015). This literature has focused primarily on the level and timing of cost sharing; we contribute to this literature by focusing on the consequences of aggregability of deductibles within family plans for moral hazard and welfare.

The findings from this paper also have implications for policy. Health insurance de-

ductibles are large and growing, particularly aggregate deductibles. For example, 31% of aggregate deductibles in employer-based high-deductible health plans were $6,000 or more in 2025 (Kaiser Family Foundation, 2025). As a result, there is growing policy discussion about the affordability of such deductible policies, which has resulted in regulations directly related to deductible design in family plans. For example, a 2016 regulation limits the ability of most plans to offer aggregate out-of-pocket maxima, which effectively limits their ability to offer aggregate deductibles. Another regulation, which actually pushes in the other direction, prohibits high-deductible (family) health plans from paying out benefits until a minimum *family* (i.e., aggregate) deductible is met. Understanding the trade-offs and impacts of different deductible structures can thus provide important evidence for policymakers in what is an active policy space.

Our analysis points to several avenues for further research. One is how different cost-sharing structures across family members affect selection into different health insurance plans. While the current model could not do this justice since families are homogeneous (conditional on size), a model that builds in more heterogeneity to health profiles could make headway on this issue. It would also be interesting to explore other cost-sharing structures, such as out-of-pocket maxima, or allowing child- or adult-specific deductibles within family plans. Finally, given the large (and growing) size of deductibles in family plans, particularly aggregate deductibles, understanding the liquidity implications of these policies is an important next step, and one that likely requires a dynamic model in the spirit of Hong and Mommaerts (2024).

The paper proceeds with a documentation of features of family health plans and the nature of family health risk in Section 2. Section 3 develops a model of family health insurance choice and Section 4 describes the calibration and presents results. Section 5 concludes.

2 Facts about family health plans and family health spending

In the US, most private health plans offer both individual plans and family plans.[1] Family plans typically offer coverage for both a primary individual (e.g., an employee at a firm that offers insurance) as well as the individual's spouse and children. In this section, we explore the features of these plans, and also the health features of the families insured by these plans.

2.1 Most families enroll in family plans

We begin by showing that most multi-person families enroll in family plans. To do this, we use the 2021 wave of the Medical Expenditure Panel Survey's (MEPS) Household Component, which asks households about health, health care usage and cost, health insurance coverage, and demographics. We restrict attention to private insurance plans that cover hospitalizations. This excludes public coverage such as Medicare, Medicaid, and TRICARE, but includes exchange-based coverage. It also excludes standalone dental, vision, Medigap, and prescription-only plans. We characterize households by the number of adults (age 26 and older) and children (age 25 and younger) in a family in a dwelling, where 26 is the cutoff for the Affordable Care Act's (ACA) dependent coverage provision.[2]

Table 1 reports, at the household level, the frequency of family plans, individual plans, and "mixed" plans (which correspond to households that have both a family plan for some household members and an individual plan for other household members), as well as their average premiums and whether the plan includes a deductible. Panel A shows that around half of all households insured by a private plan are covered under a family plan, but for larger families family plans are much more prevalent (e.g., over 70% of

[1] In contrast to private health plans, most public health insurance programs like Medicare and Medicaid only offer individual plans.

[2] A family in MEPS is defined as persons living together related by blood, marriage, or adoption, plus unmarried partners who consider themselves in the family unit, plus college students living away at school. For households that only contain individuals age 25 and under, we re-categorize them as adults.

households with multiple adults plus children).[3] Panel B reports that median premiums are around $3,000 for family plans and $1,200 for individual plans, or half to one-third the size of family plan premiums. Panel C shows that over 80% of plans, regardless of type, include an annual deductible.

Table 1: Characteristics of family plans and individual plans, MEPS data

	Family	Individual	Mixed	N
Panel A. Plan type (% of households)				
All households	48.9	41.7	9.4	7,367
One adult, no kids	22.9	75.8	1.3	3,168
One adult with kids	59.7	29.2	11.1	569
Multi-adult, no kids	51.3	39.4	9.2	1,972
Multi-adult with kids	71.2	11.3	17.5	1,658
Panel B. Median employee-paid premium ($)				
All households	3,059	1,200	4,082	7,367
One adult, no kids	2,400	1,008	2,400	3,168
One adult with kids	2,040	1,176	3,828	569
Multi-adult, no kids	3,000	1,638	3,180	1,972
Multi-adult with kids	3,600	1,308	4,272	1,658
Panel C. Any annual deductible (% of households)				
All households	83.3	82.0	91.4	7,367
One adult, no kids	84.6	81.8	86.0	3,168
One adult with kids	81.3	89.3	96.8	569
Multi-adult, no kids	81.0	82.3	85.7	1,972
Multi-adult with kids	84.8	77.4	93.0	1,658

Notes: Data from the 2021 MEPS Household Component. Sample is households with private insurance plans that cover hospitalizations; a household is defined as the number of adults 26+ and children under 26 in a family in a dwelling. The "mixed" column corresponds to households that have both a family plan for some household members and an individual plan for others. Statistics are weighted by family weights, defined as the largest person weight in the household.

There are a few caveats to this analysis. The first is that the survey definition of "family" does not necessarily map to a health insurance plan's definition of family: for example, unmarried partners can be considered a family in the survey, but not all health plans offer domestic partner coverage. This miscategorization of families will result in more

[3] Appendix Table 1 shows that over a quarter of households with family plans cover four or more individuals.

"families" with mixed coverage. The second, related, caveat is that the survey structure only allows us to observe family members who reside in the surveyed dwelling. The implication of this is that we are likely undercounting the number of individuals in a particular family plan, because we do not always observe all individuals on a family plan, only the subset that resides in the dwelling.[4] A final caveat is that employers sometimes offer a more limited "employee plus one" health insurance plan. This type of plan is grouped in with family plans in the data used in Table 1.[5] However, while such plans limit the number of family members allowed on a plan, the core deductible design questions remain.

2.2 Most employer-sponsored family plans offer aggregate deductibles; exchange family plans do not

We next characterize deductibles in family plans and individual plans. Before doing so, however, we define the different structures that deductibles can take within family plans. First, an *aggregate* deductible is one that applies to the family as a whole. Under a plan with an aggregate deductible, there is no limit to the amount one family member may contribute to the deductible and once the deductible is met, the whole family moves on to the next cost-sharing region (typically a coinsurance region or full coverage). A *per-person* deductible, in contrast, applies separately to each family member. Once one family member's deductible is met, that family member moves on to the next cost-sharing region, but that has no bearing on other family members: they still must reach their own deductible before moving to the next cost-sharing region. Finally, an *embedded* deductible includes both a per-person deductible and an aggregate deductible, such that any one individual can meet their per-person deductible, but in addition the entire family can reach the aggregate deductible if, depending on how it is structured, either (a) the family's total

[4] This is most evident from the number of households categorized as "One adult, no kids", which, if that was truly the whole family, should not be enrolled in family plans; in reality, there are likely other family members that reside in different dwellings.

