American Economic Journal: Applied Economics 2 (October 2010): 177–199
http://www.aeaweb.org/articles.php?doi=10.1257/app.2.4.177

(Over)insuring Modest Risks†

By Justin Sydnor*

Despite the large literature on anomalies in risky choice, very little research has explored the relevance of these insights in real insurance markets. This paper uses new data on consumers' choices of deductibles for home insurance to provide evidence that a surprising level of risk aversion over modest stakes is a reality in the market. Most customers purchase low deductibles despite costs significantly above the expected value. Fitting these choices to a standard model of risk aversion yields implausibly large measures of risk parameters. Potential explanations and the implications of these results for understanding the market for insurance are discussed. (*JEL* D14, D81, G21, G22)

There are vast literatures in both theoretical and experimental economics examining how people make decisions about financial risks. Experiments have revealed a range of choice anomalies that are difficult to explain within the standard expected-utility-of-wealth model (see Chris Starmer 2000 and Stefano DellaVigna 2009 for reviews). In turn, a number of new models of decision-making under risk have been put forth, with Daniel Kahneman and Amos Tversky's (1979) and Tversky and Kahneman's (1992) prospect theory making the most significant impact on the field. Yet, despite all this research, very little has been done to explore the relevance of this work to real insurance markets.[1] Are these limitations of standard models important in market settings?

This paper uses a new dataset on homeowners' choices of deductible levels for their home-insurance policies to investigate this issue. In particular, I examine the relevance in this market setting of discussions on how averse people are to moderate financial risks. This topic was raised by Kenneth Arrow (1971) and Uzi Segal and Avia Spivak (1990) and brought to the forefront recently by Matthew Rabin (2000). Rabin (2000) demonstrated that if the only reason people are risk averse is the diminishing marginal utility of wealth, which is the sole explanation for risk aversion in the classic model, then they should be very close to risk neutral over any type of modest stakes.[2] Rabin's (2000) calibrations reveal that modest stakes include

* Actuarial Science, Risk Management, and Insurance Department, Wisconsin School of Business, University of Wisconsin-Madison, 975 University Avenue, Madison, WI 53706 (e-mail: jsydnor@bus.wisc.edu). I thank Raj Chetty, Stefano DellaVigna, Botond Kőszegi, Matthew Rabin, and numerous seminar participants for advice on this project. This project was supported, in part, by a fellowship from the Program in Psychology and Economics (PIPE) at the University of California-Berkeley. All errors are my own.

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[1] See Howard Kunreuther and Mark Pauly (2006) for one of the few systematic discussion and classifications of anomalies in insurance.

[2] The insight in Rabin's (2000) calibration theorem comes from realizing that if the marginal utility of wealth diminishes enough to make people risk averse over small stakes, then it must diminish drastically over larger stakes, and would imply implausible levels of risk aversion over large stakes.

risks in the hundreds and even thousands of dollars. One of the implications of this is that to the extent that people are actually averse to modest risks, understanding risk attitudes requires that economists step away from the simple standard framework and consider alternative psychological forces behind risk aversion.

Of course, part of the importance of this insight rests on the assumption that people are significantly averse to moderate risks, a point which some have questioned (Richard Watt 2002; Ignacio Palacios-Huerta, Robert Serrano, and Oscar Volij 2006) There is extensive evidence that people do display risk aversion over small stakes in laboratory settings (e.g., Charles A. Holt and Susan K. Laury 2002, and Glenn W. Harrison and E. Elisabet Rutström 2008). Outside of laboratory settings, there are many anecdotal accounts of market settings where people appear to pay a large amount to insure against very modest financial losses (e.g., Howard Kunreuther and Mark Pauly 2006; David M. Cutler and Richard Zeckhauser 2004; Rabin and Richard H. Thaler 2001; Jacques H. Drèze 1981; and B. Peter Pashigian, Lawrence L. Schkade, and George H. Menefee 1966). Demand for low deductibles, markets for cellular-phone insurance, and extended warranties all suggest that people fail to self-insure in the way the standard model would predict. However, there have been few micro-level empirical studies of the issue, and, in fact, the few existing studies have reported relatively low levels of risk aversion in markets for modest-scale insurance (Charles J. Cicchetti and Jeffrey A. Dubin 1994; Alma Cohen and Liran Einav 2007).[3]

This paper provides the first micro-level evidence that aversion to modest-scale risk is significant in an important insurance market. As Section I describes, the dataset covers a random sample of 50,000 standard policies from a large home insurance provider and includes information on policy parameters, rating variables, and claims filed over a one-year period. Customers chose their level of coverage from a menu of four available deductibles: \$1,000, \$500, \$250, and \$100. Because losses to the customer are capped at the deductible, choosing a deductible lower than the \$1,000 maximum represents a modest increase in insurance on the order of \$500, \$750, or \$900. The questions of interest, then, are whether many customers pay for this extra coverage, and to the extent they do, how costly that insurance is to them.

Section II presents the empirical choice patterns and reveals that customers in this market deviate substantially from a risk-neutral benchmark. The vast majority (83 percent) of homeowners in the sample paid for a lower deductible, and they did so at costs that far exceeded the expected value of that additional insurance. The most common choice was the \$500 deductible and, on average, this group of customers paid \$100 to reduce the deductible from \$1,000 to \$500. Because the dataset contains information on claims filed by each customer, it is possible to calculate the average value of this additional insurance to those customers who purchased it. Claim rates for this group were under 5 percent, implying that the additional coverage was worth less than \$25 in expectation. A simple counterfactual analysis reveals that, on average, the customers who purchased lower deductibles paid five times more in additional premium than the extra insurance was worth.

[3] It is worth noting, however, that Rabin and Thaler (2001) argue that Cicchetti and Dubin (1994) wrongly conclude that purchases of telephone wire insurance support low levels of risk aversion.

These choice patterns lead to extreme measures of risk aversion when fit to a standard model with the typical identifying assumption that market participants hold correct subjective beliefs about loss probabilities. The analysis, presented in Section III, exploits the fact that observing an individual's choices from the menu of available deductibles places bounds on the curvature of her utility-of-wealth function. Using standard assumptions and a range of conservative estimates for lifetime wealth, the *lower bound* on the Arrow-Pratt measure of relative risk aversion needed to explain the choice of the median lower deductible customer is consistently in the triple and quadruple digits. In contrast, most estimates for relative risk aversion generated from choices people make over larger stakes contexts are in the single digits (e.g., Pierre-Olivier Gourinchas and Jonathan A. Parker 2002, and Raj Chetty 2006). Furthermore, the preferences are unrealistic on their face. With the preferences in the baseline specification, 99.9 percent of the lower deductible customers would be predicted to reject a gamble with an even chance of losing \$1,000 or gaining *any* sum of money. The argument that the diminishing marginal utility of wealth cannot be the explanation for attitudes toward moderate risks is clearly supported by this market data.

Section IV discusses a number of potential explanations for the tendency to over-insure modest risks. The simplest explanation, consistent with the choice patterns, is that customers systematically overestimate the likelihood of accidents. In order to rationalize the choices with standard measures of risk aversion, the typical low-deductible customer would need a subjective claim rate of approximately 18 percent, about 5 times the true claim rate. This section also discusses the ability of reference-dependent preferences to account for the observed behavior. Standard formulations of prospect theory cannot fully account for the observed demand for low deductibles. However, newer formulations of reference-dependent preferences (Botond Kőszegi and Rabin 2006, 2007) can potentially explain the observed willingness to pay for modest insurance with existing parameter estimates from other studies.

