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"Honey, the Bank Might Go Bust": The Response of Finance Professionals to a Banking System Shock

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Abstract: How do informed depositors respond to a banking crisis? To shed light on this question, we apply conjoint analysis to a sample of 417 finance professionals from six countries. For a range of bank accounts that differ in the type and level of depositor protection that they offer, we ask each participant to indicate how they would respond to a banking system shock that could potentially affect their own bank. We find that intended withdrawal rates depend only on account profile attributes and are independent of respondent characteristics and respondent expectations about deposit interest rate changes. The most important account attributes are the existence of a formal deposit insurance fund and the fraction of the deposit at risk (particularly for under-capitalized banks).

Keywords: finance professionals; banking crisis; conjoint analysis, deposit insurance

JEL Classifications: G21; G28

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1 Introduction

Several studies have argued that the 2007-2009 financial crisis began with a run on dealer banks in the repo and commercial paper markets—see, for example, Duffie (2011), Gorton and Metrick (2012a, 2012b), and Ivashina and Scharfstein (2010). This contrasts with a traditional bank run in that dealer bank participants are exclusively finance professionals rather than unsophisticated depositors. And having demonstrated a propensity to run in their business capacities, a natural question is how do finance professionals behave with respect to their personal accounts. Do they also tend to run on these accounts when trouble hits? Is any such tendency more or less pronounced than that exhibited by other depositors? And, more generally, how do finance professionals respond to a banking shock that could potentially engulf their bank, and how is this response affected by the regulatory and depositor protection system they face?

Somewhat surprisingly, little is known about the banking behavior of finance professionals. Bodnaruk and Simonov (2015) report that the private portfolios of mutual fund managers are similar to those of matched peers, while Cohn et al (2015) show experimentally that professionals display counter-cyclical risk aversion. Neither, however, sheds any direct light on professionals' banking decisions. Iyer et al. (2015) and Iyer et al. (2016) both find that the propensity to run is positively related to education, wealth, financial literacy and other features likely to be possessed by finance professionals, but neither study explicitly distinguishes between professionals and other depositors possessing similar characteristics.

Despite this lack of academic research on the matter, the personal banking behavior of finance professionals is of obvious importance. As Acharya and Mora (2015) point out, many banks suffered liquidity problems during the 2007-09 crisis and subsequently offered higher interest rates in an attempt to retain and attract deposits. Being wealthier and more financially literate than the average bank depositor, finance professionals would be expected to have the motivation and ability

to rapidly adjust their deposit holdings in response to such interest rate changes (as well as to other bank and regulatory shifts), and hence are likely to have been at the forefront of bank liquidity problems.

Finance professionals are also informed depositors. Many studies have documented the advantages of private information across a wide range of industries. For example, Hendricks and Porter (1988) show that more informed bidders in oil and gas lease auctions subsequently earn significantly greater profits than do their less informed competitors. Similarly, Levitt and Syverson (2008) report evidence that real estate agents use their superior information about housing markets to earn excess returns when they sell their own houses. In financial markets, Bodnaruk and Simonov (2015) find that mutual fund managers out-perform in stocks where they hold an information advantage. The behavior of finance professionals is, therefore, likely to reflect the best available information about the nature of a banking system shock. Moreover, as documented by Ò Gràda and White (2003), it can also trigger an imitative response amongst other depositors.

For these reasons, a better understanding of financial professionals' behavior would seem essential to comprehending, and potentially mitigating, banking system crises. In this paper, we attempt to shed some light on this matter by applying a conjoint approach to a sample of 417 finance professionals from six countries. For a range of bank accounts that differ in the type and level of depositor protection that they offer, we ask each participant two questions about a hypothetical banking system shock: one that asks them to predict how their bank will respond in terms of raising interest rates, and one that asks them how they would respond in terms of withdrawing part of all of their deposit. This allows us to infer the relative weights accorded by finance professionals to different depositor protection methods as well as gain some insight into their overall sensitivity to a systemic shock.

We obtain a number of interesting results. First, respondents who expect the largest increase in bank deposit rates following the shock also report the highest intended deposit withdrawal rates, suggesting the existence of a common factor (such as fear) to both responses. Second, the fraction of a deposit at risk of loss (given its size relative to the generosity of the insurance scheme) has a positive effect on intended withdrawals at all types of bank, although the impact is greater

at under-capitalized banks. Third, finance professionals place great store on the existence of a formal insurance fund: intended withdrawal rates are approximately 10 percentage points lower on average for banks that have membership of such a find. Fourth, although expected interest rate changes are related to various respondent characteristics (age, gender, wealth, risk tolerance, impatience, country of residence), intended withdrawal rates are not: finance professionals are a homogenous group in their personal reaction to a banking crisis. Fifth, the propensity of finance professionals to run (withdraw more than 50% of their deposit) is increasing in the the size of their deposit, the fraction of this deposit that is at risk of loss, and the existence of a formal insurance fund. Finally, when we correct for the endogeneity between expected interest rate and intended withdrawal responses by instrumenting for the former, the positive correlation between these two variables disappears but the other results noted above remain intact.

These results have several implications for banking policy. First, appearances matter. Despite being explicitly told that their country's deposit insurance agency will not fail, the withdrawal rates of finance professionals are significantly greater for accounts where the bank does not contribute to an explicit insurance fund. Second, generosity matters. Finance professionals are sensitive not only to the existence of explicit depositor protection schemes, but also to their munificence. Third, interest rate changes don't matter. While the range of interest rate changes expected by finance professionals vary widely, this bears no relationship to their intended withdrawal rates, suggesting that banks who attempt to shore up their deposit bases by raising interest rates in response to a shock may be wasting their time.

Our work builds on a nascent literature that seeks to better understand banking crises by focussing on the behavior of individual depositors; see, for example, Boyle et al. (2015), Iyer and Puri (2012), Iyer et al. (2015), Iyer et al. (2016), and Söderberg and Webster (2012). We extend this literature by focussing on a sub-group of informed, financially literate and influential investors.

The next section describes our research design and respondent sample in more detail. Section 3 undertakes some preliminary analysis and provides some summary statistics of the collected data. Section 4 outlines our regression models and the

associated estimation approach, while section 5 contains the main results. Section 6 offers some concluding remarks.