[5] Appendix Table 2 reports published statistics from the (restricted) MEPS Insurance Component, to give a sense of how common such plans are. The sample is private sector employees enrolled in their employers' health insurance plans, and the statistics show that, of employees enrolled in family or employee-plus-one plans, 58% are enrolled in family plans.

under-deductible spending reaches a particular threshold (i.e., the aggregate deductible amount), or (b) a specified number of individuals have met their per-person deductible (i.e., a fixed number of members rule).[6]

We tabulate the prevalence of each type of deductible structure separately for employer-sponsored plans and federal exchange plans. For employer-sponsored plans, we use data from the 2023 Kaiser Family Foundation (KFF) Employer Health Benefits Survey, which asks employers detailed questions about health coverage, including premiums and cost sharing among other things. We restrict our sample to the 80% of firms that offer health insurance and drop the 17 employers that do not offer family plans, for a total of 1,697 employers from which we select the largest plan of each offered plan type (HMO, PPO, HDHP, etc.) for a total of 2,339 plans.[7] Note that this is an employer-level survey, in contrast to the household-level survey above, and thus describes employer *offerings* rather than household enrollment. For the federal exchange plans, we use the CMS Plan Attributes Public Use File for plan year 2016, excluding catastrophic and dental-only plans as well as non-standard CSR variants. Note that this data also excludes plans from fully state-run exchanges.

Panel A of Table 2 reports the prevalence of deductible structures in employer-sponsored family plans, specifically for a family of four. 64% of family plan deductibles are aggregate deductibles, while 23% are embedded. Virtually no plans have per-person only deductibles, and 12% have no deductible. For plans with aggregate deductibles, the median aggregate deductible is $3,600, while embedded deductibles have a median per-person deductible of $2,000 and, for the type of embedded deductible in which a fixed number of family members must hit their deductible before the aggregate deductible is satisfied, the median number of family members is two. One nice feature of this data is that we can compare the deductibles of family plans to the corresponding single plan offered by the same company. For aggregate deductibles, the single deductible is $1,750 (slightly less than half the size of the aggregate deductible), while for embedded deductibles with

[6]Note that for a two-person family, an embedded deductible with a family threshold of twice the individual amount is identical to a per-person deductible.

[7]In our sample, 44% of the plans are PPO plans, 28% are HDHP plans, 14% are POS plans, and 13% are HMO/EPO plans.

a fixed number of members needed to satisfy the aggregate deductible, the single deductible is $1,900 (slightly less than the per-person deductible).

Table 2: Deductible structures of employer-sponsored and exchange family plans

	% of plans	Median deductible			# of plans
		Family	Per-person	Single	
Panel A. Employer-sponsored plans (KFF data)					
Aggregate	63.6	3,600	–	1,750	1,487
Embedded	22.9			1,567	536
Fixed # members	8.2	4,000[a]	2,000	1,900	191
Family threshold	14.7	n.c.	2,000	1,500	345
Per-person only	1.1	–	3,000	2,250	25
Separate, other structure	0.3	–	3,500	3,000	6
No deductible	12.2	–	–	0	285
Panel B. Federal exchange plans (CMS PUF data)					
Aggregate	6.6	4,000	–	2,000	706
Embedded	92.9	6,500	3,000	3,000	10,003
Per-person only	0.3	–	3,200	3,200	36
No deductible	0.2	–	–	–	26

Notes: Data for Panel A is the 2023 KFF Employer Health Benefits Survey, which asks about family plans for a family of four. Sample is the largest plan of each offered plan type (HMO, PPO, POS, HDHP) among firms that offer family coverage. For embedded and per-person plans, the survey collects only the per-person amount; the family-level threshold in *'Family threshold'* embedded plans is not collected (n.c.). [a]The reported family deductible for *'Fixed # members'* plans is the amount implied by the required number of members times the per-person amount, calculated as the median number of members required to meet their deductible (2) times the median per-person deductible. 'Single' is the deductible for employee-only coverage in the same plan. Data for Panel B is the CMS Plan Attributes Public Use File, plan year 2016. Sample is medical (non-dental) plans, standard metal tiers, and standard CSR variants only. 'Single' is the deductible for individual-only coverage in the same plan.

Panel B reports analogous statistics for family plans offered on the federal exchange. In contrast to employer-sponsored plan deductibles, embedded deductibles dominate federal exchange plans: 93% of family plans are embedded, with a median per-person deductible of $3,000 and a median family deductible of $6,500.[8] In these plans, the median corresponding single plan deductible is also $3,000.

It is worth noting two federal regulations that limit the choice of structure of family deductibles. The first is an Internal Revenue Service rule that applies to high-deductible

[8]Unfortunately, this data does not report the type of embedded deductible (e.g., whether a fixed number of per-person deductibles must be met or a spending threshold).

health plans (HDHPs) that are paired with a tax-advantaged health savings account (HSA). Such plans must not pay benefits until the family's combined spending reaches a statutory minimum (e.g., $3,000 in 2023 for family coverage), regardless of which members incurred it.[9] Thus HSA-qualified family plans must either use an aggregate deductible or set per-person deductibles at or above the family minimum. The second is an ACA provision that, as of 2016, caps annual *individual* out-of-pocket spending, even under family coverage (e.g., $9,100 in 2023).[10] While this applies to out-of-pocket maximum spending, not deductibles, it limits the ability to offer aggregate deductibles above the individual cap.

Overall, this section shows that both aggregate deductibles and embedded deductibles are common in family plans, though their prevalence differs substantially by whether the plan is an employer-sponsored plan or a non-group plan offered on the federal exchange.

2.3 Family deductibles do not vary with family size

We next explore the extent to which family deductibles (i.e., the aggregate deductible, or family deductible in embedded deductibles) vary with the number of members in the family plan. In other words, are family deductibles with four members twice the size of family deductibles with two members?

The available data does not allow us to examine this directly, but several pieces of evidence suggest that family deductibles typically do *not* vary with family size. First, the KFF data on employer-sponsored plans does not directly ask how family deductibles differ by the size of the family because the survey question explicitly asks about plans for a family of four. However, the average family deductible for a family of four ($3,600) is about twice the size of the single deductible in an individual plan ($1,750) rather than four times the size of the single deductible, suggesting that aggregate deductibles do not scale at least one-for-one with family size. This is similarly the case for embedded deductibles: for a family of four, the family deductible is twice the size of the per-person deductible

[9] 26 U.S.C. §223(c)(2); IRS Notice 2004-2.

[10] HHS Notice of Benefit and Payment Parameters for 2016, 80 Fed. Reg. 10750 (2015); FAQs About Affordable Care Act Implementation Part XXVII (2015).

for plans whose family deductible is a fixed number of members.

Consistent with this, the National Compensation Survey collects health plan provisions from employer plans, and while the survey documents dimensions along which deductibles can vary (e.g., network tier, salary range), family size is not one of them. A 2004 report from the Bureau of Labor Statistics, which runs the survey, describes family deductibles as "most commonly 2 or 3 times greater than individual deductible amounts" (Baker, 2004).

Finally, for plans on the federal exchange, the template provided for insurers to report their cost-sharing structure only allows one per-person and one per-family deductible for each family plan. This is again suggestive that family deductibles do not differ by characteristics like family size.[11] Moreover, per HealthCare.gov guidelines, the absolute maximum out-of-pocket limit a family plan can have in 2025 is $18,400 (compared to $9,200 for an individual plan). While this does not preclude scaling deductibles by family size, the fact that a family plan's maximum out-of-pocket limit is only twice that of an individual plan's limit (and thus out-of-pocket limits do not scale) suggests that family deductibles also likely do not scale.