Section V concludes the paper with a discussion of the broader implications of this research. In particular, I discuss the implications of these results to understanding the market structure of home insurance. A natural question here is if selling low deductibles is profitable, why does competition not drive out these costly low-deductible policies? The answer is that the company does not actually appear to earn excess profits from low-deductible customers relative to high-deductible customers. The main results of this paper show that the *marginal* cost of lower deductibles is not actuarially fair, which is the relevant question when asking whether consumers are displaying high risk aversion when buying this extra insurance. However, the *average* cost of insurance to low-deductible customers is justified by the fact that they have higher claim rates, which is the more relevant question when considering the supply side. Because the low-deductible customers have higher claim rates, which is consistent with sorting under adverse selection, if all of these customers decided to switch to high deductibles, the prices the firm charges for high-deductible contracts would have to rise. The paper concludes with a brief discussion of the implications of these findings for how one thinks about the consumer-welfare effects of the tendency to over-insure small risks.

I. Dataset

A. *Background*

The home insurance industry in the United States is large and an important part of the broader property and casualty insurance market.[4] In 2001, according to the Insurance Information Institute (*www*.iii.org), the industry had approximately $36 billion in revenue, with the average household paying $536 annually. Coverage is nearly universal, in large part because mortgage lenders require borrowers to insure their homes. While lenders require coverage, the homeowner is generally free to choose the insurance company and the details of the policy, including the deductible level.

The data for this study comprise a random sample of 50,000 policies in a single western state from a large home insurance company. A recent year was chosen to be the sample year, and, for each policy, the characteristics of the home and policyholder known to the company at the beginning and the end of the calendar year were recorded. All 50,000 observations come from the same post-2000 year, and the data contain all rating variables.

Only standard policies were used, which excludes renters, commercial property, and condominium insurance. These standard policies cover structures, personal property, and liability, and are in line with industry standards. They cover damage or loss due to theft, accidents, and weather, with weather-related incidents being the most frequent. However, as is the norm in the industry, flood and earthquake damage are excluded. Beyond the cost of repairs or replacements, in the event that a home becomes uninhabitable, the company pays for living expenses, such as motel bills and meals at restaurants. The insurer will pay for losses up to specified policy limits based on the insured value of the home. This insured value, in turn, is a reflection of the estimated cost to rebuild the home and excludes the value of land.

The primary choice that homeowners have to make with their policies is the level of the per-claim deductible. Deductibles are not bundled with other features of coverage, and basic contracts differ only in the deductible level. At the time of the study, the available deductible levels at the study company were $1,000, $500, $250, and $100. The data include the chosen contract, the amount paid for the policy, and the alternatives each homeowner had available. In addition to the information on the available menu, the company provided individual-level claims data. The dataset includes the total number of claims each homeowner filed and the amount paid to them for losses occurring during the sample year.

B. *Deductible Pricing*

The insurance company uses a standard actuarial pricing scheme. Let X_i be the matrix of policyholder variables for customer i, including the insured value of the home, zip code, etc. Then the deductible-premium menu is generated by

$$(\text{Premium}_i \,|\, \text{Deductible}_i = D_j) = \delta_j f(\mathbf{X}_i) + g(\mathbf{X}_i),$$

[4] See Martin F. Grace and Robert W. Klein (2003a, 2003b) for comprehensive studies of the industry.

where $f(\mathbf{X}_i)$ is a base price for the individual using a proprietary algorithm, δ_j is a deductible specific factor, and $g(\mathbf{X}_i)$ is an additive adjustment term (known to me) derived, again, from a proprietary algorithm (unknown to me).

The base premium, $f(\mathbf{X}_i)$, is a function of the characteristics of both the home and policyholder that influence expected losses. The most important policy characteristic is the insured home value, and it turns out that, all else equal, rates are roughly a linear function of home value. The additive term, $g(\mathbf{X}_i)$, typically represents the purchase of additional coverage, such as extended coverage for expensive jewelry.

Because premiums are adjusted for different deductible levels using a multiplicative factor, those with higher base premiums face higher marginal costs for lower deductibles. A few simple examples may help to clarify the menus.

Policyholder 1: Home was built in 1966 and had an insured value of \$181,700. The menu available to this policyholder in the sample year was:

Deductible	Premium	Relative to \$1,000 policy	Chosen
\$1,000	\$504	0	
\$500	\$588	+84	
\$250	\$661	+157	x
\$100	\$773	+269	

Policyholder 2: Home was built in 1992 and had an insured value of \$266,100. The menu available to this policyholder in the sample year was:

Deductible	Premium	Relative to \$1,000 policy	Chosen
\$1,000	\$757	0	x
\$500	\$885	+128	
\$250	\$999	+242	
\$100	\$1,171	+414	

Policyholder 2 had a higher premium for the \$1,000 deductible contract than Policyholder 1, largely because Policyholder 2 had a higher insured home value. Policyholder 2, then, also faced a greater increase in cost for the alternative of a \$500 deductible.

II. Empirical Choice Patterns

A. *Sample Averages*

Summary statistics for the full sample of homeowners are given in Table 1. Panel A provides a summary of important policy variables, and reveals that the vast majority (82.7 percent) of customers in the full sample held one of the two middle deductibles. Forty-eight percent of customers held the \$500 deductible and 35 percent held

Table 1—Summary Statistics

Variable	Full sample	Chosen deductible $1,000	$500	$250	$100
Panel A. Selected policy variables					
Insured home value	206,917	266,461	205,026	180,895	164,485
	(91,178)	(127,773)	(81,834)	(65,089)	(53,808)
Year home was built	1970	1972	1973	1966	1962
	(20.1)	(22.9)	(20.3)	(17.6)	(15.2)
Number of years insured by the company	8.4	5.1	5.8	13.5	13.2
	(7.1)	(5.6)	(5.2)	(7.0)	(6.7)
Average age of household (H.H.) members	54.3	50.8	51.1	60.4	66.9
	(15.6)	(14.3)	(14.9)	(15.7)	(15.0)
Number of paid claims in sample year (claim rate)	0.042	0.025	0.043	0.049	0.047
	(0.22)	(0.17)	(0.22)	(0.23)	(0.21)
Company payout per claim above deductible level	5,571.53	6,880.77	6,227.63	4,496.38	2,679.50
	(21,022.20)	(15,583.12)	(25,234.58)	(16,298.04)	(4,584.58)
Yearly premium paid	719.79	798.63	715.63	687.19	709.78
	(312.76)	(405.78)	(300.39)	(267.82)	(269.34)
Observations	49,992	8,525	23,782	17,536	149
Percent of sample	100	17.05	47.57	35.08	0.30

Notes: Means with standard deviations are in parentheses. The average age measure was calculated by the insurance company based on information they have about household members. This variable is not used in rating. Insured home value is the coverage limit on the insurance policy. For the claim rate and payout by the company per claim, only claims that resulted in positive payouts by the company were counted.

Available deductible	Full sample	Chosen deductible $1,000	$500	$250	$100
Panel B. Deductible-premium menu					
$1,000	$615.82	$798.63	$615.78	$528.26	$467.38
	(292.59)	(405.78)	(262.78)	(214.40)	(191.51)
$500	+99.91	+130.89	+99.85	+85.14	+75.75
	(45.82)	(64.85)	(40.65)	(31.71)	(25.80)
$250	+86.59	+113.44	+86.54	+73.79	+65.65
	(39.71)	(56.20)	(35.23)	(27.48)	(22.36)
$100	+133.22	+174.53	+133.14	+113.52	+101.00
	(61.09)	(86.47)	(54.20)	(42.28)	(82.57)

Notes: This table gives the average premium for insurance with a $1,000 deductible in the top row. Then, for each of the lower deductibles, it gives the average increase in premium relative to the next higher alternative. For example, in the first column, 86.59 is the average increase in premium a homeowner would have had to pay to hold the $250 instead of the $500 deductible. Standard deviations are given in parentheses.

the $250 deductible. Just over 17 percent of customers held the $1,000 deductible, while less than 1 percent selected the $100 level.