2 Research Design and Collection of Finance Professional Data

2.1 Conjoint approach

Our research design consists of two parts. First, we use conjoint analysis to generate data on the response of finance professionals to a hypothetical bank crisis. Second, we ask whether, and to what extent, these responses are systematically related to depositor protection parameters.

The standard conjoint approach presents a series of hypothetical profiles to respondents, who are then asked to rank these profiles according to some specified criterion. The underlying idea is that respondent rankings implicitly reveal their relative preferences across different profile attributes, and that the trade-offs involved can be quantified using standard data analysis methods. In our case, each hypothetical profile represents a bank deposit account with a unique combination of depositor protection features, and respondents are asked how they would respond to a banking system shock given the profile's attributes. This allows us to estimate the effectiveness of each of these features in moderating the crisis-induced responses of finance professionals.[1] A singular advantage of the conjoint approach is that because the respondents are actual finance practitioners, it combines the internal validity of a laboratory experiment with the external validity of a survey, and provides results that are immune to retrospection and social desirability biases: because the scenarios are hypothetical, respondents need not be swayed by the possible social consequences of their crisis-induced behavior or suffer from decisions made in the (possibly distant) past.

Implementing this approach requires specification of (i) the response variables of interest and (ii) the deposit account profiles. We now turn to these tasks.

[1] For an excellent introduction to conjoint analysis, see Green and Wild (1975).

2.1.1 Questions for finance professionals

At the beginning of the survey, participants were informed that they are depositors in a hypothetical bank at the beginning of a potential banking crisis — one of the larger banks in their banking system has just failed. They were also informed that their bank is not "too big to fail", and that their deposit insurance agency is 100% safe (so that any failed bank will be promptly closed).[2]

Following these instructions, every participant in our finance professional sample was asked two questions about each profile:

Question 1 "On hearing about the shock to the banking system, I expect my bank to raise the deposit interest rate by..."

Question 2: "Given the increased risk of bank failure and expected interest rate change, what percentage of your deposit would you immediately withdraw?"

For Question 1, respondents were offered choices in intervals of 0.5 percentage points, ranging from zero to 5.5 points or more. For Question 2, the available options went from 0% to 100% in 10% intervals.

2.1.2 Deposit account profiles

We define profiles in terms of five key attributes: maximum deposit insurance coverage per deposit ($250,000 or $100,000), relative deposit size (75%, 100% or 150% of the maximum deposit insurance coverage), co-insurance provision (100% or 75% guaranteed payment up to the maximum coverage limit), bank capital level (above or below average), and pre-funding of deposit insurance system (yes or no). Our empirical specification of all these attributes is summarized in Table 1.

Even with this relatively small number of attributes, the number of possible combinations, and hence profiles, is infeasibly large. We therefore employ the fractional-factorial design algorithm in the SPSS conjoint module to whittle the number of profiles down to eight: this keeps the survey instrument at a reasonable length and minimizes the cognitive burden on respondents, but at the same time

[2] All participants were also instructed to assume that they have no deposits in another bank, that their bank has no direct government ownership, and that neither taxes nor inflation are a relevant consideration.

Table 1: Glossary of Variables Used in this Paper

Variable	Description
Profile Attributes	
Coverage Limit	The maximum amount that a respondent can claim from the deposit insurer if the bank fails; equals either $100,000 or $250,000.
Deposit as % of Coverage Limit	Size of the deposit specified as a percentage of the coverage limit; equals either 75% or 100% or 150%.
Guaranteed Payout	The percentage of the deposit that the depositor is certain to receive if the bank fails (subject to a dollar maximum equal to the coverage limit); equals either 75% or 100%.
Insurance Fund	1 if the bank contributes to an insurance fund that can be used to pay back depositors of failed banks, 0 otherwise.
Capital Ratio	1 if the bank's capital/total assets ratio is below the average value of this ratio for comparable banks in the depositor's country of residence, 0 otherwise.
Other Profile Variables	
Deposit Size	The dollar value of the deposit.
Deposit Risk	The percentage of the deposit that is at risk (due to insufficient coverage limit or co-insurance) if the bank fails.
Respondent Characteristics	
Age $>$ 50	1 if the respondent is more than 50 years old, 0 otherwise.
Female	1 if the respondent is female, 0 otherwise.
Wealthy	1 if the respondent's financial net worth is $100,000 or more, 0 otherwise.
Risk Tolerant	1 if the respondent is willing to pay $1,000 or more for a security offering equal-probability payoffs of $5,000 and $0, 0 otherwise.
Impatient	1 if the respondent is willing to accept $900 or less now in preference to $1,000 one year from now, 0 otherwise.
Light Bank Supervision	1 if the respondent resides in a country with Barth et al (2013) bank supervisory power index value less than the sample median, 0 otherwise.

captures essential tradeoffs between the various account attributes.[3]

Table 2 describes these eight profiles. Accounts 1, 4, 5 and 7 offer deposit insurance coverage up to a maximum of $100,000 per deposit; for accounts 2, 3, 6 and 8, the coverage limit is $250,000. The deposits in accounts 5 and 6 are exactly equal to their coverage limit, accounts 1, 2, 3 and 7 are 75% of their limit, while accounts 4 and 8 equal 150% of their limits. Accounts 1, 6, 7 and 8 are subject to a depositor haircut while the remaining accounts are not. The net effect of these attributes is that deposits 2, 3 and 5 are guaranteed in full while the remainder have varying fractions at risk in the event of bank failure. Accounts 1, 3, 5 and 8 are held at banks that contribute to an explicit deposit insurance fund while the remaining accounts are held at banks that do not. Finally, accounts 1, 3, 4 and 6 are held at banks with relatively high capital while the remainder are held at banks with relatively low capital. Overall, the structure of these profiles forces our respondents to consider a number of tradeoffs between the various depositor protection policies.