2.4 Health spending is not strongly correlated within families

The data patterns described above show that deductibles in family plans can be designed very differently. The extent to which that matters, though, will depend on the relationship between family members in their health care use. In this section, we characterize the distribution of annual health care spending within families. To do this, we use administrative health care claims from the 2013 Truven MarketScan Commercial Claims and Encounters database, a large collection of claims from employer-sponsored plans that cover workers and their dependents across roughly 350 insurers nationwide.[12] Our sample comprises approximately one million families that consist of two spouses aged 30 to 50 and zero or one dependent children, who are all continuously enrolled in a family plan

[11] See, for example, https://www.qhpcertification.cms.gov/s/PY2025QHPIssuerInstructions_v1.2.pdf.

[12] Access to these data was obtained through an agreement with the National Bureau of Economic Research.

throughout 2013 but not one with any capitated payments (to ensure we observe all health spending).[13] Total annual health care spending is calculated based on service dates and is defined as the sum of expenditures paid by the insurer and paid out-of-pocket (including deductibles, coinsurance, and copayments) across inpatient, outpatient, and outpatient pharmaceutical claims, and is inflation-adjusted and expressed in 2025 dollars (see Appendix Table 3 for summary statistics on health spending).

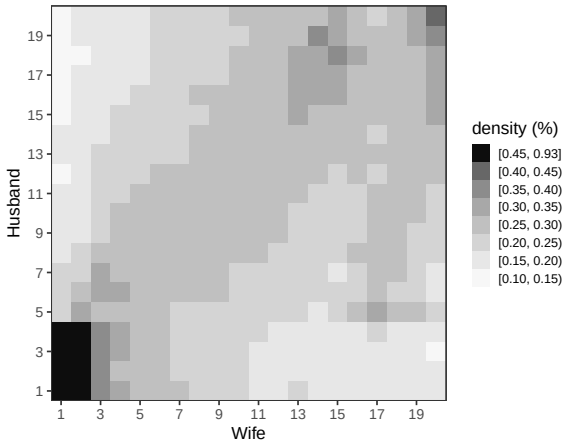
To visualize the correlation in health spending between types of family members, Figure 1 presents pairwise heatmaps of annual health expenditure (using family member type ventiles) for different pairs of family members, with darker shading indicating a higher density of observations. Across all four panels, there is a lot of mass in the bottom-left corner, reflecting the high prevalence of families in which all members jointly experience low health spending. Aside from that area, however, the mass along the diagonals is only slightly higher than uniformly distributed (e.g., around 6% along the diagonal and 17.5% on the diagonal plus one adjacent relative to 5% and 14.5% from a uniform distribution, respectively). Overall, the pairwise correlations between ventiles range from 0.13 to 0.19. Thus, while there is certainly a positive correlation between household members, this correlation is not very strong (a finding mirrored in Sinaiko et al. (2017)).

Overall, this section shows the importance of family plans, and that within family plans, deductibles are sometimes aggregate and sometimes per-person, and likely do not scale. It also showed that health spending is not highly correlated across family members. We next turn to a model of deductible design in family plans to understand the trade-offs between these two deductible structures.

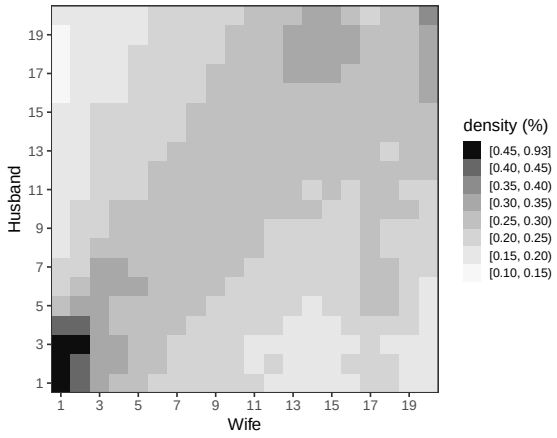
[13] See Appendix Figure 1 for the distribution of family plans by family type. In future drafts we plan to expand the sample to additional family types.

Figure 1: Health expenditure joint distributions across family members

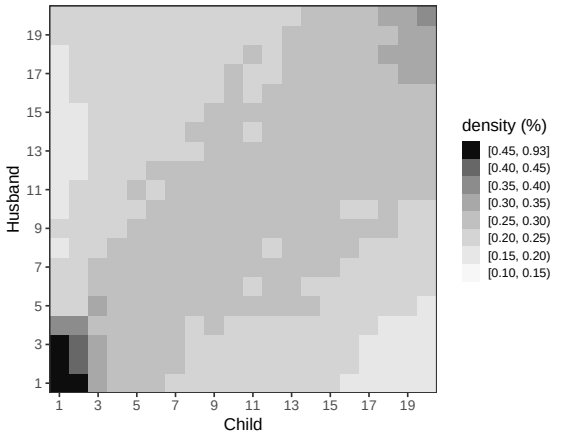
(a) Husband and wife in 2-person family



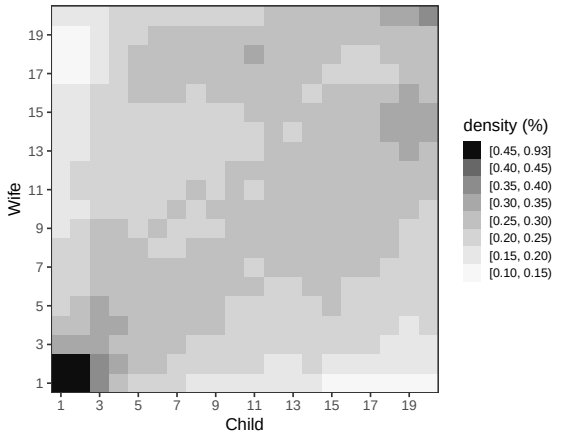
(b) Husband and wife in 3-person family



(c) Husband and child in 3-person family



(d) Wife and child in 3-person family



Notes: Figure shows the pairwise joint distributions of health expenditures across family members, characterized by 20 quantiles of health expenditures for each type of family member. Darker shading denotes higher density. Data from the 2013 Truven MarketScan Commercial Claims and Encounters database. Sample is families continuously enrolled in a non-capitated family plan throughout 2013, including husband-wife only families (panel a), and husband-wife-child families (panels b-d).

3 Model

To study the implications of different deductible structures in family plans, we develop a static model of risk-averse families whose individuals face health expenditure risk and choose medical and non-medical consumption subject to a health insurance plan that mitigates this risk. Families differ in size, and insurance plans feature deductibles to combat moral hazard.

We begin with a simplified model with binary shocks, and characterize the roles of risk protection, moral hazard, and uniformity across family sizes by gradually introducing each feature. We then turn to the full model, which we calibrate to quantify the value of different deductible structures.

3.1 Simple model with binary shocks

Consider a risk-averse family with two members, a husband and wife, both of whom are subject to a binary health shock L with probability π, such that there are four health states, $(0,0)$, $(L,0)$, $(0,L)$, and (L,L), with the husband's shock listed first. We evaluate two different policies that insure against the risk of incurring these shocks, both of which are actuarially fair and include a deductible. The first is a *per-person* deductible policy with a deductible D^P that applies separately to each spouse's spending. The second is an *aggregate* deductible policy with a deductible D^A that applies to the family's combined spending. We assume L is greater than both deductibles.