Panel B describes the average deductible-premium menu and is a good starting place to look at the costs associated with these different choices. Looking at the full sample, the average customer was offered a policy with a $1,000 deductible for roughly $615 and had to pay an extra $100 (i.e., $715) for the $500 deductible policy. At these prices, a risk-neutral individual would choose the $500 deductible policy only if she believed that her claim rate under the $500 deductible would be at least 20 percent $(715 - 615)/(1{,}000 - 500)$.[5] In contrast, one can see from panel A that actual average claim rates were less than 5 percent. The analogous calculation for the \$250 deductible using the \$500 alternative yields a risk-neutral claim rate of roughly 35 percent, and for the \$100 deductible compared to the \$250 alternative, the figure is an extremely high 88 percent. The extraordinary marginal cost of the \$100 policy helps explain why so few customers held that deductible.

Of course, looking only at the average menu could be misleading. Because there is heterogeneity in the cost customers face for lower deductibles, it is important to analyze the value of the lower deductibles to those who actually paid for them. The last four columns of panel B give the average deductible-premium menu broken down by chosen deductible. As one might expect, those who faced higher costs for lower deductibles were more likely to forgo that extra insurance. The \$1,000 deductible policyholders faced an average additional cost of \$130.89 to hold the \$500 deductible. The \$500 deductible customers had a lower average additional cost (\$99.85) to move from the \$1,000 to \$500 level and chose to pay that amount, but did not pay the average \$86.54 more that it would have cost them to hold the \$250 policy.

Those who held lower deductibles paid far more than the expected value for that extra insurance. Those with the \$500 deductible had an average claim rate of 4.3 percent (panel A of Table 1), implying an upper bound on the expected value for their contract relative to the \$1,000 alternative of \$21.50.[6] Yet, they paid an average of \$99.85 for that extra coverage. The \$250 deductible customers were even farther from the risk-neutral benchmark.

Another way of quantifying the average difference between cost and expected value for these customers is presented in Table 2. This table presents an analysis at the individual level based on calculations of how much each of the lower deductible customers would have saved or lost ex post had they instead held the \$1,000 deductible. Panel A reveals that, as a group, the \$500 and \$250 customers could have saved an average of \$99.88 during the sample year with the \$1,000 deductible.[7] This table also provides a direct measure of the ex post expected value of each deductible relative to the \$1,000 alternative, which for the \$500 deductible customers is \$19.93. The average additional premium they paid for that extra coverage (\$99.85) was five times that value.

B. *Patterns for New Customers*

These results are for the full sample of homeowners, which includes individuals who started their coverage with the company at different times. One might conjecture that those insured longer would be more sophisticated insureds, and might forgo the expensive lower deductibles. Figure 1 reveals, however, that those insured

[5] If one uses the claim rates observed for customers with a low deductible, the claim rates will include all losses above \$1,000 and the few below \$1,000 as well. As such, this formula overstates the value of a high deductible and gives a *lower bound* on the claim rate that the risk neutral customer would need to purchase the extra insurance.

[6] If each loss exceded \$1,000, then for the 0.043 expected claims each year, a customer with a \$500 deductible can expect her insurance to pay out \$21.50 $[0.043 \times (1{,}000 - 500)]$ more than a customer with a \$1,000 deductible. If some of the 0.043 expected losses would not excede \$1,000, then the lower deductible is worth less to the customer.

[7] The median savings for this group was \$109.35.

Table 2—Potential Savings with the $1,000 Deductible

Chosen deductible	Number of claims per policy	Increase in out-of-pocket payments per claim with a $1,000 deductible	Increase in out-of-pocket payments per policy with a $1,000 deductible	Reduction in yearly premium per policy with $1,000 deductible	Savings per policy with $1,000 deductible
Panel A. Full sample					
$500	0.043	469.86	19.93	99.85	79.93
N = 23,782 (47.6 percent)	(0.0014)	(2.91)	(0.67)	(0.26)	(0.71)
$250	0.049	651.61	31.98	158.93	126.95
N = 17,536 (35.1 percent)	(0.0018)	(6.59)	(1.20)	(0.45)	(1.28)
Average forgone expected savings for all low-deductible customers: $99.88					

Chosen deductible	Number of claims per policy	Increase in out-of-pocket payments per claim with a $1,000 deductible	Increase in out-of-pocket payments per policy with a $1,000 deductible	Reduction in yearly premium per policy with $1,000 deductible	Savings per policy with $1,000 deductible
Panel B. New customers					
$500	0.037	475.05	17.16	94.53	77.37
N = 3,424 (54.6 percent)	(0.0035)	(7.96)	(1.66)	(0.55)	(1.74)
$250	0.057	641.20	35.68	154.90	119.21
N = 367 (5.9 percent)	(0.0127)	(43.78)	(8.05)	(2.73)	(8.43)
Average forgone expected savings for all low-deductible customers: $81.42					

Notes: Means with standard errors are in parentheses. The second column in each table gives the increase in out-of-pocket payments per claim if individuals instead held the $1,000 deductible. If all claims were for losses exceeding $1,000, this measure would be $750 for the $250 deductible customers and $500 for the $500 deductible customers. The increase in out-of-pocket payments *per policy* is a measure of the relative expected value of the lower deductible. It is calculated by averaging the increase in out-of-pocket payments that each individual would have paid with the alternative $1,000 deductible. Most did not file a claim, so, for most, this number is zero. The potential savings (the last column) is calculated at the individual level by taking the difference between that individual's potential reduction in yearly premium and the increase in out-of-pocket losses that individual would have experienced with the alternative $1,000 deductible.

with the company for longer were actually more likely to hold one of the lower deductibles. For instance, less than 10 percent of those who had been insured with the company for three years or less held the $250 deductible, while those insured 11–15 years chose this level 60 percent of the time.

While on the surface this pattern might seem to suggest that those insured longer had a higher demand for low deductibles, it seems likely that it is actually the result of consumer inertia. The menu of deductibles offered by the company in the state was constant over time, but in the past, low deductibles were cheaper. This is because the relationship between deductible costs and insured home value has remained roughly constant over time. As home values have risen, there has been a corresponding rise in the premium differences for different deductibles. Of course, individuals are free to update their deductible at any time. But renewal notices do not list the current menu, and there is growing evidence that even when there is significant money at stake, individuals often fail to adjust their initial choices over time.[8] Therefore, for

[8] See, for instance, Brigitte C. Madrian and Dennis F. Shea (2001), Gabriel D. Carroll et al. (2009), and DellaVigna and Ulrike Malmendier (2006).