2.2 Data collection

To allow for the possibility that differences in the strength and implementation of banking regulation affect finance professionals' response to a banking shock, we sought participants from multiple countries. In doing so, we followed two principal strategies. First, primarily in the US, we directly approached a variety of relevant organizations such as banks, insurance companies, investment banks, accounting firms and government departments. Second, primarily in other countries, we worked through umbrella groups such as local CFA chapters, INFINZ (New Zealand) and the Financial Market Supervisory Authority (Liechtenstein) to attract participants.

Two typical descriptions of companies in the first group are:

> A cross section of US–based accounting and finance professionals. The majority of the participants work either directly in the investment division or work closely with investment transactions on a daily basis. Experience levels generally range from 5 to 30 years.

[3]This design assumes that each attribute is independent of all others, which rules out interactions among them.

Table 2: Bank Account Profiles

This table describes the eight bank account profiles used in the survey. Each profile has five attributes. Coverage limit is the maximum amount that a respondent can claim from the deposit insurer if the bank fails; it equals either $100,000 or $250,000. Deposit as % of coverage limit is the size of the deposit specified as a percentage of the coverage limit; it equals either 75% or 100% or 150%. Guaranteed payout is the percentage of the deposit that the depositor is certain to receive if the bank fails (subject to a $ maximum equal to the coverage limit); it equals either 75% or 100%. Insurance fund refers to whether or not the bank contributes to an insurance fund that can be used to pay back depositors of failed banks. Capital ratio = above (below) if the bank capital/total assets ratio is above (below) the average value of this ratio for comparable banks in the depositor's country of residence. Deposit size is the dollar value of the deposit. Deposit risk % is the percentage of the deposit that is at risk (due to insufficient coverage limit or co-insurance) if the bank fails.

	Bank Account Profile							
Attribute	1	2	3	4	5	6	7	8
Information provided to respondents								
Coverage limit	$100000	$250000	$250000	$100000	$100000	$250000	$100000	$250000
Deposit as % of coverage limit	75%	75%	75%	150%	100%	100%	75%	150%
Guaranteed payout %	75%	100%	100%	100%	100%	75%	75%	75%
Insurance fund	Yes	No	Yes	No	Yes	No	No	Yes
Bank capital ratio	Above	Below	Above	Above	Below	Above	Below	Below
Implied information								
Deposit size	$75000	$187500	$187500	$150000	$100000	$250000	$75000	$375000
Deposit risk	25%	0%	0%	33%	0%	25%	25%	33%

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Where we were able to track participation by employees of such companies, our response rate averaged a fairly-healthy 26%.

Our final sample consists of 417 respondents from six countries—Austria (18 participants), Germany (8), Liechtenstein (13), New Zealand (50), Switzerland (30), and the US (298). Although heavily weighted towards US participants, the sample's multi-national flavour provides additional variation in finance professionals' reactions to a banking sector shock and, as noted above, permits estimation of the link between such responses and the participants' experience with banking regulation.

3 Preliminary Analysis

Table 3 summarizes the frequency distributions of responses to both the expected interest rate change and intended withdrawal questions. Of the 3336 responses across the eight profiles, most (almost 72%) expect their bank to raise the interest rate on their deposit by less than two percentage points, consistent with the "upwards-sticky" feature of deposit rates observed by Driscoll and Judson (2013). Intended withdrawal rates show more variation: although a significant minority (24.34% of the sample) indicate an intention to sit tight, a sizeable 16.28% intend to withdraw their entire deposit, with 58.8% wishing to withdraw a fraction somewhere between 10% and 90%.

Figure 1 shows the mean responses by profile. The finance professionals in our sample respond most strongly — with average withdrawal rates of 50% or more — for profiles 6–8. The accounts in these three profiles are all subject to 25% haircuts in the event of bank failure, and are held in a bank that either has low capital (profiles 7 and 8) or does not contribute to an insurance fund (profiles 6 and 7). By contrast, the other account that faces a 25% haircut (profile 1) is held in a bank where both of these negative features are absent and the average withdrawal rate is less than 40%. At the other end of the scale, the profile 3 account has high bank capital, a contributory deposit insurance fund, no haircut, and an average

Table 3: Frequency Distributions of Responses to Banking System Shock

This table reports the frequency distributions of 3336 responses by 417 finance professionals to news about a banking system shock. Panel A shows the distribution of responses to the question *"On hearing about the shock to the banking system, I expect my bank to raise deposit interest rate by"*. Panel B shows the distribution of responses to the question *"Given the increased risk of bank failure and expected interest rate change, what percentage of your deposit would you immediately withdraw?"*

Panel A: Interest Rate Change		Panel B: Intended Withdrawal	
Response (%age points)	Frequency %	Response (percentage)	Frequency %
0	27.61	0	24.34
$0.5 - 2$	44.04	$10 - 40$	27.31
$2.5 - 3.5$	17.38	50	16.40
$4 - 5$	6.84	$60 - 90$	15.09
5.5 or more	2.58	100	16.28
Missing	1.56	Missing	0.60

