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Abstract: Using a conjoint analysis of 417 finance professionals from six countries, we find no evidence that higher interest rates cause knowledgeable depositors to moderate their withdrawals during a banking crisis. In fact, intended withdrawals are positively correlated with expected interest rate changes. After accounting for endogeneity, this relationship disappears, consistent with the attractiveness of higher returns being offset by increased doubts about bank solvency. The withdrawal decisions of finance professionals are also independent of their personal characteristics, but they appear to place considerable store on deposit insurance generosity and the presence of a formal insurance fund.

Keywords: interest rates; deposit withdrawals; banking crisis; conjoint analysis

JEL Classifications: G21; G28

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Can Banks Placate Knowledgeable Depositors by Offering Higher Interest Rates During a Banking Crisis?

1 Introduction

Researchers have noted the tendency of banks to offer higher interest rates in an attempt to retain and attract deposits during a banking crisis (e.g., Acharya and Mora, 2015; Goldberg and Hudgins, 2002; Lambert et al., 2017; Park and Peristiani, 1998). In this paper, we investigate the likely success of such efforts. That is, given varying degrees of deposit insurance generosity, do depositors at potentially-troubled banks respond positively or negatively to the offering of higher interest rates by such banks?

The theoretical response is ambiguous. On the one hand, a higher interest rate provides compensation for perceived extra risks (if any) and so is potentially attractive to wary depositors. On the other hand, a more sophisticated response could interpret a higher interest rate as signaling that the bank is riskier than previously thought, which would encourage greater deposit withdrawals.

The second, signaling, effect seems most likely to be a characteristic of "knowledgeable" depositors who understand risk-return tradeoffs and the incentives faced by banks. For such depositors, the response to a higher offered interest rate by a potentially-troubled bank is uncertain: their demand for the deposits of such a bank may rise, fall, or remain the same, depending on how they assess the relative magnitudes of the compensation and signaling effects.

As a result of these conflicting effects, the extent to which higher interest rates are likely to be effective in shoring up a bank's deposit base is unclear, at least for knowledgeable depositors.[1] Unfortunately, investigating the crisis reaction of knowledgable depositors to the offer of a higher interest rate faces obvious difficulties. First, data on individual depositors' transactions during a banking crisis are typically unavailable, or are available only for a single bank from a single country (e.g., Iyer and Puri, 2012; Iyer et al., 2016b). Second, even where such data do exist, they are unable

[1] We make no claims that our results necessarily generalize to the average depositor, since knowledgeable depositors are likely to differ in important ways. Nevertheless, knowledgeable depositors may influence the behavior of other bank depositors, particularly during a crisis.

to distinguish between knowledgeable and other depositors. To work around these problems, we adopt a conjoint analysis approach that surveys a multinational sample of 417 finance professionals. We focus on finance professionals because they seem likely to meet our knowledgeable-depositor criterion: depositors who work in the finance industry should have a relatively good understanding of risk-return tradeoffs, banks, deposit insurance, and other relevant issues.

For a range of bank accounts that differ in the type and level of depositor protection offered, we ask our sample of finance professionals two questions about their reaction to the hypothetical collapse of a major national bank: one question asks them to predict how their bank will respond in terms of raising interest rates, while the other asks them how (*given* the expected interest rate change) they would respond in terms of withdrawing some fraction of their deposit. This allows us to isolate the tradeoff between interest rates and deposit withdrawals at the individual depositor level, after controlling for variation in deposit insurance coverage and several personal characteristics (such as age, gender and risk tolerance, and experience with deposit insurance systems).

Our main result is that anticipated higher interest rates do not reduce intended deposit withdrawals during a crisis, at least for finance professionals. In fact, answers to the two questions are strongly *positively* correlated (i.e., higher interest rates are associated with greater withdrawal percentages), although this appears to be due to the existence of a common unobservable factor. When we correct for the resulting endogeneity problem by instrumenting the expected interest rate change, the positive relationship between the two variables disappears. This is consistent with knowledgeable depositors, as proxied by our sample of finance professionals, viewing the offer of higher interest rates during a crisis as a two-edged sword: the attractiveness of higher interest rates is offset by increased doubts about bank solvency.