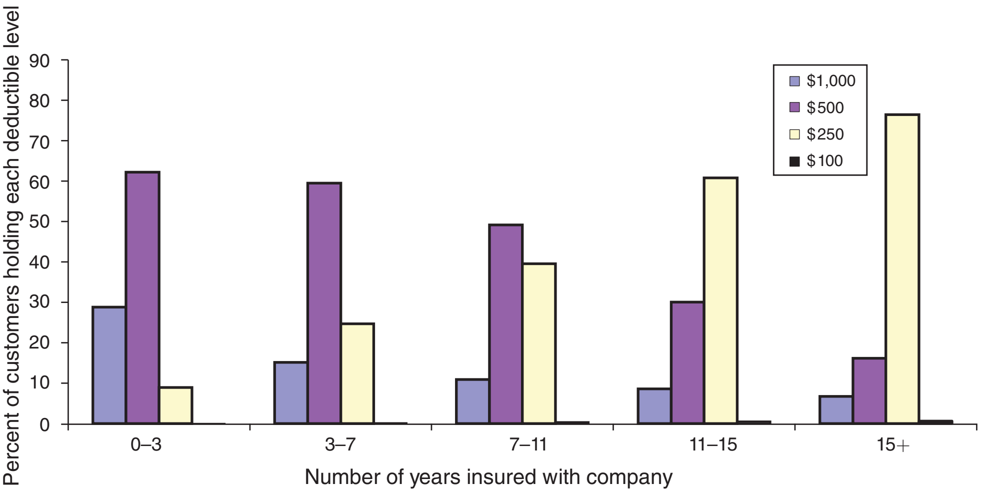

FIGURE 1. DEDUCTIBLE CHOICE BY YEARS INSURED WITH COMPANY

Notes: This chart gives the fraction of customers holding each deductible level by groups of tenure with the company. The percent of the sample that falls into each category is as follows: 0–3 years (34.16 percent), 3–7 years (22.97 percent), 7–11 years (12.95 percent), 11–15 years (10.48 percent), 15+ years (19.44 percent).

some homeowners it is likely that the observed choice of lower deductibles partially reflects inertia and not solely an active choice reflecting risk preferences.

Analyzing variation in the marginal cost of lower deductibles gives suggestive support for this inertia hypothesis. Figure 2, panel A provides a graph of the fraction of customers who held a deductible lower than $1,000 by the cost the customers faced to reduce the deductible from $1,000 to $500.[9] The figure clearly shows that newer customers are responding more strongly to variation in the current cost of holding lower deductibles than customers who have been insured longer. At a marginal cost of $50 to lower the deductible, 95 percent of customers insured longer than 10 years, and 90 percent of those insured less than three years, purchased a lower deductible. However, at a higher marginal cost of $100, the fraction purchasing the lower deductible among newer customers falls to 67 percent, but changes very little for long-term insureds.

Table 2 showed that there is substantial expected savings from switching to the high deductible for the average low-deductible customer. The bottom panel of Figure 2 provides a way of looking at the heterogeneity in this potential savings by graphing the expected savings from switching to the high deductible as a function of the marginal cost of lowering the deductible from $1,000 to $500. The line would lie along zero if lower deductibles were priced actuarially fairly from the perspective of the customers. This figure shows, however, that across the entire range low-deductible customers could have expected significant ex post savings from holding the $1,000 deductible. The potential savings are higher for the longer tenure customers across the spectrum of costs, because a greater fraction of them held the $250 deductible, which is a worse buy ex post than the $500 deductible.

[9] The curve gives the predicted values from a kernel regression, where the dependent variable is one if an individual chose a deductible lower than $1,000, and zero otherwise.

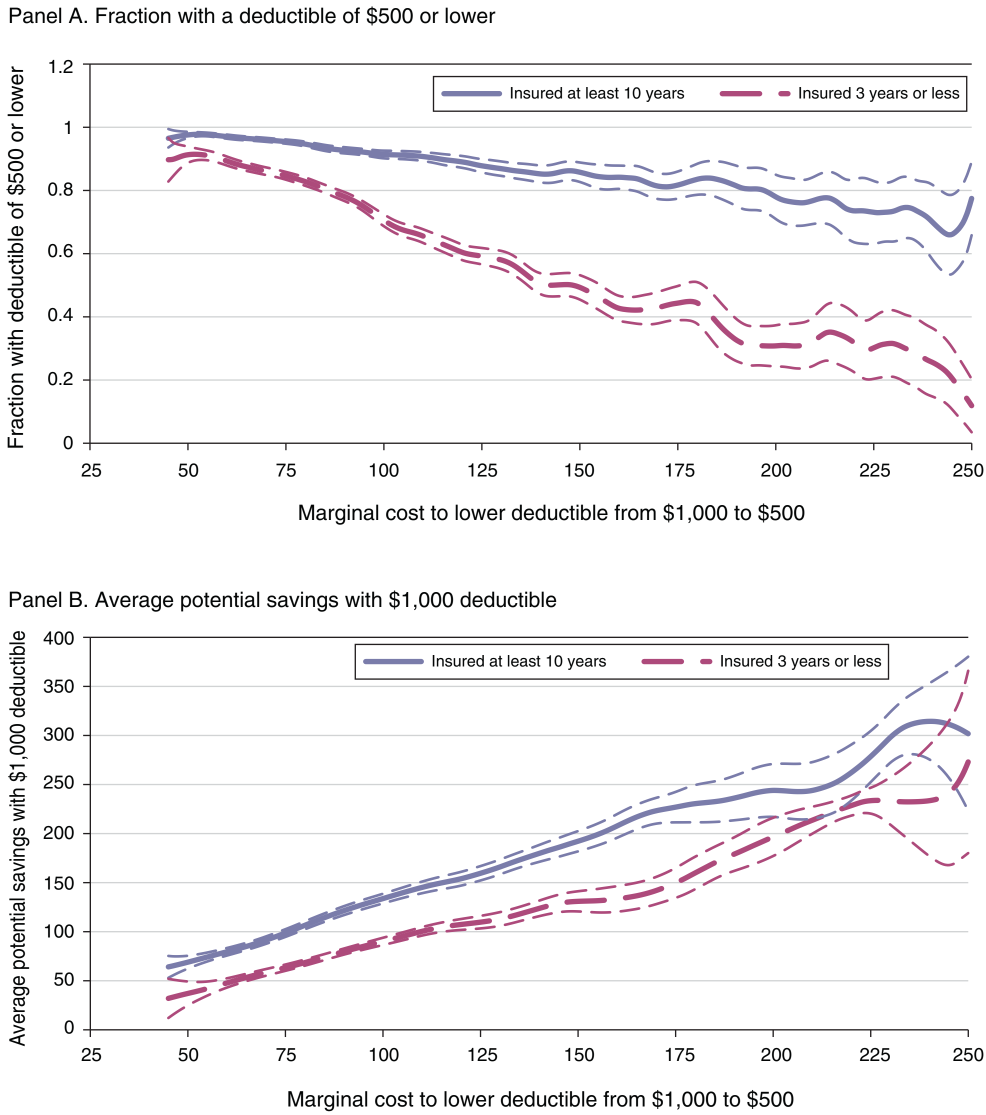

Figure 2. Deductible Choice and Savings by Cost of Low Deductible

Notes: Panel A shows the fraction of customers who held a deductible of $500 or lower as a function of the cost the customer faced to reduce the deductible from $1,000 to $500. Panel B shows the average potential savings that the customers who held a deductible of $500 or lower could have expected to receive by switching to the high deductible, again, as a function of the cost, these customers paid to lower the deductible from $1,000 to $500. These graphs use locally weighted kernel regressions using quartic kernels with bandwidths of 10 and 20 for Figure 2, panel A and panel B, respectively. The thick dashed lines are for customers insured with the company for three years or less, while the solid lines are for customers insured for at least ten years consecutively with the company. The proportion of the full sample in each of these cohort groups is approximately 35 percent. The dashed lines give 95 percent confidence intervals calculated using a bootstrap procedure with 200 repetitions.

While consumer inertia seems to play an important part in this market, concentrating on the choices of newer customers, the demand for lower deductibles is still very strong. From Figure 2, it is clear that the majority of customers who had been with the company for 3 years or less chose the lower deductibles when the additional cost was below \$130. Roughly 12 percent of the sample consisted of customers who were new to the company in the sample year—these could be new homeowners or homeowners previously insured with other companies. For these homeowners, consumer inertia is not an issue at all. The majority (61 percent) of these new customers also chose the middle deductibles, with 55 percent holding the \$500 deductible and 6 percent holding the \$250 deductible. Only three customers (0.05 percent) held the \$100 deductible, while the remaining 39 percent held the \$1,000 deductible. Panel B of Table 2 reveals that, just as in the full sample, the new customers who chose a lower deductible paid much more than that extra coverage was worth in expectation. On average, these customers paid roughly five times what this extra insurance was worth in expectation. The analysis in the remainder of the paper will focus on the choices of these new customers who made their deductible choices under the current menu.