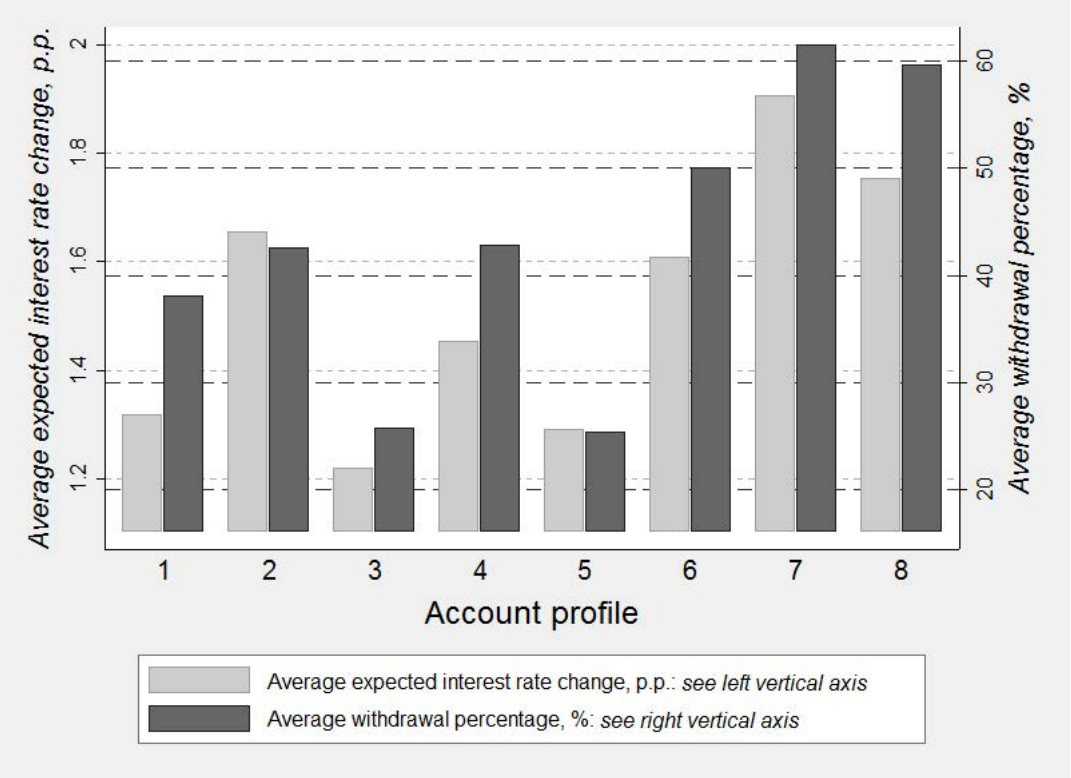

Figure 1: Average respondent withdrawal percentage and expected interest rate change by profile.

withdrawal rate of only 25%.

Another interesting feature revealed by Figure 1 is the obviously strong and positive relationship between responses to the two questions (sample correlation = 0.94): profiles with high (low) mean expected interest rate changes also tend to have high (low) intended withdrawal rates. This suggests the existence of some underlying respondent-specific factor (such as 'fear' or cognitive ability) that affects the reaction of respondents to the news about a bank failure, and hence both the interest rate change they expect and the fraction of their deposit they intend to withdraw. For example, respondents who are most shaken by the news expect banks to respond forcefully (i.e., a big interest rate change) and decide to withdraw a large proportion of their deposit, while less fearful respondents see the news as no big deal and hence expect only a small interest rate change and intend to withdraw only a small proportion of their deposit. Such an endogenous relationship between the two outcome variables potentially creates problems for estimating the relationship between intended withdrawal rate and profile attributes; we return to this issue in detail later in the paper.

The personal characteristics of respondents may also influence their responses to each of the questions individually. Since this potentially affects the relationships we are primarily interested in — the estimated impact of the profile attributes on withdrawal rates and expected interest rate changes — we include controls for respondent age (older than 50 years), gender, and wealth (> $100,000); see Table 1 for more details. We also attempted to elicit information about respondent risk tolerance and impatience. For the former, respondents were asked the following question:

> You are offered the opportunity to buy a security that will immediately expire and pay you back, with equal probabilities, either a total of $5,000 or nothing. What is the maximum amount that you are willing to pay for this security?

Respondents who quoted a price of $1000 or more were categorized as risk tolerant. To identify impatience, respondents were asked a question about two riskless alternives:

> Suppose you are offered a gift of $1,000 payable in one year from today. Alternatively, you may specify any amount to be gifted to you right now. What is the minimum amount you would accept right now instead of the $1,000 in one year?

Respondents who quoted an amount of $900 or more were categorized as impatient. Finally, we use the Barth et al. (2013) Supervisory Power Index to distinguish between respondents who live in countries with relatively light-handed bank supervision and those who are domiciled in more tightly-controlled regimes.[4] Respondents based in countries with index scores below the sample median (Germany, Liechtenstein and New Zealand) were categorized as being under light supervision.

Unsurprisingly, as column (1) of Table 4 reveals, the majority of our sample of finance professionals are relatively wealthy males under the age of 50.[5] Both risk tolerance and impatience are characteristics possessed by approximately 50% of the sample.

Columns (2) and (3) of Table 4 report mean responses by personal characteristic. Overall, both anticipated interest rate changes and intended withdrawal rates, particularly the latter, appear relatively insensitive to these characteristics: all characteristic sub-group withdrawal rates lie within plus or minus 10% of the full sample average rate of 0.432. The characteristic with the strongest impact is residence in a light-supervision country: such respondents expect a 33% bigger interest rate rise and intend an 11% greater withdrawal fraction. Interestingly, older and wealthier professionals expect relatively small interest rate changes but intend to make relatively large withdrawals. This may reflect greater relevant experience on the part of such respondents: they are more aware of upward-stickiness in interest rates, but are also more likely to have witnessed a previous banking crisis (and hence are more wary).

[4] This index is constructed from World Bank surveys of bank regulation between 1999 and 2011.

[5] The Economist (22 October, p15) notes that "In finance, executives begin bowing out in their 40s, flush with wealth and drained by stress."

Table 4: Respondent Characteristics

This table reports descriptive statistics for various statistical characteristics of the 417 respondents in our sample. Column (1) shows the sample proportions for each respondent characteristic. Column (2) shows the mean response to the question *"On hearing about the shock to the banking system, I expect my bank to raise deposit interest rate by"*. Column (3) shows the mean response to the question *"Given the increased risk of bank failure and expected interest rate change, what percentage of your deposit would you immediately withdraw?"*. Terms in square brackets show the mean response of the comparison group. For example, the mean interest rate change expected by respondents over (under) 50 years old is 1.384 (1.600) percentage points. All respondent characteristics are defined in Table 1.

Characteristic	Sample Proportion	Mean Interest Rate Change (p.p.)	Mean Intended Withdrawal (%)
	(1)	(2)	(3)
Age > 50	0.350	1.384	43.83
		[1.600]	[42.88]
Female	0.264	1.325	41.84
		[1.596]	[43.70]
Wealthy	0.832	1.470	43.53
		[1.794]	[41.65]
Risk tolerant	0.489	1.666	41.89
		[1.389]	[44.49]
Impatient	0.511	1.689	43.18
		[1.353]	[43.25]
Light bank supervision	0.170	1.921	47.16
		[1.443]	[42.40]
Full Sample		1.525	43.21

4 Regression Modelling Approach

To disentangle the various effects, we turn to multivariate methods. In this section, we outline our regression models and estimation approach. The models account for the interval-type nature of survey responses and allows for the latter to be affected by account profile and respondent characteristics. In addition, we account for potential mutual dependence of a respondents answers across the eight account profiles by including respondent-specific unobservable effects in the models.