Although our primary focus is on the tradeoff between expected interest rate changes and intended withdrawals of knowledgeable investors, we also extend recent research that treats the behavior of finance professionals as a topic of interest in its own right. For example, Bodnaruk and Simonov (2015) report that the private portfolios of mutual fund managers are similar to those of matched peers who lack financial expertise, Cohn et al. (2015) show experimentally that professionals display counter-cyclical risk aversion, and Agarwal et al. (2017) find that professionals

are less likely to default on their mortgage. None of these, however, sheds any direct light on professionals' personal banking decisions. Iyer et al. (2016a) and Iyer et al. (2016b) 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, suggesting that such investors may be *more* likely to react strongly when confronted with a banking shock. However, neither study explicitly distinguishes between professionals and other depositors possessing similar characteristics, so the extent to which their results reflect the behavior of finance professionals is unclear. Our analysis hopes to shed further light on the personal banking actvities of this important group of investors, particularly how their crisis-period decisions are affected by depositor protection features and bank risk.

In this regard, three results stand out. First, generosity matters. Finance professionals are sensitive not only to the existence of explicit depositor protection schemes, but also to the type and extent of the coverage they offer. Second, appearances matter. Finance professionals place great store on the existence of a formal, pre-funded, deposit insurance fund when faced with a potential banking crisis: intended withdrawals are approximately 10 percentage points lower on average for banks that contribute to such a fund. Third, finance professionals are a homogenous group in their personal reaction to a banking crisis: their intended withdrawal rates are independent of personal characteristics.

The next section describes our research design and respondent sample in more detail. Section 3 undertakes some preliminary analysis and provides summary statistics of the collected data. Section 4 outlines our basic estimation approach and the associated results, together with some robustness tests. In section 5, we allow for the likelihood of endogenous responses and undertake an instrumental variables estimation of the relationship between expected interest rate changes and intended withdrawal percentages. We also extend our analysis to the potential for bank runs. Finally, section 6 offers some concluding remarks.

2 Research Design and Data Collection

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 investigate whether, and to what extent, these responses are systematically related to each other and to depositor protection parameters.

The standard conjoint approach is a field experiment which presents a series of hypothetical profiles to informed 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. The principal advantage of conjoint analysis is that it combines the internal validity of a laboratory experiment with the external validity of a survey.[2] Compared to a survey, which focuses on historical behavior, it produces results that are less subject to retrospection and social desirability biases: because all scenarios are hypothetical, respondents need not be swayed by the possible social consequences of their crisis-induced behavior, or fail to recall decisions made in the (possibly distant) past. Compared to a laboratory experiment, it can accommodate multi-critera decision-making (such as different aspects of a deposit insurance regime) and allows us to focus directly on subjects of interest — in this case finance professionals rather than, say, students.[3]

In the case we wish to consider, each hypothetical profile is represented by a bank on-call deposit account with a unique combination of depositor protection features. Respondents are then asked how they would respond to a banking system shock given each profile's attributes. This allows us to estimate the effectiveness of each attribute in moderating the crisis-induced responses of finance

[2]For an excellent introduction to conjoint analysis, see Green and Wind (1975). For an application to banking, see Boyle et al. (2015).

[3]The conjoint approach is not costless. In particular, it assumes that each attribute is independent of all others, thus ruling out interactions among them. Also, tractability requires that the various profile attributes be restricted to a small number of possible values.

professionals.

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

2.1.1 Questions and response variables

At the beginning of the survey, participants were informed that they are depositors in a hypothetical bank at the beginning of a possible banking crisis — one of the larger banks in their country has just failed. As Cubillas et al. (2017, p.47) point out:

> "The collapse of a large bank can threaten the stability of a country's whole financial system through further failures as a result of direct credit losses, contagion effects or a general loss of confidence."

Participants 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).[4]

Following these instructions, every participant in our finance professional sample was asked two questions about each account 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% steps.[5]

[4] 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 relevant considerations.

[5] A potential limitation is that some respondents may, in some cases, have had a negative value (e.g., expected a lower interest rate) in mind, but reported zero (i.e., the nearest available answer option) due to the survey design. To counter this, we use (see section 4.1) an interval-type regression where the likelihood of a zero answer is the

A potential complication here is that, since 2010, section 337.6 of the FDIC's rules and regulations has restricted "less than well capitalized" banks in the United States from offering deposit rates that are more than 75 basis points higher than those prevailing in the relevant market area.[6] However, we do not impose this restriction on our survey respondents, for two principal reasons. First, our respondents are never told to assume that their bank is under-capitalized, only that a large bank in their system has failed and that this raises the likelihood of financial difficulties for their bank. Thus, the restriction does not apply to the scenario our respondents are asked to consider. Second, similar regulations are not part of the regulatory landscape in other countries represented in our sample.

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 in the banking system), and pre-funding of deposit insurance (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, equals 48 ($2 \times 3 \times 2 \times 2 \times 2$) which is infeasibly large for a survey. 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 allows us to capture essential tradeoffs between the various account attributes.

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

probability that the latent interest rate change is between $-\infty$ and 0.25 percentage points. Similar considerations apply to Question 2.