C. *Industry Comparisons*

These findings are likely to apply to the homeowners insurance market more broadly. Grace and Klein (2003a) provide an industry overview and assert that most homeowners carry fixed deductibles, "…with \$250–\$500 being the most common." The rating structure is also broadly consistent with those at other companies. For instance, Cutler and Zeckhauser (2004) report premium differences of over \$200 between contracts with \$1,000 and \$500 deductibles for two example policies in Philadelphia and Orlando. Similar magnitudes are also found in the California Department of Insurance's 2006 online survey of homeowners insurance premiums. As for claim rates, the industry reports (www.iii.org) somewhat higher national claim rates (8.4 percent) than those seen here, however, these may be affected by the more extreme weather in the Midwest and South. In a study of the home insurance industry in California, Gurbhag Singh (2004) reports an average yearly claim frequency of 5.5 percent per insured home. Taken all together, then, it appears that the menu, prices, and (at least in western states) the claim rates observed in this sample are all in line with those at other companies.

D. *Magnitude*

These payments for low deductibles represent "real money" at both the individual and aggregate levels. If these patterns hold nationally, a partial-equilibrium back-of-the-envelope calculation suggests that homeowners could expect to save roughly \$4.8 billion per year by holding the highest available deductible.[10] As Section V discusses in detail, however, this is only a partial equilibrium result. Because the company would likely change prices if all customers started purchasing higher deductibles, the aggregate consumer expenditures in an equilibrium, where consumers were less willing to purchase low deductibles, would not likely be reduced much. At the individual level, if these patterns persist over time, assuming a real interest rate of only 3 percent, a typical individual who bought his house at the age of 30,

[10] Sixty million homes, 80 percent with "low deductibles," and an expected savings of \$100.

and consistently chose the highest deductible, could expect to save approximately \$6,300 by the time he retired at the age of 65. Furthermore, with a Poisson claim rate of 5 percent, over 35 years there is only a $1/455$ chance that this homeowner would lose any money and only a $1/11{,}236$ chance of losing more than \$1,000 by holding the high deductible.

III. Standard Model: EU(W)

This section analyzes deductible choices within a standard expected-utility-of-wealth model. Following the framework in Chetty (2006), it assumes customers respond to risks based on an (indirect) utility-of-wealth function, where wealth is the present value of lifetime income.[11]

To examine the deductible-choice situation, imagine the individual faces a choice between one year insurance contracts with yearly premium, P, and deductible, D. Assume that other than a loss to the home, the individual faces no other risk to lifetime wealth. Furthermore, assume, for simplicity, that the individual faces at most one loss during the year that occurs with probability π (I relax this assumption below), and holds accurate subjective beliefs about the likelihood of a loss. Finally, assume that all losses exceed the highest deductible under consideration, which simplifies the analysis and overstates the value of lower deductibles.

Under these assumptions, the expected utility of the contract with premium P and deductible D for loss probability π is given by

$$V(P, D, \pi) = \pi u(w - P - D) + (1 - \pi)u(w - P),$$

where u is the Von Neumann-Morgenstern (indirect) utility function over wealth, and w is the individual's level of initial wealth. Given a choice between contracts, the individual chooses the contract j that maximizes her expected (indirect) utility:

$$\max_j \pi u(w - P_j - D_j) + (1 - \pi)u(w - P_j).$$

Allowing for the possibility of multiple losses during the year, and recalling that the deductible is per claim, this expression becomes

$$\max_j \sum_n \pi_n u(w - P_j - nD_j) \quad \text{for } n = 0, 1, 2, \ldots,$$

where π_n is the probability of incurring exactly n losses to the home during the year.

A. *Generating Bounds on Risk Aversion*

If the utility function u has only one parameter (say θ) controlling the level of risk aversion, observing an individual's choice between deductible levels places bounds on that parameter. For a homeowner who choses the \$1,000 deductible, we can

[11] Chetty's (2006) discussion helps to clarify that the appropriate measure of wealth should be related to permanent income, rather than measures, such as physical wealth and monthly income, that are often used in the literature.

find an upper bound because there is a unique θ such that she would be indifferent between the \$1,000 and the \$500 deductible contracts. For those who chose the \$500 deductible, because we observed that the individual preferred this level to the \$250 and \$1,000 alternatives, respectively, we can find both an upper and lower bound. The alternatives of the \$500 and \$100 deductibles provide similar bounds for those who chose the \$250 deductible.

I have calculated the bounds on risk aversion for each individual implied by the individual's choice using the common constant relative risk aversion (CRRA) and constant absolute risk aversion (CARA) functions for u. CRRA utility is given by $u(x) = x^{1-\rho}/(1 - \rho)$ for $\rho \neq 1$, and $u(x) = \ln(x)$ for $\rho = 1$. The parameter ρ is the Arrow-Pratt measure of *relative risk aversion*; $\rho = 0$ is the risk neutral case, while $\rho > 0$ implies risk aversion. CARA utility is given by $u(x) = (1/-r)\, e^{-rx}$, where r is the Arrow-Pratt measure of *absolute risk aversion*.

Table 3 reports these bounds on risk aversion at both the median (panel A) and twenty-fifth to seventy-fifth percentiles (panel B) for new customers for a range of assumptions about initial wealth and claim rates.[12] I focus on new customers because, given the possibility of consumer inertia, using the full sample might overstate the level of risk aversion.

B. *Baseline Estimates*

The first model in Table 3 (model 1) shows the bounds on relative risk aversion for the CRRA utility function assuming that all individuals have lifetime wealth of \$1 million, and that individuals have (subjective) claim rates equal to the average observed claim rate for that deductible level. For this case, looking at the \$1,000 deductible customers, the upper bound on relative risk aversion was 2,823 for the median customer and 3,173 at the seventy-fifth percentile. The results are more meaningful for the \$500 deductible customers, for whom there is both a lower and upper bound on risk aversion. The median \$500 deductible customer had an implied lower bound of 1,839 with an upper bound of 5,064. The lower bound at the twenty-fifth percentile for this group is still 1,614. The \$250 deductible customers displayed higher levels of risk aversion bounded by 4,337 and 14,032 at the median.

How should one interpret these levels of ρ? The basic assumptions of the model here correspond to those used by Chetty (2006), and, thus, it is instructive to compare these results to Chetty's. Chetty (2006) presents calibrations that bound the coefficient of relative risk aversion using estimates of labor supply elasticities in the United States. He concludes that the labor supply evidence bounds the coefficient somewhere under two. As another point of reference, Gourinchas and Parker (2002) estimate a structural model of consumption over the lifecycle using data from the Consumer Expenditure Survey, and estimate coefficients of relative risk aversion ranging from 0.5 to 1.4. The lower bound on the coefficient of relative risk aversion observed here is around 1,000 times the level estimated by these existing studies.

[12] Because there is not a closed-form solution for these bounds, I used a simple search algorithm to calculate, for each individual in the sample, the cutoff value of ρ (CRRA) or r (CARA) for indifference between any two deductible-premium pairs.