For respondent i and account profile j let r^*_{ij} be the latent expected interest rate increase (in percentage points) and r_{ij} be its observed, interval-type counterpart generated by the question put to our sample of finance professionals. We partition

the range of potential answers into intervals and assume that a particular value of r_{ij} is reported as long as r^*_{ij} falls into an interval centered on r_{ij}; we specify the interval as $[b(r_{ij}), t(r_{ij})]$, where $b(.)$ and $t(.)$ are the known lower and upper bounds respectively. For example, $r_{ij} = 4$ provided that $r^*_{ij} \in [3.75, 4.25]$. Similarly, let w^*_{ij} and w_{ij} be the respective latent and observed deposit withdrawal percentages, and let a particular value of w_{ij} be reported if and only if w^*_{ij} happens to be in an interval $[b(w_{ij}), t(w_{ij)}]$. For example, $w_{ij} = 50$ so long as $w^*_{ij} \in [45, 55]$.

Next, let p_{rj} denote the vector of attributes of account profile j that can potentially affect respondents' expectations about the interest rate, i.e., p_{rj} includes Deposit Size, Deposit Risk, Insurance Fund, and Capital Ratio. Similarly, let vector q_{ri} be the vector of respondent i characteristics that can potentially affect interest rate expectations, i.e., q_{ri} includes Age > 50, Female, Wealthy, Risk Tolerant, Impatient, and Light Bank Supervision. To simplify notation, we stack p_{rj} and q_{ri} in a vector $x_{rij} = [p^{'}_{rj}, q^{'}_{ri}]^{'}$. Defining p_{wj} and q_{wi} similarly for the withdrawal percentage, we also have the vector $x_{wij} = [p^{'}_{wj}, q^{'}_{wi}]^{'}$.[6]

With this investment in notation, our model of the expected interest rate change can be specified as:

$$r^*_{ij} = x^{'}_{rij}\beta_r + u_{ri} + \epsilon_{rij} \tag{1}$$

where β_r is the vector of coefficients to estimate, u_{ri} is the unobservable respondent-specific random effect (which takes the same value across the eight account profiles), and ϵ_{rij} is the error term. The respondent effect u_{ri} may, for example, help account for unobserved differences in the respondents' perceptions of the survey instrument and interpretation of the questions. Similarly, the model of the intended deposit withdrawal percentage is:

$$w^*_{ij} = x^{'}_{wij}\beta_w + u_{wi} + \epsilon_{wij} \tag{2}$$

where β_w is the coefficient vector, u_{wi} is the respondent effect, and ϵ_{wij} is the error term.

To estimate the models by maximum likelihood, we impose distributional assumptions on respondent effects and error terms. In model (1), we define $x_{ri} =$

[6]Note that x_{rij} need not be identical to x_{wij} and that either or both can potentially include a constant term and interactions between profile and respondent characteristics.

$[x_{ri1}^{'}, x_{ri2}^{'}, ..., x_{ri8}^{'}]'$ and assume that (i) $u_{ri} \mid x_{ri} \sim N(0, \sigma_{ru}^2)$ and (ii) $\epsilon_{rij} \mid u_{ri}, x_{ri} \sim$ *i.i.d.* $N(0, \sigma_{r\epsilon}^2)$. The likelihood contribution of respondent i, L_i, is the joint probability of the respondent's answers to the expected interest rate question for all eight bank account profiles:

$$\begin{aligned} L_i(\theta_r) &= L(r_{i1}, r_{i2}, ..., r_{i8} \mid x_{ri}, \beta_r, \sigma_{ru}^2, \sigma_{r\epsilon}^2) \\ &= \int \left[\prod_{j=1}^{8} \left[F_{r\epsilon}(t(r_{ij}) - x_{rij}^{'}\beta_r - u_{ri}) - F_{r\epsilon}(b(r_{ij}) - x_{rij}^{'}\beta_r - u_{ri}) \right] \right] dF_{ru}(u) \end{aligned}$$

where the parameter vector $\theta_r = [\beta_r^{'}, \sigma_{ru}^2, \sigma_{r\epsilon}^2]'$, $F_{r\epsilon}$ is the cumulative distribution function (c.d.f.) of a $N(0, \sigma_{r\epsilon}^2)$ random variable, and F_{ru} is the c.d.f. of a $N(0, \sigma_{ru}^2)$ random variable. Parameter estimates are obtained by maximizing the sample log-likelihood function $lnL(\theta_r) = \sum_{i=1}^{n} lnL_i(\theta_r)$ in Stata 14, which approximates the integral $\int(.)dF_{ru}(u)$ using an adaptive Gauss-Hermite quadrature method. Model 2 is estimated in an analogous manner.

5 Results

5.1 Expected interest rate change

Although our primary interest is in intended withdrawal rates, we first estimate models of the interest rate change forecast by respondents (equation (1)), since any such change potentially affects withdrawals. In column (1) of Table 5, we report the results from regressing the forecast interest change on the account profile attributes only. Somewhat surprisingly, since rational forecasts of interest rate changes should be independent of a respondents' personal situation, the expected change is bigger for large deposits. However, although statistically significant at the 1% level, the effect is economically tiny—an extra $100,000 of deposit is associated with only a 5.7 basis point greater interest rate increase. The impacts of the non-personal profile attributes are as expected: the interest rate rise expected by finance professionals is bigger for deposits offering weaker depositor protection, for deposits not backed by an explicit insurance fund, and for deposits held at under-capitalized banks. Nevertheless, these effects also seem quite small economically. For example, the average interest rate increase expected at a bank with below-average capital is only

Table 5: Regression Models of Respondents' Expected Interest Rate Change

The dependent variable is the interest rate change expected by the respondent, which is regressed on various profile and respondent characteristics defined in Table 1. Estimated coefficients indicate the average percentage point change in the interest rate following a 1-unit increase in the explanatory variable. All models use 3284 respondent-profile observations obtained from 417 respondents, include respondent random effects, and are estimated using maximum-likelihood. Terms in parentheses are robust standard errors clustered at the respondent level. ***, ** and * denote significance at the 1%, 5%, and 10% levels respectively.