[6] See, for example, https://www.fdic.gov/news/news/financial/2009/fil09062a.pdf

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.
Additional Variables Constructed Using Profile Attributes	
Deposit Size	The dollar value of the deposit.
Fraction at 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 instead of $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 that is less than the sample median, 0 otherwise.

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; this has three options: 75%, 100%, 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. Fraction at 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	$100,000	$250,000	$250,000	$100,000	$100,000	$250,000	$100,000	$250,000
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
Capital ratio	Above	Below	Above	Above	Below	Above	Below	Below
Implied information								
Deposit size	$75,000	$187,500	$187,500	$150,000	$100,000	$250,000	$75,000	$375,000
Fraction at risk	25%	0%	0%	33%	0%	25%	25%	33%

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 among the various depositor protection policies.

2.2 Data collection

To allow for the possibility that finance professionals' response to a banking shock may be affected by different exposures to deposit insurance and banking regulation, we sought participants from three global regions: Europe, New Zealand (NZ), and the United States (US). Our rationale was that these regions capture different degrees of depositor protection: one with a long history of deposit insurance (US), one with a shorter history and recently subject to a major bank failure (Europe), and one without deposit insurance (NZ).

In obtaining respondents from these three regions, 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. Once the relevant organizations were identified, we contacted the executive management to solicit their endorsement of the study to their members in the hope of maximizing response rates. Second, primarily in Europe and NZ, we worked through umbrella groups such as local CFA chapters, INFINZ (NZ) and the Financial Market Supervisory Authority (Liechtenstein) to recruit participants.[7]

While specific job titles of the respondents vary, all of them are finance professionals in that they either work in the investment division, or provide financial planning solutions, or oversee financial market operations.[8] Two typical descriptions of the type of work performed by our respondents

[7]This approach to obtaining participants meant we were unable to calculate response rates in Europe and NZ. Among prospective US respondents, the response rate was 26.5%.

[8]For confidentiality reasons, we are unable to disclose the identities of organizations employing our survey respondents.

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.
>
> Our advisors provide holistic financial planning solutions directly to customers, and work across the spectrum of insurance, risk management, investments and retirement planning.

Data collection and organization were undertaken between January 2015 and March 2016. Our final sample consists of 417 respondents distributed as follows: 69 from Europe, 50 from NZ, and 298 from the US.[9] Although heavily weighted towards US participants, the sample's multi-national flavor nevertheless provides cross-country variation in finance professionals' reactions to a banking sector shock.

3 Preliminary Analysis

Table 3 summarizes the frequency distributions of responses to both the expected interest rate change and intended withdrawal questions. Of the 3,336 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. Intended withdrawals 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%. For the full sample of responses, the mean expected interest rate change is 1.53 percentage points and the mean intended withdrawal is 43.21%.

Figure 1 breaks down the mean responses by account profile. The finance professionals in our sample respond most strongly — with average withdrawal amounts of 50% or more — for profiles

[9]The intra-Europe breakdown is: Austria (18 participants), Germany (8), Liechtenstein (13), and Switzerland (30).

Table 3: Frequency Distributions of Responses to Banking System Shock

This table reports the frequency distributions of 3,336 responses by 417 finance professionals to news about a banking system shock. Panel A shows the distribution of responses in percentage points (p.p.) to the question *"On hearing about the shock to the banking system, I expect my bank to raise the deposit interest rate by"* (3,284 non-missing observations). 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?"*(3,316 non-missing observations) The last row provides the mean responses to the two questions.

Panel A: Interest Rate Change		Panel B: Intended Withdrawal	
Response (p.p.)	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
Mean	1.53p.p.	Mean	43.21%

6–8. The accounts in these three profiles are subject to a 25% haircut 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 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, but still faces an average withdrawal of 25%.

Our finance professional respondents do not seem to have complete confidence in deposit insurance. As the survey instructions informed them that the deposit insurance agency for their bank cannot fail, this is somewhat puzzling. It may be that, as professionals, their concerns relate to promptness of payment.[10] They also place great store on the pre-funding of deposit insurance,

[10] As Ellis (2013) points out that there is a small chance that, if a crisis is big enough, the Federal Deposit Insurance Corporation (FDIC) will be unable to pay insured depositors, and a somewhat bigger chance that payment will be delayed.