Table 3—Bounds on Coefficient of Relative Risk Aversion

Model	$1,000 ($n = 2{,}474$) LB	UB	$500 ($n = 3{,}424$) LB	UB	$250 ($n = 367$) LB	UB	Reject *any* 50/50 gamble with potential loss of $1,000
Panel A. Bounds at the fiftieth percentile							
1 CRRA; $1 mil; deductible average	—	2,823	1,839	5,064	4,337	14,032	100.0%
2 CRRA; $1mil; individual estimate	—	2,979	2,013	5,406	4,621	14,650	99.9%
3 CRRA; $500k; individual estimate	—	1,488	1,005	2,700	2,308	7,319	99.9%
4 CRRA; IHV; individual estimate	—	690	353	947	711	2,244	99.8%
5 CRRA; $100k; individual estimate	—	294	199	535	458	1,452	99.9%
6 CRRA; $50k; individual estimate	—	145	98	265	226	718	99.8%
7 CRRA; $5k; individual estimate	—	7	6	21	18	58	92.9%
8 CARA; $1mil; individual estimate	—	2,983	2,015	5,411	4,626	14,661	99.9%

Mode wealth class	$1,000 ($n = 2{,}474$) LB	UB	$500 ($n = 3{,}424$) LB	UB	$250 ($n = 367$) LB	UB	Reject *any* 50/50 gamble with potential loss of $1,000
Panel B. Bounds at the twenty-fifth and seventy-fifth percentile							
1 CRRA; $1 mil; deductible average	—	3,173	1,614	5,582	3,898	15,283	100.0%
2 CRRA; $1mil; individual estimate	—	3,270	1,721	5,933	4,007	15,780	99.9%
3 CRRA; $500k; individual estimate	—	1,632	860	2,963	2,002	7,882	99.9%
4 CRRA; IHV; individual estimate	—	953	257	1,282	516	2,999	99.8%
5 CRRA; $100k; indiv. estimate	—	322	170	587	398	1,564	99.9%
6 CRRA; $50k; individual estimate	—	158	84	290	196	774	99.8%
7 CRRA; $5k; individual estimate	—	8	6	22	16	61	92.9%
8 CARA; $1mil; individual estimate	—	3,275	1,722	5,940	4,010	15,796	99.9%

Notes: This table gives percentile cuts on the bounds of the coefficient of relative risk aversion implied by various model assumptions. All calculations are for customers who joined the company during the sample year. Panel A shows the bounds for the median customer, while panel B shows the lower bound at the twenty-fifth percentile and the upper bound at the seventy-fifth percentile. The individual claim-rate estimates used for models 2–8 use predicted values from the Poisson regressions described in the text. Model 4 uses initial wealth levels equal to the customer's insured home value (IHV). For the CARA model, the bounds on the coefficient of absolute risk aversion have been converted into measures of relative risk aversion assuming a wealth of $1 million to facilitate a comparison of the results of the CRRA and CARA models. The far right column (repeated in both panels) shows, for each model, the percent of the $500 and $250 customers who would reject any 50/50 gamble with a potential loss of $1,000 based on the lower bound of risk aversion implied by their choices. See the text for further discussion.

Another way to interpret the risk aversion seen here is to follow the spirit of the "Rabin Critique" (Rabin 2000), and ask how individuals with these preferences would respond when offered other gambles. Taking the lower bound on ρ, for each low-deductible customer from model 1, I calculated whether there existed a gain,

Table 4—Poisson Regression of Claim Rates

Explanatory variable	Dependent variable: number of paid claims (all losses) (mean = 0.0425 for $500 group) (1)	(2)	(3)
$250 Deductible	0.146***	0.223***	0.234***
	(0.046)	(0.056)	(0.056)
	[1.158]	[1.250]	[1.263]
$1,000 Deductible	−0.522***	−0.555***	−0.553***
	(0.075)	(0.078)	(0.078)
	[0.593]	[0.574]	[0.575]
Ins. home val. ($10,000s)		0.013***	0.015***
		(0.003)	(0.003)
		[1.013]	[1.015]
Years insured = (days/365)		0.035***	0.027**
		(0.012)	(0.012)
		[1.035]	[1.027]
Years insured^2		−0.002***	−0.002***
		(0.0005)	(0.0005)
		[0.998]	[0.998]
Age of home (years)			0.017***
			(0.004)
			[1.017]
Age of home^2			−0.0002***
			(0.00005)
			[0.999]
Senior discount			−0.140**
			(0.065)
			[0.869]
Smoke/burglar alarm discount			0.129**
			(0.051)
			[1.137]
Constant	−3.158***	−3.948***	−4.050***
	(0.0315)	(0.172)	(0.196)
Territory controls		x	x
Observations	49,843	49,843	49,843
Log likelihood	−8,777.843	−8,693.246	−8,674.388

Notes: Standard errors are in parentheses. Incident rate ratios are in square brackets. The Poisson regression model is $\lambda = \exp(\beta\, X)$, where λ is the number of claims filed. Implied losses are calculated by taking the amount paid to the customer for a claim and adding that customer's deductible.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

G, that would make the homeowner willing to accept a 50/50 lose $1,000/gain G gamble. With these preferences, for 99.95 percent of the 3,791 new customers who chose either the $250 or $500 deductible there exists no gain that could compensate them for a 50 percent chance of losing $1,000.

C. *Robustness Checks*

Of course the results for model 1 are sensitive to the assumptions about lifetime wealth and subjective claim rates. The rest of Table 3 reveals, however, that the conclusions hold under a range of assumptions. Consider first the measure of claim rates. Using the deductible-level average claim rate for the chosen deductible eliminates any bias resulting from adverse selection or moral hazard on the choice of deductible. However, even within a deductible level it could be the case that there is some degree of adverse selection. As discussed in Section II, customers face heterogenous costs of lowering their deductible. Those who paid more for the lower deductible might be expected to file more claims than others with the same deductible, which might bias the results somewhat. To address this, I ran basic Poisson regressions of claim rates on the policy variables that affect premiums, and used the predicted values from this regression as a predicted measure of individual claim rates. These regression results are presented in Table 4. The coefficients on the policy variables generally have the predicted sign, but are quite small in magnitude, revealing that within a deductible level the policy variables have little predictive power on claim rates. As Table 3 shows (model 2), using this alternative measure of claim rates actually raises the bounds on risk aversion slightly, but does not meaningfully change any of the results.

The measure of lifetime wealth is a more important consideration. Lifetime wealth of \$1 million is likely to be a reasonable conservative estimate of permanent income for these individuals who own homes with average insured values (i.e., excluding the value of land) of around \$200,000. Nonetheless, the basic conclusions here are robust even if one considers much lower levels of lifetime wealth. Models 3–7 of Table 3 use decreasing levels of initial wealth, including individual insured home values (model 4). Even if one were to assume a lifetime wealth of only \$100,000 for these homeowners (model 5), the lower bounds on risk aversion are still more than 100 times those of the Chetty (2006) and Gourinchas and Parker (2002) studies, and continue to predict strong rejections of a 50/50 gamble with a downside of losing \$1,000.

The table also includes results using values of lifetime wealth of \$50,000 and \$5,000. These are clearly unrealistically low estimates of lifetime wealth, but they are instructive cases in at least two ways. First, they provide comparable estimates of the CRRA parameter for studies that report measures of ρ using wealth measures such as monthly or yearly income. Second, and more importantly, they highlight that although extremely low initial wealth leads to single-digit measures of risk aversion, when initial wealth is low single-digit CRRA parameters still imply extreme risk aversion. For initial wealth of \$5,000, the implied lower bound on ρ is less than 7 for over 75 percent of the \$500 deductible customers. Yet with these implied preferences, virtually none of these individuals would be willing to accept a 50/50 gamble with a downside of losing \$1,000. Low wealth can reduce the measure of risk aversion, but it cannot make the observed behavior consistent with realistic attitudes toward the hypothetical gamble.