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	0.844^{***}	1.092^{***}	0.856^{***}	1.103^{***}
	(0.11)	(0.12)	(0.30)	(0.31)
Bank account profile characteristics				
Deposit size (in $100K)	0.057^{***}	0.028	0.057^{***}	0.027
	(0.02)	(0.02)	(0.02)	(0.02)
Fraction at risk	0.904^{***}	0.121	0.904^{***}	0.122
	(0.14)	(0.23)	(0.14)	(0.23)
Deposit insurance is pre-funded	-0.307^{***}	-0.375^{***}	-0.307^{***}	-0.375^{***}
	(0.04)	(0.04)	(0.04)	(0.04)
Low bank capital	0.379^{***}	0.141^{**}	0.379^{***}	0.141^{**}
	(0.04)	(0.07)	(0.04)	(0.07)
Fraction at risk x low bank capital		1.316^{***}		1.315^{***}
		(0.30)		(0.30)
Individual respondent characteristics				
Age > 50			−0.198	−0.198
			(0.21)	(0.21)
Female			-0.431^{**}	-0.432^{**}
			(0.22)	(0.22)
Wealthy			-0.471^{*}	-0.471^{*}
			(0.26)	(0.26)
Risk tolerant			0.401^{**}	0.401^{**}
			(0.19)	(0.19)
Impatient			0.543^{***}	0.542^{***}
			(0.19)	(0.19)
Light bank supervision			0.525^{**}	0.525^{**}
			(0.25)	(0.25)
Sample log-likelihood	−5164	−5155	−5150	−5140
Likelihood ratio χ^2	249.3	278.8	268.0	297.5
$p-$value	0.00	0.00	0.00	0.00
Respondent random effects χ^2	3197	3211	3053	3067
$p-$value	0.00	0.00	0.00	0.00

14.1 basis points greater than that at a bank with above-average capital. Similarly, the presence of an explicit insurance fund lowers the expected interest rate response by less than a third of a percentage point. Also, the difference between a deposit with 0% at risk (account profiles 2, 3 and 5) if the bank fails and a deposit with 33% at risk (profiles 4 and 8) is only 30 basis points.

In theory, weak depositor protection should only be an issue if the bank has a reasonable probability of failing, so in column (2) we interact fraction at risk with low bank capital. Now deposit size no longer matters, and the fraction at risk only matters for banks with below average capital. The latter effect is also somewhat more economically substantial: the difference between a deposit with 0% at risk and a deposit with 33% at risk at an under-capitalized bank is 44 basis points.

In columns (3) and (4) of Table 5, we add in the respondent characteristics variables. This yields two main results. First, the coefficient estimates for the profile attributes are essentially unchanged. Second, forecast interest rate changes are systematically related to several respondent characteristics: although age does not seem to play a role, male, less wealthy, more risk tolerant and more impatient finance professionals all expect their banks to respond more forcefully to the banking system shock. Perhaps most interestingly, respondents who are resident in countries with relatively light bank supervision anticipate an excess interest rate increase of more than half a percentage point on average.

Overall, finance professionals appear to believe that informally-protected accounts held at banks in a relatively weak financial position will experience the largest interest rate rises following a banking system shock, regardless of their personal characteristics.

5.2 Intended withdrawal rate

Turning to intended withdrawal rates, we report the results from estimating equation (2) in Table 6. As can be seen in columns (1) and (2), finance professionals' personal responses to a banking system shock differ in some ways from their predictions of bank responses. Below average bank capital has no negative implications for intended withdrawals unless the account also has a significant fraction at po-

Table 6: Regression Models of Respondents' Intended Deposit Withdrawal Rate

The dependent variable is the intended withdrawal rate change expected by the respondent, which is regressed on various profile and respondent characteristics defined in Table 1. Estimated coefficients indicate the average percentage reduction in deposit size following a 1-unit increase in the explanatory variable. All models use 3316 respondent-profile observations obtained from 417 respondents, include respondent random effects, and are estimated using maximum-likelihood. Terms in parentheses are robust standard errors clustered at the respondent level. ***, ** and * denote significance at the 1%, 5%, and 10% levels respectively.

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	16.11^{***}	31.96^{***}	14.33^{**}	30.16^{***}
	(2.48)	(3.26)	(6.32)	(6.66)
Bank account profile characteristics				
Deposit size (in $100K)	3.282^{***}	1.416^{*}	3.282^{***}	1.414^{*}
	(0.71)	(0.75)	(0.71)	(0.75)
Fraction at risk	95.68^{***}	46.23^{***}	95.66^{***}	46.19^{***}
	(5.12)	(8.36)	(5.12)	(8.36)
Deposit insurance is pre-funded	-13.51^{***}	-17.82^{***}	-13.51^{***}	-17.82^{***}
	(1.33)	(1.45)	(1.33)	(1.45)
Low bank capital	17.23^{***}	2.033	17.23^{***}	2.025
	(1.34)	(2.45)	(1.34)	(2.45)
Fraction at risk x low bank capital		82.59^{***}		82.63^{***}
		(11.28)		(11.28)
Individual respondent characteristics				
Age > 50			−0.393	0.373
			(4.24)	(4.24)
Female			−3.129	−3.132
			(4.35)	(4.34)
Wealthy			3.102	3.170
			(5.22)	(5.22)
Risk tolerant			−3.037	−3.060
			(3.85)	(3.85)
Impatient			0.169	0.129
			(3.77)	(3.76)
Light bank supervision			7.658	7.725
			(5.18)	(5.17)
Sample log-likelihood	−6616	−6589	−6614	−6587
Likelihood ratio χ^2	699.0	752.1	702.6	755.8
$p-$value	0.00	0.00	0.00	0.00
Respondent random effects χ^2	1152	1176	1138	1162
$p-$value	0.00	0.00	0.00	0.00

tential risk of loss. Conversely, weak depositor protection resulting in a significant fraction at risk is associated with a significantly higher withdrawal rate even at a well-capitalized bank: the intended withdrawal rate is 15.4% greater on a deposit with 33% at risk relative to a deposit with 0% at risk. One feature is similar though: deposits not backed by an explicit insurance scheme experience withdrawal rates that are 17.82% greater.