Actuarial fairness implies that both policies generate the same expected insurer payout, $2\pi(1-\pi)(L-D^P)+\pi^2(2L-2D^P)$ under the per-person deductible policy and $2\pi(1-\pi)(L-D^A)+\pi^2(2L-D^A)$ under the aggregate deductible policy. Setting these equal gives the relationship between the two deductibles of:

$$D^P \;=\; \frac{2-\pi}{2}\,D^A \tag{1}$$

This equation shows that the per-person deductible is smaller than the aggregate deductible. This is because each spouse who incurs a health shock L triggers a per-person

deductible, but only one aggregate deductible is triggered regardless of the number of spouses who incur a health shock, so actuarial equivalence requires a lower threshold for the per-person deductible. Moreover, the per-person deductible is more than half as large because if $D^P = \frac{1}{2}D^A$, the per-person policy would pay out too much in the two states in which exactly one spouse is sick. Panel A of Table 3 reports out-of-pocket spending across the four states, and shows that families pay less with per-person deductibles when exactly one spouse is sick ($D^P < D^A$), but more in the worst-case state in which both are sick ($2D^P > D^A$).

Table 3: Out-of-pocket spending and over-consumption by health state, simple model

	Health state		
	Neither sick	One sick	Both sick
Probability	$(1-\pi)^2$	$2\pi(1-\pi)$	π^2
Panel A. Out-of-pocket cost			
Per-person deductible	0	D^P	$2D^P$
Aggregate deductible	0	D^A	D^A
Panel B. Over-consumption under moral hazard			
Per-person deductible	0	ω	2ω
Aggregate deductible	0	2ω	2ω

Notes: Panel A reports the family's total out-of-pocket expense in each health state under the per-person deductible policy and the aggregate deductible policy, where each spouse is either healthy (with zero loss) or sick (with loss L) and $D^P, D^A < L$. Panel B reports the additional medical consumption generated by moral hazard under the two deductible policies.

This simple model implies that risk-averse families (who pool their resources and health expenditures based on an aggregate budget) weakly prefer the aggregate deductible policy. To see this, note that out-of-pocket spending conditional on at least one spouse being sick is a lottery over $\{D^P, 2D^P\}$ under the per-person deductible policy, but a certain D^A under the aggregate deductible policy. Given that both policies have the same expected out-of-pocket cost, the per-person deductible policy is a mean-preserving spread of out-of-pocket costs. It then follows from Jensen's inequality that risk averse families prefer the aggregate deductible policy because it provides better risk protection.[14]

[14]This base model and its implications are very reminiscent of the simple model in Hong and Mommaerts

3.2 The role of moral hazard

The simple model in Section 3.1 assumes no behavioral response to the deductible contracts, meaning health consumption is purely their health shock of 0 or L. Under that assumption of no moral hazard, the aggregate deductible policy weakly dominates for every risk-averse family. We now show that introducing moral hazard generates a trade-off: aggregate deductibles deliver better risk protection, but per-person deductibles generate less wasteful health consumption from moral hazard (at least in this simple model).

We add moral hazard to this simple model by assuming that individuals over-consume medical consumption by an amount ω once their out-of-pocket cost of doing so is zero (see the full model in Section 3.4 for details of the model that generates this behavior). Panel B of Table 3 shows how the amount of over-consumption differs across deductible structures. Under a per-person deductible, each family member's marginal price depends only on her own spending, so a healthy spouse (who has not crossed her own deductible and thus whose marginal price of health consumption is the full price) does not over-consume, regardless of her partner's spending. In contrast, under an aggregate deductible the marginal price drops to zero for *everyone* once the deductible D^A is reached. This implies that when one spouse is sick, the healthy spouse also faces a zero price and consumes ω despite having no health need. Overall, this means that aggregate deductibles generate more moral hazard than per-person deductibles in this simple model.

We assume this additional discretionary care is funded by adjusting the deductible (rather than premiums) to maintain actuarial fairness. Because the two policies fund different amounts of discretionary care, the deductible relationship is now:

$$D^P = \frac{2-\pi}{2} D^A - \omega(1-\pi). \tag{2}$$

The per-person deductible is now much lower than the aggregate deductible, relative to the no-moral-hazard benchmark. This is because the aggregate deductible generates

(2024), which studies a dynamic model of an individual insurance policy with deductibles that span either one or two periods instead of a static model of a family insurance policy with deductibles that 'span' either one family member or two family members.

more health consumption, which must be paid for with larger deductibles. As a result, expected out-of-pocket spending is lower in the per-person deductible (by $2\pi(1-\pi)\omega$). This is the efficiency advantage of per-person deductibles.

This efficiency advantage induces a trade-off for welfare. Aggregate deductibles provide better risk protection, which risk averse families value (as shown in Section 3.1), but aggregate deductibles also generate more moral hazard. Because this over-consumption is not valued at above their cost ex-ante, it is negatively valued by families. Thus, the overall gains of an aggregate deductible policy relative to a per-person deductible policy depend on the extent of moral hazard and the value of risk protection.[15]

3.3 The role of family size

Another characteristic of family plans that may matter for deductible design is that plan features often do not scale with family size, as Section 2.3 discusses. This can affect the relative value of aggregate versus per-person deductibles because per-person deductibles by definition scale with family size while aggregate deductibles do not, which generates cross-subsidization from smaller families to larger families.

We extend the base model (excluding moral hazard) by including three-person families and assume equal numbers of two-person and three-person families ($N = 2$ and $N = 3$). We first assume premiums that scale linearly with family size. The relationships between the per-person deductible and the aggregate deductibles that scale with family size ($D^{A,2}$ and $D^{A,3}$) or do not scale with family size (D^A) are:

$$D^P = \frac{q_2}{2\pi} D^{A,2} = \frac{q_3}{3\pi} D^{A,3} = \frac{q_2 + q_3}{5\pi} D^A \tag{3}$$

where $q_N \equiv 1-(1-\pi)^N$ is the probability that a size-N family reaches its deductible, and the per-person deductible D^P does not vary with family size because it is priced member by member. From this equation, one can show that the size of D^A is between the sizes

[15] Note that this trade-off is only clear in this very simple model. In a model with continuous shocks (as in Section 3.4), it is not obvious that per-person deductibles better control moral hazard. For example, in the region where $D^P < L < D^A$, aggregate deductibles actually generate less moral hazard. So the role of moral hazard depends on the health shock distribution, which we calibrate later.

of the two scaled deductibles ($D^{A,2} < D^A < D^{A,3}$), which generates a cross-subsidy (in expectation) from $N = 2$ to $N = 3$ families. Thus, without moral hazard, $N = 3$ families will always prefer the aggregate deductible to the per-person deductible due to both risk protection as well as the positive cross-subsidization in expectation. For $N = 2$ families, this negative expected cross-subsidization induces a trade-off: the aggregate deductible leads to higher average out-of-pocket spending than the per-person deductible (because of the negative expected transfer of the aggregate deductible), but better risk protection. So whether they prefer the per-person or the aggregate deductible depends on the relative strength of those two channels.

Adding moral hazard. The deductible relationship when deductibles do not scale and in an environment with moral hazard is analogous to the simple case in Equation (2), in that moral hazard induces over-consumption, and more so for aggregate deductibles, which increases the gap between the aggregate and per-person deductible.[16] Because this over-consumption is inefficient, moral hazard reduces welfare and thus typically pushes the willingness to pay in the direction of per-person deductibles.