A final way to approach the question of initial wealth is to use the CARA utility specification, which does not depend on initial wealth. Model 8 in Table 3 presents bounds on risk aversion assuming individual-estimate claim rates and CARA utility. To ease comparisons, the CARA measure of absolute risk aversion has been converted to a measure of relative risk aversion by multiplying the results by 1 million. As such, the result for model 8 is directly comparable to model 1. The results with the CARA specification are almost identical to those with the CRRA specification, and, again, would imply incredibly risk-averse reactions to a gamble with a potential downside of losing \$1,000. These CARA results can also be compared to the level of risk aversion found in the deductible choice of Israeli automobile drivers. Cohen and Einav (2007) estimate a median coefficient of absolute risk aversion from a CARA utility function of 3×10^{-5}, which is orders of magnitude lower than the median lower bound for the \$500 customers here of 2×10^{-3}. I return to this comparison in the final section.

Homeowners may face substantial background risk to their wealth, which was not captured in the model. If other risks to lifetime wealth are uncorrelated with losses to the home, the results do not change meaningfully. For example, a person could face a 50/50 chance of losing their current job, which might lower lifetime wealth from say \$1 million to \$100,000. Table 3 shows, however, that even with a sure lifetime wealth of \$100,000, the deductible choices imply extreme risk attitudes. The more relevant worry would be if background risk to lifetime wealth were correlated with losses to the home, in which case, in the event of a loss, the marginal value of a dollar would be especially high. Except in very rare cases, such as people who run businesses from their homes, home accidents are unlikely to be correlated with other shocks to lifetime wealth.

IV. Potential Explanations

The results in Section III suggest that people pervasively over-insure modest risks when making home insurance purchases. The amount of risk aversion that is consistent with the diminishing marginal utility of wealth is simply not enough to account for these choices in a rational expectations framework. The question, then, is why people pay for this insurance. The nature of the available data make it difficult to conclusively test between potential explanations. However, this section discusses some of the leading potential explanations for the over-insurance of these modest risks, and provides some simple metrics of how plausible each possibility is as a full explanation for the observed behavior.

A. *Risk Misperception*

Perhaps the most obvious potential explanation for these results is that people may have standard risk preferences, but may not have accurate subjective beliefs about claim rates. Of course, without information on subjective beliefs, this possibility cannot be tested, and, indeed, such an explanation could be given to virtually any finding of deviations from risk neutrality in a market setting. However, the bias in subjective beliefs would need to be quite high and widely held to explain the observed choices. For instance, assuming lifetime wealth of \$1 million, the choice of the \$500 deductible by the average new customer is consistent with a single-digit coefficient of risk aversion only for a subjective claim rate of 18.3 percent—nearly 5 times the observed claim rate of 3.7 percent. For more modest overestimation of claim frequency, the high estimates of risk aversion remain.

B. *Consumption Commitments*

Chetty's (2006) framework for expected utility of wealth assumes that people can costlessly smooth consumption over the lifecycle. As Chetty and Adam Szeidl (2007) point out, however, many consumption choices (e.g., housing) are costly to adjust in the short run, and, as such, an individual facing moderate risks may choose to smooth those risks over only a portion of consumption (e.g., food expenditures). This pattern raises the local curvature of the (indirect) utility function and makes a person more risk averse over moderate stakes than his global utility function would imply. While clearly relevant to deductible choice, as Chetty and Szeidl (2007) note, these considerations cannot plausibly explain the choice to pay roughly \$100 to insure against a 4 percent chance of an extra \$500 loss. For instance, Chetty (2003) provides a calibration of the local curvature of the utility function and finds a CRRA parameter of 7.37. While considerably higher than the CRRA parameter of 1.25 that Chetty (2006) estimates for the global utility, a CRRA parameter of 7.37 is still an order of magnitude or two too low to explain the observed deductible choices.

C. *Borrowing Constraints*

Along the lines of consumption commitments, it could also be possible that individuals are severely liquidity constrained and cannot borrow. This is unlikely to be a serious consideration for the majority of homeowners in the sample, who live in rather expensive homes. Even first-time home buyers, who have just made a large down payment, typically have access to more than \$1,000 in credit. Furthermore, it is not entirely obvious which way extreme liquidity constraints should bite in deductible choice. On one hand a lower deductible is appealing because a liquidity-constrained homeowner may not be able to cover the cost of repairs under a high deductible. On the other hand, there is flexibility in whether to make repairs if a loss occurs (e.g., one need not replace a stolen television), and the money saved up-front by choosing a higher deductible is especially valuable to a temporarily liquidity-constrained individual.[13]

D. *Role of Sales Agents*

Another possibility is that homeowners are not particularly risk averse, but are influenced or pressured to take the more expensive lower deductible contracts by the company's sales agents, who earn partial commissions. While this is a possibility, it is important to note that it is much easier to sell someone something they want in the first place. Furthermore, because this company is not one of the lowest cost providers, the agents frequently suggest high deductibles as a way of lowering policy costs. The data also suggest that the agents are not simply controlling the choices. Over time, as policy costs have risen, customers have shifted away from the lowest deductibles, which makes sense for the customer, but goes against the incentives of the sales agents.

E. *Menu Effects*

The available menu itself may affect choices. People have a tendency to avoid picking the extreme options from a menu and may be reluctant to pick the highest

[13] It is also worth considering how a person gets into a position of extreme liquidity constraints. If the reason is high discount rates, then the reduction in up-front insurance costs would be even more valuable relative to reductions in deductible payments that occur in the future.

or lowest deductible available. If they are unsure of their preferences, they may also infer information about the appropriate choice from the available menu, as in the model by Emir Kamenica (2008). This effect is likely at play to some extent in this market, but it would be hard to argue that it could be the sole explanation for the observed choice patterns. Given the costs here, these menu effects would have to be quite strong to lead risk-neutral individuals away from the $1,000 deductible. In addition, while menu effects could explain the choice of the $500 or $250 deductible, they do not account for which of the two customers pick. In particular, they have difficulty accounting for why, despite an unchanging menu, subjects have switched from the $250 to the $500 deductible over time.

F. *Reference-Dependent Preferences*

The final explanation worth consideration is the possibility that consumers are choosing low deductibles in accordance with their risk attitudes, but that risk attitudes over modest stakes are driven by considerations other than the diminishing marginal utility of wealth. The leading alternative models of risk preferences come from Kahneman and Tversky's (1979) and Tversky and Kahneman's (1992) work on prospect theory. In prospect theory, decision makers focus narrowly on a particular risk and evaluate the outcome compared to a reference point. Prospect theory provides an explanation for first-order risk aversion over modest stakes through the concept of loss aversion, the idea that even small losses are significantly more painful than equivalent gains are pleasurable. Loss aversion is represented by the well-known "kink" in the prospect theory value function at the reference point. Rabin (2000) suggests that loss aversion is one of the more likely explanations for individuals high levels of risk aversion over modest stakes.

However, there has long been a recognition within the literature that standard formulations of prospect theory cannot fully explain insurance purchases over modest stakes. The reason is that since insurance involves paying money to reduce losses, the decision is entirely within the "loss domain" and away from the kink in the value function. As such, loss aversion does not affect insurance purchases in standard prospect theory. In fact, because most estimates of the prospect theory value function are convex over losses (i.e., exhibit "diminishing sensitivity"), in prospect theory people are slightly risk loving over losses.