Columns (3) and (4) of Table 6 include the respondents' personal characteristics. However, none of these is related to intended withdrawal rates, and their inclusion has no effect on the results in columns (1) and (2). This result is somewhat comforting. According to the mutual fund theorem of Markowitz (1952) and Tobin (1958), the composition of an investor's risky asset portfolio should depend only on the perceived investment opportunity set and be independent of personal characteristics. To the extent that finance professionals' perceptions of investment opportunities are independent of the personal characteristics for which we have data, this is precisely what we find. Thus, in contrast to the analysts discussed in the asset allocation puzzle of Canner et al. (1997), our finance professionals apparently behave in accordance with modern portfolio theory.[7]

Overall, the results of Table 6 suggest that when it comes to effective depositor protection, both appearances and generosity matter. Despite explicitly telling study participants that their country's deposit insurance agency will not fail, deposits held at banks that contribute to a *formal* insurance fund experience much lower withdrawal rates. Withdrawal rates are also significantly lower for accounts subject to generous protection coverage (e.g., 0% risk of loss in the event of bank failure) even if the risk of needing to draw on that coverage (e.g., at a well-capitalized bank) is low.

5.3 The relationship between intended withdrawal rate and expected interest rate change

The models reported in Table 6 omit two important features. First, respondents were asked (see section 2.1.1) to signal their intended withdrawal rate "(g)iven...the

[7]This might not be the case if investors have different exposures to non-traded assets like human capital, but this is unlikely to be an issue for a homogenous group such as finance professionals.

Table 7: The Relationship Between Intended Deposit Withdrawal Rate and the Expected Interest Rate Change

The dependent variable is the respondents' intended withdrawal rate, which is regressed on the expected interest rate change and various account profiles that are defined in Table 1. Estimated coefficients indicate the average percentage reduction in deposit size following a 1-unit increase in the explanatory variable. All models use 3316 respondent-profile observations obtained from 417 respondents, include respondent random effects, and are estimated using maximum-likelihood. Terms in parentheses are robust standard errors clustered at the respondent level. ***, ** and * denote significance at the 1%, 5%, and 10% levels respectively.

Explanatory Variable	(1)	(2)
Constant	14.95^{***}	24.71^{***}
	(1.69)	(2.18)
Expected interest rate change	8.55^{***}	8.317^{***}
	(0.49)	(0.48)
Deposit size (in \$100K)	2.008^{***}	0.802
	(0.46)	(0.49)
Fraction at risk	58.20^{***}	28.91^{***}
	(3.26)	(5.26)
Deposit insurance is pre-funded	-6.49^{***}	-9.188^{***}
	(0.87)	(0.94)
Low bank capital	9.190^{***}	0.297
	(087)	(1.53)
Fraction at risk x low bank capital		50.52^{***}
		(7.16)
Sample log-likelihood	−6616	−6589
Likelihood ratio χ^2	699.0	752.1
$p-$value	0.000	0.000
Respondent random effects χ^2	1152	1176
$p-$value	0.000	0.000

expected interest rate change". Thus, the expected interest rate change is potentially a missing variable in equation (2) and hence in the Table 6 models. Second, the expected interest rate change is also an outcome variable and so is an endogenous regressor in equation (2).

To address these issues, we need to find suitable instruments for the expected interest rate change before including it in the withdrawal rate models. Fortunately, Tables 5 and 6 suggest some obvious candidates: the set of respondent personal characteristics are significantly related to the expected interest rate change, but

not to the intended withdrawal rate, and hence potentially satisfy the exclusion restrictions.

We proceed in two steps. First, we include the expected interest rate change as an additional exogenous regressor in equation (2) and report the results in Table 7. Anticipating the subsequent instrumental variables estimation, we omit the respondent personal characteristics.

Table 7 confirms the strong positive association between intended withdrawal rate and expected interest rate change: the estimated coefficient is statistically significant at better than the 1% level, although it is economically quite small. The strength of the relationships between intended withdrawal rate and the deposit profile attributes is unaffected, although their magnitude is substantially smaller than in Table 6.

If the expected interest rate change were exogenous in these models, we would expect to see it have a negative impact on the intended withdrawal rate: a bigger interest rate rise offers greater risk compensation and hence, all else the same, should induce a lower withdrawal rate. The positive association we actually observe suggests there is some unobserved common factor that simultaneously affects the responses to both questions. For instance, more fearful respondents may wish to withdraw a greater percentage of their deposit and project this behavior onto their prediction of what their bank will do. As any such common factor will cause correlated errors in the expected interest rate and intended withdrawal rate regression equations, we need to move to the second step and instrument for the endogenous expected interest rate change.

We employ two sets of instruments, both, for reasons discussed above, based on the respondents' personal characteristics. The first set consists of all personal characteristic variables; the second contains only the Risk Tolerant and Impatient variables. The latter is the strongest set of instruments available to us and validity is not rejected by the Sargan-Hansen statistic. The same test casts some doubt on the validity of the former set, but we report it for completeness and to illustrate that the results are not very sensitive to the precise choice of instruments.

Columns (1) and (2) of Table 8 report the results from using the full set of instruments while columns (3) and (4) employ the part set. Adjusting for the

Table 8: Instrumental Variables Models of Respondents' Intended Deposit Withdrawal Rate

The dependent variable is the respondents' intended withdrawal rate, which is regressed on various profile and respondent characteristics. To allow for the the endogeneity of the expected interest rate change, we employ two sets of instruments: Full (Age $>$ 50, Female, Wealthy, Risk Tolerant, Impatient, and Light Bank Supervision) and Part (Risk Tolerant, Impatient). All variables are defined in Table 1. Estimated coefficients indicate the average percentage reduction in deposit size following a 1-unit increase in the explanatory variable. All models use 3316 respondent-profile observations obtained from 417 respondents, include respondent random effects, and are estimated using maximum-likelihood. Terms in parentheses are robust standard errors clustered at the respondent level. ***, ** and * denote significance at the 1%, 5%, and 10% levels respectively.