Uniform premiums. If premiums also do not scale with family size (so that both $N = 2$ and $N = 3$ families pay the same total premium), the same mechanisms operate, but small families now subsidize large families through two channels: the aggregate deductible and the premium. The premium channel operates under both deductible structures alike, so it creates a transfer even under per-person deductibles and largely drops out of the comparison between them (aside from potential wealth effects). The qualitative conclusions are thus unchanged.

3.4 Full model

We now characterize the full model, which incorporates a continuous joint health shock distribution and formally describes preferences and the nature of moral hazard.

[16] Specifically, the analogous relationships are $D^P = \frac{q_2}{2\pi} D^{A,2} - \frac{\omega(q_2-\pi)}{\pi} = \frac{q_3}{3\pi} D^{A,3} - \frac{\omega(q_3-\pi)}{\pi} = \frac{q_2+q_3}{5\pi} D^A - \frac{\omega\left[2(q_2-\pi)+3(q_3-\pi)\right]}{5\pi}$

Preferences. We assume a unitary model of family preferences over non-medical and medical consumption of its members. We follow the specification of Einav et al. (2013), adapted to a family setting in which total non-medical consumption c across all family members serves as the numeraire, and the value of medical spending for each family member i exhibits diminishing marginal utility once that member's spending exceeds their health need L_i. Aggregating over the family's N members, utility is

$$u(c, m_1 - L_1, ..., m_N - L_N) = u\left(c + \sum_{i=1}^{N}\left[(m_i - L_i) - \frac{1}{2\omega_i}(m_i - L_i)^2\right]\right) \tag{4}$$

As in Einav et al. (2013), families will always choose $m_i \geq L_i$ for each family member because for $m_i < L_i$, the marginal utility of an extra dollar spent on medical consumption m_i is greater than the marginal utility of an extra dollar spent on nonmedical consumption c. We therefore treat L_i as the medically necessary component of spending and any excess $m_i - L_i$ as discretionary care induced by insurance. Without insurance, families would choose zero additional discretionary care, or $m_i = L_i$; with full insurance, families would choose $m_i = L_i + \omega_i$ (including when $L_i = 0$), where $\omega_i \geq 0$ governs the extent of additional medical care consumed due to insurance, or moral hazard.

This extra medical consumption is inefficient insofar as the family's value of the consumption is lower than its cost. In other words, while the family willingly consumes the extra care ex-post (i.e., once they are insured), they do not value that extra care ex-ante because its cost is passed back to the family in the form of higher premiums or deductibles. Because the aggregation structure of deductibles affects who is exposed to moral hazard, moral hazard may be an important channel through which welfare implications of deductible structures operate.

Health risk and health spending. Family members are subject to health shocks L_i, that are drawn from a joint distribution $f(L_1, ..., L_N)$. Health spending m_i, however, need not be the same as health shocks L_i given the moral hazard described above. We assume that family members only over-consume if their health shocks L_i have surpassed the deductible.[17]

[17] In reality, some may want to over-consume if L_i is slightly below D^P (or for the aggregate deductible, $\sum_N L_i < D^A$), but we do not allow for that due to computational tractability and because other work implies

Health insurance contract. A health insurance contract specifies a premium and a deductible structure. Throughout, we hold the premium fixed at P_N for every family, and treat the deductible as the sole margin that adjusts across contracts. We consider two deductible structures: an *aggregate* deductible that applies to the family's total medical spending, so that the whole family is covered once total spending crosses the threshold, and a *per-person* deductible that applies separately to each member's medical spending. We also consider two ways of calculating deductible sizes within a deductible structure: a *uniform* deductible that is constant regardless of family size, and a *size-specific* deductible that can vary by family size N. Crossing these dimensions yields four contracts: a uniform aggregate deductible D^A, a size-specific aggregate deductible $D^{A,N}$, a uniform per-person deductible D^P, and a size-specific per-person deductible $D^{P,N}$.

We assume each contract has the same actuarial value, such that each deductible is pinned down by the insurer making the same expected profits across each contract (e.g., if the insurer made zero profits, then each deductible is set such that the expected payouts equal the premium). For the size-specific contracts, the relevant pool is a single family size, so $D^{A,N}$ and $D^{P,N}$ break even within each size separately. For the uniform contracts, the pool is the entire population of families, so the single deductible D^A (or D^P) breaks even on average across family sizes.

Out-of-pocket medical expenditures and non-medical consumption. Family out-of-pocket medical expenditures, oop, depend on the type of deductible. Under the two aggregate deductibles, out-of-pocket spending is equal to $oop = \min\{\sum_i m_i, D^A\}$ and $oop = \min\{\sum_i m_i, D^{A,N}\}$, respectively, while under per-person deductibles, out-of-pocket spending is equal to $oop = \sum_i \min\{m_i, D^P\}$ and $oop = \sum_i \min\{m_i, D^{P,N}\}$. Given out-of-pocket spending, family consumption is $c = Y - P_N - oop$, where Y is family income and P_N is the premium.

that individuals generally respond more to spot prices than expected end-of-year prices (Brot-Goldberg et al., 2017)

Family problem and willingness to pay for alternative insurance contracts. Putting it all together, families choose medical consumption m_i of each family member to maximize:

$$\begin{aligned} V(Y, L_1, ..., L_N | \, D) = \max_{m_1,...,m_N} \quad & u\left(c + \sum_{i=1}^{N}\left[(m_i - L_i) - \frac{1}{2\omega_i}(m_i - L_i)^2\right]\right) \\ \text{s.t.} \quad & c = Y - P_N - oop(m_1, \ldots, m_N; \, D) \\ & m_i \geq L_i \quad \forall i \end{aligned} \tag{5}$$

where $D \in \{D^A, D^{A,N}, D^P, D^{P,N}\}$ is the contract's deductible and $oop(\cdot\,; D)$ is the corresponding out-of-pocket schedule defined above.

To compare the value that families place on per-person deductibles relative to aggregate deductibles, we compute the amount of income Z a family would be willing to pay for the per-person deductible to be indifferent between the ex-ante value of the two deductibles:

$$E_{L_1,...,L_{N_f}} V(Y, \cdot \,|\, D^A) = E_{L_1,...,L_{N_f}} V(Y - Z, \cdot \,|\, D^P) \tag{6}$$

and analogously for $D^{A,N}$ and $D^{P,N}$ for the case of deductibles that scale with family size. A positive Z means the family prefers the per-person deductible, as it would be willing to pay up to Z to remain with the per-person deductible relative to the aggregate deductible, and vice versa for a negative Z.

4 Calibrating the welfare gain of per-person deductibles

We next calibrate the full model and report the willingness to pay for per-person deductibles under different environments. We use the sample of MarketScan claims introduced in Section 2.4 to characterize the joint distribution of health shocks within families, and calibrate the remaining parameters of the model using estimates from the literature.[18]

[18] For now, we only use two-member and three-member families, in which two-member families consist of a husband and wife, and three-member families consist of a husband, wife, and child. We plan to expand this to more family types in the next draft.

4.1 Joint distribution of health shocks

We use the 2013 MarketScan claims data to characterize joint distributions of health shocks (see Section 2.4 for details). Our sample consists of families in which both spouses are between age 30 and 50 and who are continuously enrolled in a non-capitated family plan throughout 2013. For each family size, the joint distribution comes from an empirical joint distribution of health spending in which we assume all husbands have the same marginal distribution, all wives have the same marginal distribution, and (in three-person families) all children have the same marginal distribution. We allow correlation between the three marginal distributions, and discretize each marginal distribution into 20 bins of equal probability for each family member (as shown in Figure 1).