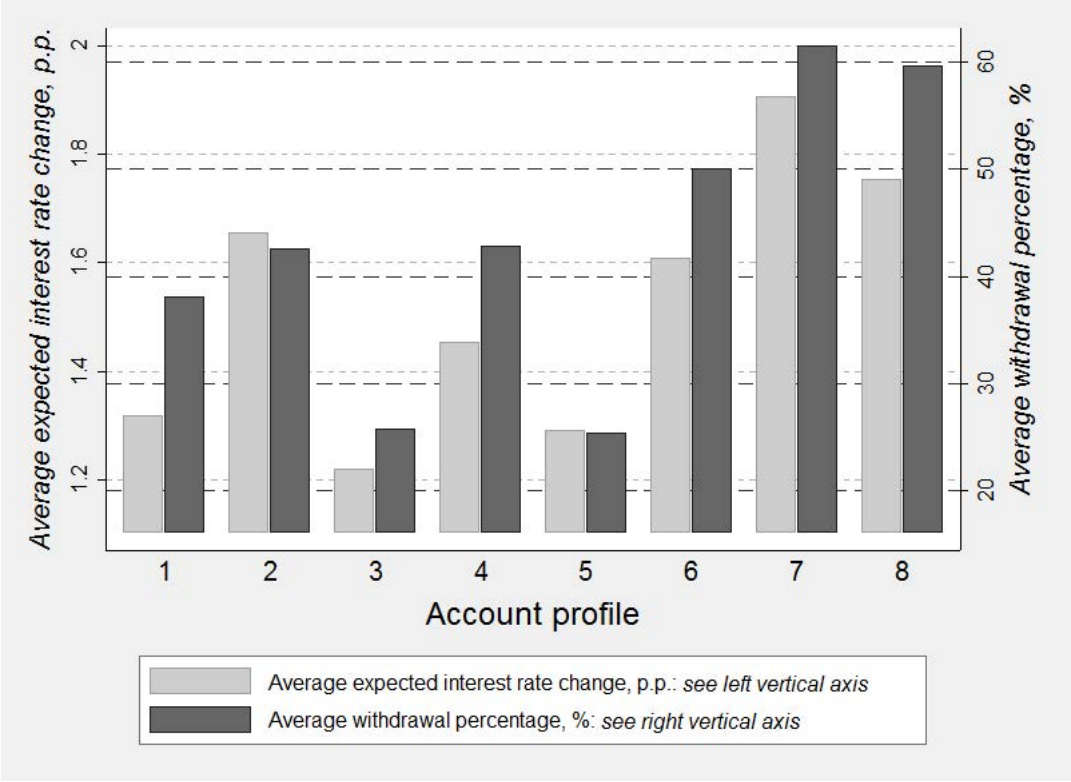

Figure 1: Average expected interest rate change and withdrawal percentage by profile.

which again suggests a pre-occupation with the speed of payment. This shows up in a comparison of profiles 7 and 8: despite having a greater fraction of its deposit at risk of loss, the average intended withdrawal percentage is lower for the latter profile (although the difference is not statistically significant). Since the only other dimension along which the two profiles differ is insurance pre-funding (which profile 8 offers, but 7 does not), this suggests that respondents prefer insurance pre-funding to a relatively small increase in insurance coverage.

The other interesting feature of Figure 1 is that profiles with high (low) mean expected interest rate changes also tend to have high (low) intended withdrawal percentages, suggesting that responses to the two questions may be positively correlated. To investigate this further, we estimate the eight correlations for each account profile: profile 1 (0.254), 2 (0.318), 3 (0.319), 4 (0.280), 5 (0.299), 6 (0.302), 7 (0.280), 8 (0.198), all of which are significantly different from zero at the 0.01% level or better. These strong correlations could indicate that finance professionals interpret

interest rate rises by troubled banks primarily as a signal of "bad news", but could also reflect an endogeneity problem rather than a causal relationship. We return to this issue in detail later in the paper.

The personal characteristics of respondents may also influence their responses. For example, Söderberg and Wester (2012) provide evidence suggesting that women might be less reactive than men in the event of a financial crisis. Therefore, when estimating the impact of profile attributes on the expected interest rate change and intended withdrawal percentage, we include controls for respondent age (indicator for > 50 years), gender (indicator for female), and wealth (indicator for net worth $>$ \$100,000). The definitions of these variables appear in Table 1.

We also include controls for personal risk and time preferences. While risk and time are difficult to separate in financial decision-making, research indicates that they relate to different aspects of investor preferences (e.g., Andreoni and Sprenger, 2012). Thus, we attempt to distinguish between them using two different questions. In the case of risk preferences, respondents were asked the following question adopted (with modifications) from Guiso and Paiella (2008):

> 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?

A larger willingness-to-pay is indicative of greater risk tolerance. We split the responses into two approximately equal-sized groups, creating a dummy (labelled "risk tolerant") set equal to 1 for respondents quoting a maximum price of \$1,000 or more, and 0 otherwise.