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	23.44^{***}	34.10^{***}	30.54^{***}	42.39^{***}
	(4.89)	(4.05)	(7.92)	(6.13)
Expected interest rate change	2.001	2.051	-3.472	-3.486
	(3.57)	(2.31)	(5.95)	(3.82)
Deposit size (in \$100K)	2.279^{***}	0.897	2.506^{***}	0.987^{*}
	(0.50)	(0.57)	(0.56)	(0.59)
Fraction at risk	62.66^{***}	29.20^{***}	66.40^{***}	29.56^{***}
	(4.14)	(6.08)	(5.36)	(6.30)
Deposit insurance is pre-funded	-7.957^{***}	-10.93^{***}	-9.184^{***}	-12.49^{***}
	(1.19)	(1.26)	(1.63)	(1.55)
Low bank capital	11.09^{***}	0.897	12.68^{***}	1.447
	(1.36)	(1.78)	(1.96)	(1.87)
Fraction at risk x low bank capital		57.20^{***}		63.16^{***}
		(8.62)		(9.49)
Instruments	Full	Full	Part	Part

endogeneity of the expected interest rate change has two principal effects. First, the positive relationship between intended withdrawal rates and expected interest rate changes disappears: the two outcome variables are independent. Second, the various relationships between intended withdrawal and account profile attributes are essentially unchanged: low bank capital does not result in higher intended withdrawals unless the account also has a significant fraction at potential risk of loss, but a significant fraction at risk (weaker deposit protection) is associated with significantly higher withdrawals even at a well-capitalized bank.

The new implication of interest from Table 8 is the independence of intended

withdrawal rates from expected interest rate changes. Finance professionals apparently decide on the reallocation of their asset portfolios without regard to the attractiveness of changes undertaken by their bank. This suggests that bank efforts to maintain their deposit funding sources by raising interest rates may be of little value—for finance professionals, the response to a banking shock appears to be price-inelastic.

5.4 The propensity of finance professionals to run

Our models to date have focused on the entire distribution of withdrawal rates. However, it is possible that extreme withdrawal responses—runs—may have different characteristics. To investigate this issue, we follow Iyer et al. (2015) and introduce a new variable equal to 1 if the intended withdrawal rate is 50% or more (a "run") and 0 otherwise. Table 9 shows four probit models estimated using this new dependent variable. The results are essentially the same as before: the propensity of finance professionals to run depends on the generosity and pre-funding of deposit insurance, is affected by low bank capital only if insurance generosity is relatively low as well, and is independent of expectations about interest rates available on deposits.

6 Concluding Remarks

How do informed depositors respond to a banking crisis? In this paper, we have attempted to shed light on this question by applying conjoint analysis to a sample of 417 finance professionals from six countries. This sample of respondents appears to be reassuringly "rational". They predict relatively small changes to interest rates following a banking system shock, consistent with them being aware of upward-stickiness of deposit rates, and the quantities they intend to withdraw from their accounts are independent of their personal characteristics, consistent with modern portfolio theory.

Our results suggest that when it comes to depositor protection, both appearances and generosity matter. Withdrawal rates by finance professionals are significantly lower when their bank participates in a pre-funded insurance scheme, even

Table 9: The Propensity of Finance Professionals to Run

This table presents results from probit models (coefficients reported are marginal effects). The dependent variable equals 1 if the intended withdrawal rate exceeds 50%. The models in columns (3) and (4) employ two sets of instruments for the endogenous expected interest rate change variable: Full (Age > 50, Female, Wealthy, Risk Tolerant, Impatient, and Light Bank Supervision) and Part (Risk Tolerant, Impatient). All other variables are defined in Table 1. All models include respondent random effects. Terms in parentheses are robust standard errors clustered at the respondent level. ***, ** and * denote significance at the 1%, 5%, and 10% levels respectively.

Explanatory Variable	(1)	(2)	(3)	(4)
Expected interest rate change			0.014	-0.059
			(0.07)	(0.07)
Bank account profile characteristics				
Deposit size (in $100K)	0.0116^{*}	0.012^{*}	0.011^{**}	0.011^{**}
	(0.01)	(0.01)	(0.00)	(0.00)
Fraction at risk	0.152^{**}	0.152^{**}	0.161^{**}	0.146^{**}
	(0.08)	(0.08)	(0.08)	(0.07)
Deposit insurance is pre-funded	-0.117^{***}	-0.117^{***}	-0.117^{***}	-0.125^{***}
	(0.01)	(0.01)	(0.02)	(0.01)
Low bank capital	0.018	0.018	0.018	0.022
	(0.02)	(0.02)	(0.02)	(0.02)
Fraction at risk x low bank capital	0.614^{***}	0.615^{***}	0.617^{***}	0.632^{***}
	(0.10)	(0.10)	(0.11)	(0.09)
Individual respondent characteristics				
Age > 50		0.002		
		(0.04)		
Female		-0.012		
		(0.04)		
Wealthy		0.023		
		(0.04)		
Risk tolerant		-0.053^{*}		
		(0.03)		
Impatient		0.008		
		(0.03)		
Light bank supervision		0.075^{*}		
		(0.04)		
Instruments	NA	NA	Full	Part
# of observations	3316	3316	3279	3279
Respondent random effects	Yes	Yes		
Sample log-likelihood	-1466	-1463	-7657	-7695
Likelihood ratio χ^2	414.9	420.6		
$p-$value	0.00	0.00		
Respondent random effects χ^2	966.1	944.9		
$p-$value	0.00	0.00		

when they know that their country's insurance agency is foolproof. Withdrawals are also lower when deposit insurance covers a greater fraction of deposits. On the other, interest rate changes do not have any impact on withdrawal decisions, suggesting that bank efforts to shore up their deposit bases by raising interest rates in response to a shock may be ineffectual. .

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