The only explanation for modest-scale insurance purchases in prospect theory comes from the observation that people tend to overweight small probabilities in their decision making.[14] With a linear value function, the difference in the price (ΔP) a customer would pay for an insurance contract with a lower deductible is simply the weighted probability of a loss multiplied by the difference in deductible levels: $\Delta P = w(\pi)\Delta D$.[15] Conventional estimates of probability weighting, however, can

[14] The evidence on probability weighting suggests that many people overweight low-probability events and underweight high-probability events when making decisions. For background and evidence on probability weighting, see Colin F. Camerer and Teck-Hua Ho (1994); Drazen Prelec (1998); Kahneman and Tversky (1979); Tversky and Kahneman (1992); Tversky and Craig R. Fox (1995); Tversky and Peter Wakker (1995); and Wakker and Tversky (1993).

[15] Here, π is the objective probability of a loss, and $w()$ is the probability weighting function that transforms the objective probability into a decision weight.

only account for around half of the observed willingness to pay for lower deductibles. For example, if one uses this simple formula with the functional form and parameter estimate for probability weighting reported in Tversky and Kahneman (1992), a customer with a 4 percent probability of a loss would be willing to pay around \$45 to lower the deductible from \$1,000 to \$500. That is a little more than twice the expected value, but far below the \$95 that new customers at the company actually paid for low deductibles.

Newer models, particularly Kőszegi and Rabin (2006, 2007), suggest a way in which reference-dependent preferences could lead to purchases of costly modest-scale insurance. In the Kőszegi-Rabin (2006, 2007) framework, feelings about money given up for a purchase are segregated from attitudes toward surprise losses.[16] The idea is quite similar to Nathan Novemsky and Kahneman (2005), who argue that money given up as part of a transaction is a "cost" and does not induce the psychological pain of a "loss," what they call the "no loss in buying" hypothesis. In these frameworks, then, loss aversion affects attitudes toward money paid when an accident happens (i.e., the deductible), but not the amount of money paid up front for the policy. This difference means that loss aversion can increase the willingness to pay for insurance. Following the discussion in Novemsky and Kahneman (2005), the willingness to pay calculation from the last paragraph can instead be given by $\Delta P = \lambda w(\pi)\Delta D$, where λ is the coefficient of loss aversion. Tversky and Kahneman 's (1992) original estimates for prospect theory give a value of λ of 2.25. This would imply a willingness to pay for the \$500 deductible for a customer with a claim rate of 4 percent of just over \$100, which is consistent with the observed willingness to pay for the low-deductible customers in this market. As such, this reference-dependent framework can potentially rationalize the observed choices using existing parameter estimates from other studies.

V. Discussion

The results of this paper suggest that there may be value in exploring alternative preference models in applied work on insurance markets. Doing so may open up new insights about behaviors and may generate policy prescriptions in areas such as health insurance and annuities. It also may be useful in rationalizing seemingly disparate results across different domains of insurance. For example, Cohen and Einav (2007) find much lower levels of risk aversion in their study of deductible choice than I find here. The most obvious potential reason for the difference is simply population heterogeneity. It is reasonable to suspect that Israeli drivers are substantially less risk averse than American homeowners. On the other hand, the reference-dependent model, and specifically probability weighting, suggest another mechanism that may be at work. Typical estimates of the weighting function imply much less severe overweighting of probabilities in the range of 20 percent to 30 percent, which is what the drivers in the Israeli sample experienced, than they do for low probabilities like the 4–5 percent chance of a homeowners insurance loss. It is

[16] See the discussion of Choice Acclimating Personal Equilibria in Kőszegi and Rabin (2007).

unclear whether that dynamic actually accounts for the differences; yet, it is clearly an example of a potential research direction for future work on insurance behavior.

Although the focus of this paper is on consumer choice, it is also reasonable to step back and consider the implications of these results for the understanding of the supply side of this market. The most obvious question that arises here would seem to be whether the company is making excess profits on customers who purchase the low deductible. If so, why does competition not lead new companies to offer these low-deductible contracts at reduced prices?

A look at the profitability of these contracts suggests that prices may be consistent with a competitive equilibrium. The company earns roughly similar profits from low-deductible and high-deductible customers. That might at first seem surprising in light of the findings presented above. However, the important thing to note is that the results above demonstrated that the *marginal* cost (to customers) of lowering the deductible exceeded what that additional insurance was worth to the customers. That is the relevant comparison from the customers' perspective, since their losses are capped at the deductible. For the firm, however, because losses can be quite large, the profitability of different groups of customers depends a great deal on whether there are differences in claim rates between the groups. For example, with average claim payouts around $5,500, a claim-rate differential of even 1 percent would mean that in equilibrium the company would need to collect an extra $55 from the low-deductible customers in order to equalize profits between the groups. The *average* cost matters to the company.

Table 5 provides suggestive evidence that lower deductible customers do, in fact, have higher claim rates than their high-deductible counterparts, and that the average profit level for the two groups of customers are quite similar. The top portion of the table shows raw claim rates and profitability levels for the two deductible groups.[17] The claim rate for new customers who held the $500 deductible was 3.7 with 2.1 percent for those with $1,000 deductibles. Restricting to accidents over $1,000, the claim rates are 3.2 percent and 2.1 percent, respectively. The third column shows that in the raw data, the $1,000 policies are actually more profitable than the $500 deductible policies ($577 versus $502). This reflects the fact that the company has higher profit rates on more expensive houses and those households are more likely to hold high deductibles. To create a direct comparison of similar household with different deductible levels, the bottom part of the table uses propensity-score matching that controls for all of the policy characteristics used in pricing the contracts. The matching estimation reveals that $500 deductible customers yielded an average $23.21 higher profit for the company relative to their $1,000 deductible counterparts. This difference is statistically insignificant and is much lower than the $77.37 figure from the analysis from the consumer perspective in the previous section. In addition, considering that this figure does not include claim processing costs, the difference in equilibrium profitability of the low-deductible and high-deductible customers is probably very small.

[17] The measure of profit used here is simply the difference between the premium collected for a policy and the amount paid out to the customer for claims.

TABLE 5—CLAIM RATES AND PROFITABILITY BY DEDUCTIBLE

Chosen deductible	Claim rate	Claim rate ($L > \$1,000$)	Profit
		Raw averages	
\$500	0.037	0.032	\$501.59
\$1,000	0.021	0.021	\$576.96
		Matched samples	
\$500	0.038	0.034	\$592.16
\$1,000	0.021	0.021	\$568.94
ATT difference	0.017**	0.013**	\$23.21
	(0.005)	(0.005)	(76.99)

Notes: This table provides information on claim rates and profits (defined as the difference between collected premium and company payouts for claims) for new customers who chose the \$500 or \$1,000 deductibles. The top part of the table shows raw averages, while the bottom uses matched samples based on simple propensity score matching on the available rating variables using caliper matching with a radius of 0.02. The second column shows claims for losses that would have exceeded \$1,000 by eliminating the claims for the \$500-deductible customers that had payouts below \$500. Standard errors on the ATT differences are given in parentheses.
**Significant at the 5 percent level.

These results put the consumer-welfare costs of purchasing low deductibles into perspective. Individual customers could benefit financially by avoiding over-insuring modest risk. However, if all homeowners changed their behavior, the company would likely need to raise insurance costs or create a new higher deductible in order to separate the more and less risky customers. This is the reason that the back-of-the-envelope calculation on aggregate savings in Section II is a partial equilibrium result. The market, as it exists now, is inconsistent with standard risk preferences. But if all customers had standard risk preferences, the new market equilibrium would not necessarily be welfare improving for the customers. This result highlights that there are often subtleties when considering the ability of firms to exploit consumer biases in market settings and suggests that a careful examination of these issues should be a priority for research going forward. In particular, a given individual might benefit from debiasing that caused him to avoid purchasing low deductibles, but a policy aimed at changing all consumers' behavior is unlikely (at least in home insurance) to improve the equilibrium for the consumer.

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