4.2 Other parameters

Beyond the joint health shock distribution, there are three important parameters that we take from the literature. The first is the risk aversion coefficient. Following much of the health insurance literature, we use CARA preferences in which $u(x) = 1 - \exp(-\alpha x)$ with coefficient of absolute risk aversion $\alpha = 0.0004$ based on Handel (2013). The second is the moral hazard parameter, ω, which we set to equal 30% of the average health shock for each type of family member, following Einav et al. (2013). This corresponds to values of \$1,462, \$2,799, \$1,121, for husbands, wives, and children in three-person families, respectively, and \$1,542 and \$3,135 for husbands and wives in two-person families, respectively. Finally, we set family premiums equal to \$11,900 for two-person families and \$14,200 for three-person families, corresponding to the premiums of an ACA marketplace benchmark (second-lowest-cost silver) plan (Kaiser Family Foundation, 2026).[19]

[19]Specifically, KFF only publishes averages for a 40-year-old (\$5,950 per year). For the 40-year-old couple, we double this; for the 30-year-old couple with a young child, we scale this premium by the federal age rating curve of 30-year-olds relative to 40-year-olds (1.134/1.278) and add a child premium using the same curve (0.765/1.278) (Centers for Medicare & Medicaid Services, 2016).

4.3 Willingness to pay for per-person deductibles

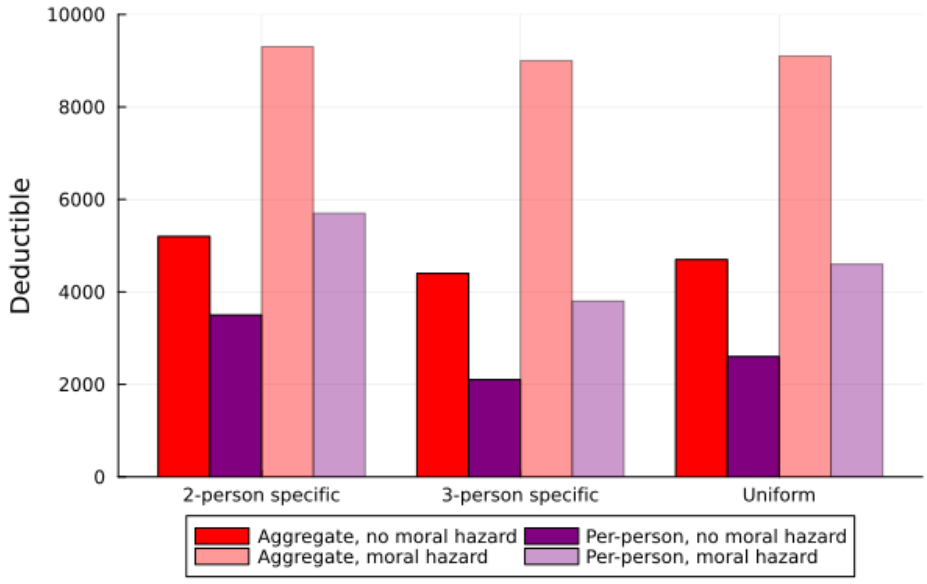
With the model calibrated using the parameters described above, we compute the willingness to pay for per-person deductibles relative to aggregate deductibles under several different scenarios.

We start by analyzing the role of risk protection. To do this, we shut down moral hazard (i.e., we set $\omega = 0$), and assume deductibles are family size-specific. The sizes of the deductibles in this scenario are depicted in the darker red and purple bars in the leftmost and middle sets of bars of Panel (a) of Figure 2 (for the two-person and three-person families, specifically), and show that the per-person deductibles are slightly more than half the size of the aggregate deductibles.[20] The darker blue bars in Panel (b) of Figure 2 report the willingness to pay for the per-person deductible, and show that both types of families prefer the aggregate deductible: the willingness to pay for per-person deductibles is -$278 on average across both family sizes (leftmost dark blue bar). The reason for this is that aggregate deductibles provide better insurance in "worst-case" states in which all family members receive large health shocks that would put them over their per-person deductibles, and risk-averse families value that (as discussed in Section 3.1).

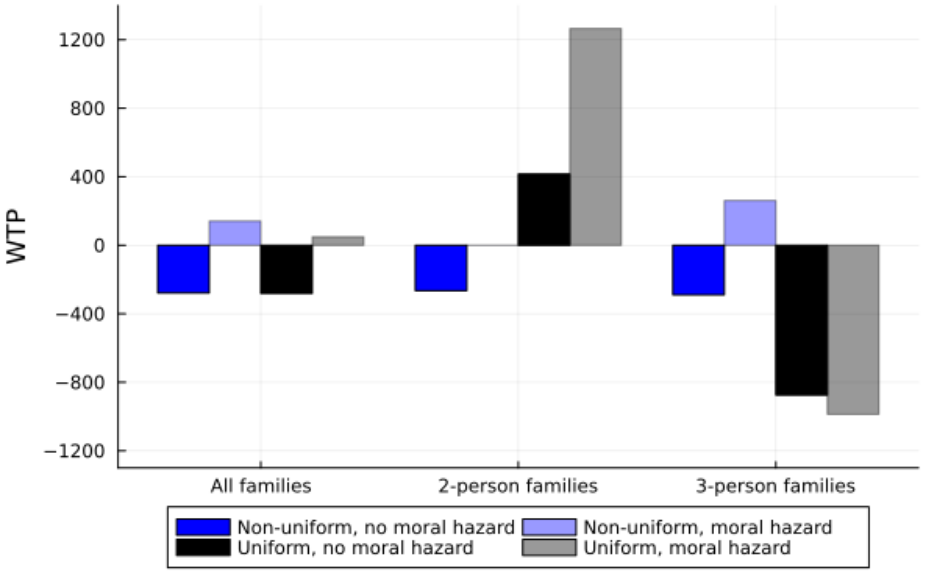
We next add moral hazard to the environment. As discussed in Section 3.2, moral hazard decreases welfare because individuals do not ex-ante value the over-consumption induced by moral hazard. The extent to which it manifests in aggregate and per-person deductibles, however, depends on the health shock distribution. Appendix Figure 2 illustrates the areas of the joint distribution that generate moral hazard under per-person and aggregate deductibles, and shows that some regions generate more moral hazard under per-person deductibles (e.g., regions above the per-person deductible but under the aggregate deductible) while other regions generate more moral hazard under aggregate deductibles (e.g., regions in which the aggregate deductible is reached but one's own per-

[20] Note that the deductibles in three-person families are smaller than the deductibles in two-person families because (1) average health shocks are smaller for husbands and wives in three-person families than husbands and wives in two-person families in our sample, (2) the children in three-person families have much smaller average health shocks than husbands and wives in either type of family, and (3) for two-person families the premium covers around 76% of expected costs, while for three-person families the premium covers aroun 79% of expected costs.