To elicit information about time preferences, we draw on an extensive discussion in Frederick et al. (2002) and ask our respondents the following question about two riskless alternatives:

> 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?

Willingness to accept a smaller amount is indicative of greater impatience. Similar to the case of risk tolerance, we split the sample into two approximately equal-sized groups, creating a dummy

(labelled "impatient") set equal to 1 for respondents quoting a minimum current value of $900 or less, and 0 otherwise.

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.[11] Respondents based in countries with index scores below the sample median (Germany, Liechtenstein and New Zealand) are categorized as being under light supervision.

Column (1) of Table 4 reveals that the majority of our sample of finance professionals are relatively wealthy males under the age of 50.[12] Approximately 26% are female, and 17% come from countries with light bank supervision. Columns (2) and (3) of Table 4 report mean responses to the interest rate and withdrawal questions, respectively, for the full sample and for subsamples defined according to values of personal characteristics (recall that all characteristics are binary). Table 4 also shows, for each characteristic, whether differences between respective subsample means are statistically significant (based on a two-sided t-test).

Overall, expected interest rate changes appear to be somewhat sensitive to personal characteristics, while intended withdrawals tend to be less so. For example, all subsample mean withdrawal amounts are within 10% of the full sample average of 43.21. The characteristic with the strongest impact is residence in a light-supervision country: such respondents expect a 33% greater interest rate rise and intend an 11% larger withdrawal fraction on average than those from heavy-supervision countries (both differences are statistically significant at the 1% level). Interestingly, older and wealthier professionals expect smaller interest rate changes (differences between subsample means are statistically significant), but plan to make slightly larger withdrawals on average (differences are not statistically significant, however) than their younger and poorer counterparts. This may reflect greater relevant experience on the part of older and wealthier respondents: they could be more aware of upward-stickiness in interest rates (Driscoll and Judson, 2012), but are also more likely to have witnessed a prior banking crisis (and hence would be more likely to withdraw deposits).

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

[12] The Economist ("Private Equity: The Barbarian Establishment", 22 October 2016, 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 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. Columns (2) and (3) also report the statistical significance of the differences in group means: ***, ** and * denote significance at the 1%, 5%, and 10% levels respectively. All respondent characteristics are defined in Table 1.

Characteristic	Sample Proportion	Mean Interest Rate Change (p.p.) ($n = 3284$)	Mean Intended Withdrawal (%) ($n = 3316$)
	(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]

4 Regression Modeling

4.1 Conceptual and Econometric Model

To disentangle the various effects, we turn to multivariate methods. The survey instrument's layout suggests a conceptual model in which the expected interest rate response is determined first, with the withdrawal rate chosen second given the expected interest rate response. In effect, the shock to the banking system and expected interest rate change shift the investment opportunity set.

We formally model this structure in the following way. For respondent i, where $i = 1, 2, ..., n$ (the

total number of respondents), and bank account profile j, where $j = 1, 2, ..., 8$, let r_{ij} and w_{ij} denote the expected interest rate increase (in percentage points) and withdrawal percentage, respectively. Let p_j be the vector of attributes of account profile j, which contains variables denoting Deposit Size, Fraction at Risk, Insurance Fund, and Capital Ratio, plus a constant. Also, let q_i be the vector of characteristics of respondent i, which contains indicators for Age > 50, Female, Wealthy, Risk Tolerant, Impatient, and Light Bank Supervision. Then our conceptual model implies the two-equation system:

$$r_{ij} = p_j' \cdot \alpha_p + q_i' \cdot \alpha_q + u_{ri} + \epsilon_{ij}, \tag{1}$$

$$w_{ij} = \beta_r \cdot r_{ij} + p_j' \cdot \beta_p + q_i' \cdot \beta_q + u_{wi} + \eta_{ij}, \tag{2}$$

where α_p, α_q, and β_p are vectors of coefficients to estimate; β_r is a scalar coefficient to estimate; u_{ri} and u_{wi} are respondent random effects; and ϵ_{ij} and η_{ij} are idiosyncratic error terms. The random effects u_{ri} and u_{wi} are included to help account for possible unobserved differences in the approaches taken by respondents to answering the two questions.[13]

One complication with estimating equations (1) and (2) is that, strictly speaking, interest rate and withdrawal responses collected in the survey are interval-type rather than numerical.[14] For example, consider a respondent who intends to withdraw x% of his or her account balance, where $x \in [45, 55]$ and is unobservable to the researcher. Because the survey instrument specifies withdrawal options in steps of 10% from 0% to 100%, the respondent would have selected 50% (the nearest available option).