Figure 2: Deductible sizes and willingness to pay for per-person deductible



(a) Deductible sizes



(b) Willingness to pay for per-person deductible

Notes: Panel (a) reports the deductible sizes under different scenarios, for deductibles specific to two-person families (first set of bars), deductibles specific to three-person families (second set of bars), and uniform deductibles, weighted by the relative number of two-person and three-person families (third set of bars). Panel (b) reports the willingness to pay for a plan with a per-person deductible relative to a plan with an aggregate deductible under different scenarios, for all families (first set of bars), two-person families (second set of bars), and three-person families (third set of bars). The bars in the all families set of bars are a weighted average of two-person and three-person families with the weights given by the fraction of two-person and three-person families in our sample.

person deductible is not).[21] Appendix Figure 3 reports estimates of over-consumption from moral hazard based on the model calibrated using the joint distribution of health shocks in our sample, and shows that moral hazard is higher under aggregate deductibles. To pay for this over-consumption, which ranges from around $1,500 in extra spending for per-person deductibles in two-person families to around $2,500 in extra spending for aggregate deductibles in three-person families, the sizes of the deductibles increase substantially. Per-person deductibles increase by around $2,000 (light purple bars relative to dark purple bars), and aggregate deductibles increase by about $4,400 (light red bars relative to dark red bars). This flips the willingness-to-pay estimates to positive values: with moral hazard, families prefer per-person deductibles over aggregate deductibles by $140 on average (light blue bar). Thus, despite the better risk protection value of aggregate deductibles, per-person deductibles are a better tool for handling environments with moral hazard.

Finally, we consider the role of "uniform" deductibles, i.e., deductibles that are common across family sizes. As shown in Section 2.3, deductibles typically do not differ by family size (nor do per-person deductibles differ by family member type, e.g., child, adult male, or adult female). The size of deductibles that are constrained to be uniform are reported in the last group of bars in Panel (a). The first thing to note is that uniform deductibles are in between the sizes of family size-specific deductibles, which generates cross-subsidization. Interestingly, because deductibles are *smaller* for three-person families, it is actually three-person families that subsidize two-person families under uniform deductibles. In the black and gray bars of Panel (b), we report the willingness to pay for per-person deductibles for two-person families and three-person families when the deductibles are constrained to be uniform across family size. In an environment without moral hazard, this results in an average willingness to pay of -$281 (the leftmost black bar), virtually the same as the size-specific deductible case. After introducing moral hazard, the willingness to pay flips to $49 (the leftmost gray bar), similar to the size-specific deductible case. Much of this average effect, however, comes from the cross-subsidization

[21] This is very similar to Figure 6 in Hong and Mommaerts (2024), which illustrates a similar schematic but over different aggregations over time rather than aggregation over family members.

of deductibles from three-person families to two-person families, which is particularly stark for per-person deductibles. In sum, our results suggest that while aggregate deductibles have desirable risk protection properties, per-person deductibles can nevertheless outperform aggregate deductibles under environments of moral hazard and uniformity constraints.

5 Conclusion

Health insurance contracts routinely cover multiple family members, but the question of how cost sharing should be structured in such scenarios has received little attention. This paper explores this in the context of aggregate and per-person deductibles, first showing that both types of deductible structures are common in health insurance plans in the United States. We then build and calibrate a model in which families face correlated health risks and choose medical and non-medical consumption under uncertainty, and use it to quantify the difference in welfare between the two deductible designs. We show that aggregate deductibles have better risk protection properties, but are typically worse at controlling moral hazard and generate (perhaps unwanted) cross-subsidization between family sizes when constrained to offer uniform (i.e., family size-invariant) deductibles.

There are several interesting avenues for future research. First, these two deductible structures are not the only way to design cost-sharing policies in bundled insurance contracts. One alternative is embedded deductibles, which are common in federal exchange plans and are somewhat of a middle ground between the two deductible structures examined in this paper. Another is deductibles that can vary within person-type (e.g., child deductibles and adult deductibles). More broadly, an examination of out-of-pocket maxima could have very similar implications. Second, while the focus of this paper was on cost-sharing structures in the context of household bundling of insurance, it abstracts from questions related to adverse selection. A parallel literature studies how bundling impacts selection, but abstracts from cost sharing (Nguyen, 2022; Solomon, 2024). Because deductible structures differ in the out-of-pocket risk they impose on families of

different sizes and health profiles, they may also shape which families select into which plans. A fruitful next step would thus be to study the selection issues raised by deductible design in bundled insurance plans.

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Appendix Figures and Tables

Appendix Table 1: Covered household members in family plans, MEPS data

	People covered by the family plan (%)					
	One	Two	Three	Four	Five or more	N
All households	17.1	36.5	20.4	17.2	8.8	3,588
One adult, no kids	89.5	3.5	2.5	2.5	1.9	588
One adult with kids	16.3	46.1	27.9	7.8	1.9	386
Multi-adult, no kids	8.6	88.2	2.6	0.6	0.0	1,178
Multi-adult with kids	1.1	14.6	34.0	32.9	17.4	1,436

Notes: Data from the 2021 MEPS Household Component. Sample is households with private insurance plans that cover hospitalizations; a household (the row category) is defined as the number of adults 26+ and children under 26 in a family in a dwelling. Coverage (the column category) is based on the number of individuals in the sample with the same policy identifier. Individuals who are in a family plan but do not reside in the same dwelling (and hence are not in the MEPS sample) are not included, but individuals who are in the family plan and reside in the dwelling but are not in the MEPS definition of a family are included. Statistics are weighted by family weights, defined as the largest person weight in the household.

Appendix Table 2: Employee-plus-one coverage, MEPS Insurance Component data

	Single	Employee-plus-one	Family
Panel A: Percent of enrolled employees in each type of plan, 2020			
All firms	55.8	18.5	25.7
Fewer than 10 employees	62.7	15.1	22.2
10–24 employees	64.4	14.3	21.2
25–99 employees	64.0	15.6	20.4
100–999 employees	59.1	17.4	23.6
1,000 or more employees	52.0	20.0	28.0
Panel B: Average annual premium, 2022			
Premium (dollars)	7,590	14,943	21,931
Ratio to single premium	1.00	1.97	2.89

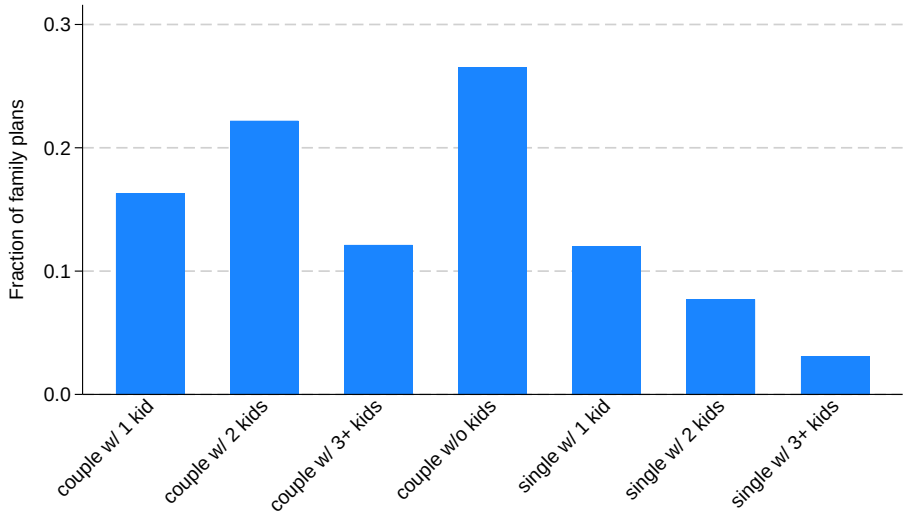
Notes: Data from published statistics based on the MEPS Insurance Component. Sample is private-sector establishments. Panel A: percent of enrolled employees taking each coverage tier, from MEPS-IC national tables I.C.4, I.E.4, and I.D.4 (2020, the most recent year published as national tables). Panel B: average annual total premium per enrolled employee in 2022, from AHRQ, "Trends in Health Insurance at Private Employers, 2008–2022." Employee-plus-one coverage insures the employee plus exactly one family member (spouse or child); when plus-spouse and plus-child premiums differ, MEPS-IC records the plus-child amount. Family premiums refer to a family of four.