To allow for this feature of our data, we employ interval regression methods unless otherwise noted. That is, to estimate the interval-type analog of equations (1) and (2) we re-specify each equation in terms of a latent dependent variable, define the correspondence between this variable and response options in the survey, impose normality on the random effects and idiosyncratic errors, and estimate parameters by maximum likelihood.[15]

[13] We subsequently test the nulls of $Var(u_{ri}) = 0$ and $Var(u_{wi}) = 0$, and reject both.

[14] To minimize respondent fatigue and non-response, respondents were asked to select an answer from a given set of options rather than provide a numerical response.

[15] When the interval regression option is not available, as is the case for instrumental variables estimation in section 5.1, we use GLS (panel data linear regression with random effects). Stata 14 is used to perform all estimations.

4.2 Results: expected interest rate change

Although our primary interest is in intended withdrawal percentages, we first estimate models of the interest rate change expected by respondents (equation (1)). As well as providing insight into the behavior of finance professionals, this also allows us to check the plausibility of the responses provided by our sample.

Table 5 reports the results. The estimated relationships in column (1) seem reasonable and intuitive: the interest rate rise expected by finance professionals is bigger for large deposits (which are more important to banks — see Rose, 2015), deposits offering weaker depositor protection, deposits not backed by an explicit insurance fund, and deposits held at banks with lower-than-average capital. Although statistically significant at the 1% level or better, these effects are all economically modest. For example, an additional $100,000 of deposit is associated with only a 5.7 basis point greater expected interest rate rise. Similarly, the average interest rate increase expected at a bank with below-average capital is only 37.9 basis points greater than that at a bank with above-average capital, while 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 full insurance coverage (account profiles 2, 3 and 5) and a deposit with 33% at risk of loss (profiles 4 and 8) is only 29.8 basis points (0.33×90.4).

In theory, weak depositor protection should only be an issue if the bank has a non-trivial probability of failing, so in column (2) we interact fraction at risk with low bank capital. Now the deposit size effect becomes insignificant, and fraction at risk only matters for banks with below average capital. The latter effect is also slightly more economically substantial: at a bank with below-average capital, the expected interest rate change is 43.8 basis points lower for a deposit with full insurance coverage than for a deposit with 33% at risk of loss.

Expected interest rate changes are also related to several respondent characteristics: although age does not seem to play a significant role, male, less wealthy, more risk tolerant and more impatient finance professionals all expect their banks to raise interest rates more aggressively following the banking system shock. Also, respondents from countries with relatively light bank supervision anticipate an average interest rate increase that is more than half a percentage point greater than

Table 5: Conceptual Models of Expected Interest Rate Change

The dependent variable is the expected interest rate change, which is regressed on various profile and respondent characteristics defined in Table 1 — see equation (1). Estimated coefficients indicate the average percentage point change in the interest rate following a 1-unit increase in the explanatory variable. Both models use 3,284 non-missing expected interest rate change answers obtained from 417 respondents, include respondent random effects, and are estimated by maximum likelihood using interval regression methods to account for the interval-type nature of the dependent variable. The likelihood ratio χ^2 is the test statistic value for joint significance of the explanatory variable coefficients. The respondent random effects χ^2 is the test statistic value in the test of the null of no random effects. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5%, and 10% levels respectively.

Explanatory Variable	(1)	(2)
Constant	0.856^{***}	1.103^{***}
	(0.30)	(0.31)
Bank account profile characteristics		
Deposit size (in $100K)	0.057^{***}	0.027
	(0.02)	(0.02)
Fraction at risk	0.904^{***}	0.122
	(0.14)	(0.23)
Insurance fund	-0.307^{***}	-0.375^{***}
	(0.04)	(0.04)
Low bank capital	0.379^{***}	0.141^{**}
	(0.04)	(0.07)
Fraction at risk × low bank capital		1.315^{***}
		(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	−5,150	−5,140
Likelihood ratio χ^2	268.0	297.5
$p-$value	0.00	0.00
Respondent random effects χ^2	3,053	3,067
$p-$value	0.00	0.00

that expected by their more heavily-supervised counterparts.

To summarize our key finding in this section: finance professionals appear to believe that lightly-protected accounts held at banks in a relatively weak financial position will experience the largest interest rate rises following a banking system shock. This seems intuitively plausible.

4.3 Results: intended withdrawal percentage

Turning to intended deposit withdrawals, Table 6 contains the results from estimating equation (2) using interval regression methods. Notably, the intended withdrawal percentage is positively related to the expected interest rate change: a one percentage point rise in the expected interest rate is associated with an additional 12 percentage point intended deposit withdrawal, an estimated effect that is statistically significant at the 1% level. Thus, far from higher interest rates moderating deposit withdrawals, they seem to exacerbate such outflows.

This result also consistently appears in a wide range of sub-samples. In case there are intra-sample nuances, we successively split our sample along the following dimensions: respondent country (US, non-US, Europe, and NZ), strength of bank supervision, pre-funding of deposit insurance, and bank capital. In all cases (10 models), the intended withdrawal percentage is positively related to the anticipated interest rate change (average coefficient of 12.92) and is statistically significant at the 1% level.[16] Overall, both the full- and sub-sample results are consistent with knowledgeable investors interpreting bank offers of higher interest rates as a signal that the bank is riskier than previously thought, with this effect dominating the greater return on offer. We assess this conclusion further in the next section.

Account attributes have intuitive effects on intended withdrawals. First, incomplete insurance coverage is associated with a significantly higher withdrawal rate even at a well-capitalized bank: for example, the intended withdrawal rate is 15.1 percentage points (0.33×45.77) greater on a deposit with 33% at risk relative to a deposit with full insurance coverage. Second, below-average bank capital is associated with greater withdrawals only for deposits with incomplete insurance

[16] As they largely repeat the information appearing in Table 6, we do not tabulate these results, but instead make them available in an Online Appendix located at... REFEREE: please see the attached Appendix.

Table 6: Conceptual Models of Intended Deposit Withdrawal Percentage

The dependent variable is the intended withdrawal percentage, which is regressed on the expected interest rate change and various profile and respondent characteristics defined in Table 1 — see equation (2). Estimated coefficients indicate the average percentage reduction in deposit size following a 1-unit increase in the explanatory variable. Both models use 3,316 non-missing intended withdrawal answers obtained from 417 respondents, include respondent random effects, and are estimated by maximum likelihood using interval regression methods to account for the interval-type nature of the dependent variable. The likelihood ratio χ^2 is the test statistic value for joint significance of the explanatory variable coefficients. The respondent random effects χ^2 is the test statistic value in the test of the null of no random effects. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5%, and 10% levels respectively.

Explanatory Variable	(1)	(2)
Constant	−1.593	12.10
	(6.13)	(6.47)
Expected interest rate change	12.81***	12.47***
	(0.76)	(0.75)
Bank account profile characteristics		
Deposit size (in $100K)	2.630***	1.060
	(0.68)	(0.72)
Fraction at risk	87.10***	45.77***
	(4.93)	(8.03)
Insurance fund	−10.33***	−14.01***
	(1.31)	(1.40)
Low bank capital	13.34***	0.689
	(1.31)	(2.35)
Fraction at risk × low bank capital		69.49***
		(10.87)
Individual respondent characteristics		
Age > 50	1.079	1.045
	(4.07)	(4.05)
Female	0.285	0.169
	(4.17)	(4.15)
Wealthy	6.549	6.545
	(5.00)	(4.99)
Risk tolerant	−5.698	−5.655
	(3.69)	(3.68)
Impatient	−4.656	−4.555
	(3.62)	(3.61)
Light bank supervision	2.849	3.075
	(4.96)	(4.95)
Sample log-likelihood	−6,391	−6,371
Likelihood ratio χ^2	979.9	1020
$p-$value	0.00	0.00
Respondent random effects χ^2	1,116	1,131
$p-$value	0.00	0.00

coverage. Third, deposits not backed by an explicit insurance scheme experience withdrawal rates that are 10.3–14.0 percentage points greater than those that are.

The sub-sample analysis in the online appendix reveals two additional account profile nuances. First, holding all other factors constant, the importance of pre-funding insurance is less marked among NZ respondents, possibly because that country does not have deposit insurance. Second, pre-funding is associated with *greater* withdrawals of deposits held in banks with above average capital. This may reflect the fact that such deposits are low risk and so pre-funding is seen as unnecessarily adding to the bank's costs.

Overall, these results suggest that when it comes to influencing crisis-period deposit withdrawals by knowledgeable investors, both generosity and appearances matter for depositor protection schemes. Intended withdrawals are significantly lower for accounts offering generous protection coverage, even if the risk of needing to draw on that coverage (e.g., at a well-capitalized bank) is low. Moreover, even though our respondents were explicitly informed that their country's deposit insurance agency would not fail, intended withdrawals are significantly lower in accounts at risky banks if they contribute to a formal insurance fund. As discussed in section 3, it may be that finance professionals associate pre-funding with prompt payment, which would explain their apparent lack of confidence.