Appendix Table 3: Health shock distributions among family members

	3-person families			2-person families	
	Husband	Wife	Kid	Husband	Wife
Mean	4,875	9,333	3,738	5,139	10,451
Standard deviation	22,115	27,349	21,308	24,041	28,615
Fraction with zero expenditure	0.175	0.066	0.089	0.192	0.078
25th percentile	165	852	423	132	854
Median	857	2,704	1,176	810	2,954
75th percentile	3,339	10,092	2,904	3,350	11,654
90th percentile	9,818	23,444	6,744	10,165	26,554
Mean number of claims	26	47	23	27	51
Number of families		556,387		474,763	

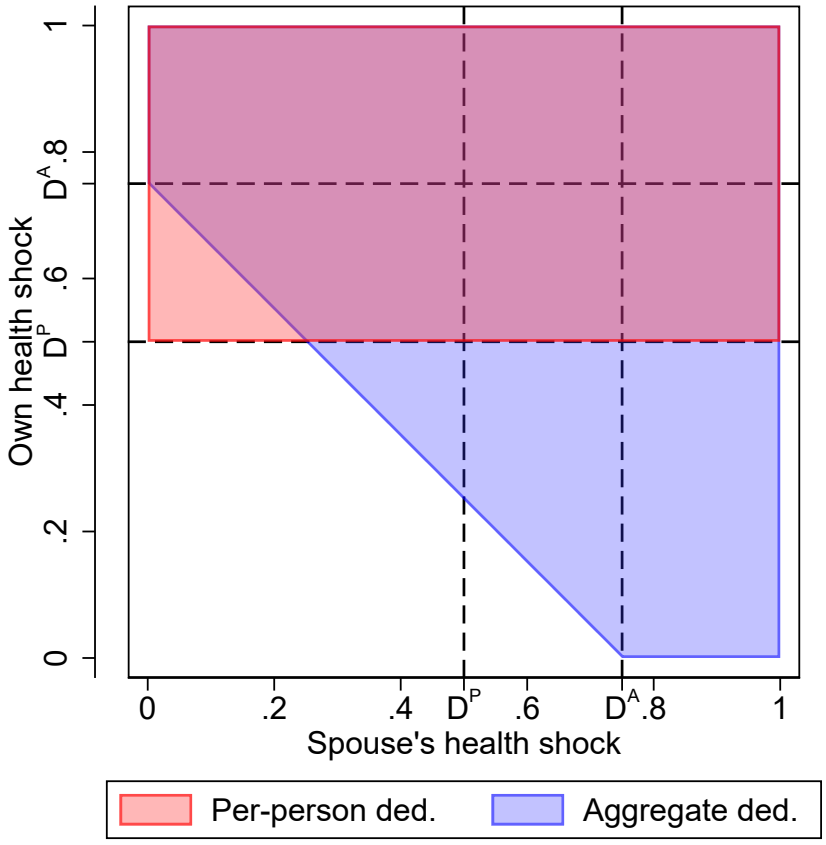
Notes: Data from the 2013 Truven MarketScan Commercial Claims and Encounters database. Sample is families in which both spouses are aged 30 to 50 who have zero or one dependent, and all members are continuously enrolled in a non-capitated family plan throughout 2013. Health shocks are measured as total annual health care spending, defined as the sum of expenditures paid by the insurer and paid out-of-pocket across inpatient, outpatient, and outpatient pharmaceutical claims, based on service dates, inflation-adjusted to 2025 dollars. Number of claims is the number of claims per individual over the year.

Appendix Figure 1: Distribution of family plans in Truven MarketScan sample



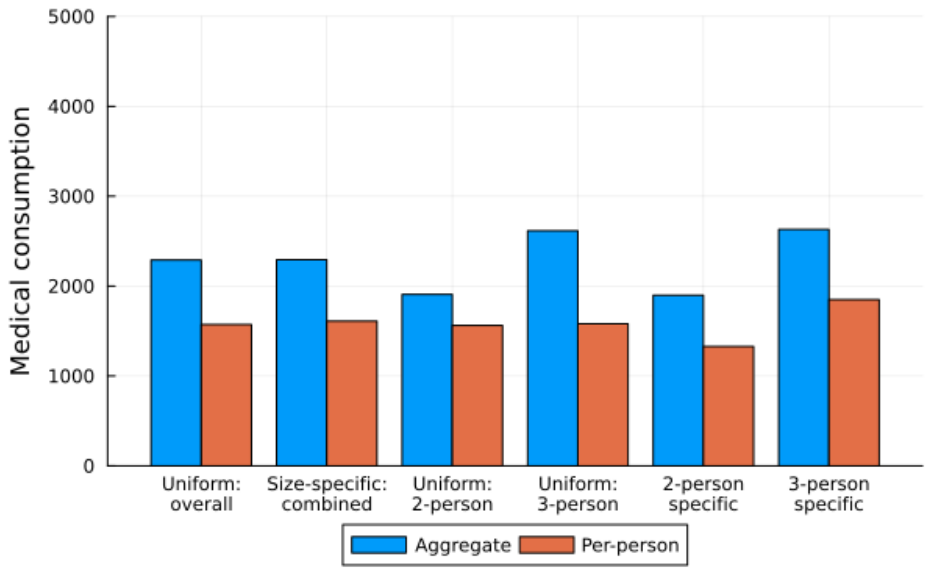
Notes: Data from the 2013 Truven MarketScan Commercial Claims and Encounters database. Sample is all families continuously enrolled in a non-capitated family plan throughout 2013, prior to the restrictions on age and family composition used in the analysis sample. "Couple" refers to plans covering a policyholder and spouse, "kids" refer to covered dependent children, and "single" refers to plans that do not cover a spouse.

Appendix Figure 2: Moral hazard schematic by health shock distribution, simple model



Notes: Figure illustrates, for a two-person family in the simple model of Section 3.2 (but allowing for continuous shocks from 0 to 1), the combinations of health shocks under which an individual over-consumes medical care under a plan with a per-person deductible (red) and under a plan with an aggregate deductibles (blue). D^P and D^A denote the per-person and aggregate deductible amount, respectively.

Appendix Figure 3: Over-consumption by plan type



Notes: The bars represent the amount of additional medical consumption in an environment with moral hazard relative to an analogous environment without moral hazard. The uniform plan averages the over-consumption of two-person and three-person families using the given fraction of each type of family in the economy. The size-specific combined bar reports the total amount of over-consumption averaging over two-person and three-person families in family-size specific deductibles. The "uniform: 2-person" and "uniform: 3-person" bars show over-consumption for two-person families and three-person families separately under uniform deductibles. The family size-specific bars report the over-consumption for a given family size under a family-size specific deductible.