By contrast, and interestingly, respondent personal characteristics are unrelated to intended withdrawals. As Table 6 reveals, none of the characteristics is individually significant, and tests of their joint significance are no different: in column (1), the test statistic value $\chi^2(6) = 6.70$ (p-value = 0.35); in column (2), $\chi^2(6) = 6.65$ (p-value = 0.35). As can be seen in the online appendix, exactly the same finding also arises in all the sub-sample analysis.

One possible explanation for this result is that the role of personal characteristics in withdrawal decisions is being absorbed, and hence obscured, by the r_{ij} term appearing in equation (2), since these characteristics *do* affect respondents' expectations about interest rate changes. To check this possibility, we estimate a reduced-form version of (2), obtained by substituting the expression for r_{ij} from equation (1) into the withdrawal equation (2):

$$w_{ij} = p_j' \cdot \gamma_p + q_i' \cdot \gamma_q + v_{wi} + \varepsilon_{ij}, \tag{3}$$

where γ_p and γ_q are vectors of coefficients to estimate, v_{wi} is a respondent random effect, and ε_{ij} is an error term.

Table 7 contains the results from estimating equation (3), and again reveals no relationship between the personal characteristics of finance professionals and their intended withdrawal rates. None of the estimated coefficients are individually close to being statistically significant, and all are, in the main, economically small as well. Nor are they jointly significant: in column (1), the test statistic value $\chi^2(6) = 3.65$ (p-value = 0.72); in column (2), $\chi^2(6) = 3.73$ (p-value = 0.71). Although the finance professionals in our sample are a heterogeneous group, their responses to a banking crisis are essentially homogeneous.

5 Endogeneity and Runs

5.1 Endogeneity of expected interest rate change

The models reported in Table 6 allow for respondents' expectations about interest rates to have a direct impact on their intended withdrawal percentages. However, a key challenge to estimating this relationship, and equation (2) as a whole, consistently is the possible endogeneity of r_{ij}. Since r_{ij} and w_{ij} are (almost) simultaneously determined, it seems reasonable to expect that a common unobservable factor could affect both variables. For example, respondents who are (unobservably) more anxious about the safety of their deposits in a particular account profile may not only wish to withdraw a greater percentage of the deposit, but also project such anxiety onto the prediction of a higher interest rate to be offered by their bank. In that case, the error terms in equations (1) and (2) would be correlated, leading to endogeneity of r_{ij} in (2). Estimating (2) by OLS would then produce inconsistent coefficient estimates.

To deal with this issue, we require suitable instruments for the expected interest rate change that will allow us to use instrumental variables (IV) estimation. That is, we need to identify one or more variables that have no direct impact on intended withdrawals, but do so indirectly via interest rate expectations. For this purpose, we use the risk preference variables (Risk Tolerance and Impatient indicators), for the following reasons. First, Tables 6 and 7 suggest that these

Table 7: Reduced-Form Models of Intended Deposit Withdrawal Percentage

The dependent variable is the intended withdrawal percentage, which is regressed on various profile and respondent characteristics defined in Table 1 — see equation (3). Estimated coefficients indicate the average percentage reduction in deposit size following a 1-unit increase in the explanatory variable. Both models use 3,316 non-missing intended withdrawal answers obtained from 417 respondents, include respondent random effects, and are estimated by maximum likelihood using interval regression methods to account for the interval-type nature of the dependent variable. The likelihood ratio χ^2 is the test statistic value for joint significance of the explanatory variable coefficients. The respondent random effects χ^2 is the test statistic value in the test of the null of no random effects. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5%, and 10% levels respectively.

Explanatory Variable	(1)	(2)
Constant	14.33^{**}	30.16^{***}
	(6.32)	(6.66)
Bank account profile characteristics		
Deposit size (in \$100K)	3.282^{***}	1.414^{*}
	(0.71)	(0.75)
Fraction at risk	95.66^{***}	46.19^{***}
	(5.12)	(8.36)
Insurance fund	-13.51^{***}	-17.82^{***}
	(1.33)	(1.45)
Low bank capital	17.23^{***}	2.025
	(1.34)	(2.45)
Fraction at risk × low bank capital		82.63^{***}
		(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	−6,614	−6,587
Likelihood ratio χ^2	702.6	755.8
$p-$value	0.00	0.00
Respondent random effects χ^2	1,138	1,162
$p-$value	0.00	0.00

variables have no direct impact on intended withdrawal choices, but Table 5 shows that they do affect expected interest rate changes. That is, they satisfy a necessary empirical criterion for suitable instruments (we consider their suitability more formally below). Second, they are also theoretically plausible. In determining their withdrawal response to the potential crisis, respondents will consider the valuation consequences for their investment. Any valuation changes must reflect changes in expected payoffs, or expected returns, or both (Campbell and Shiller, 1988). If finance professionals have rational expectations about future cashflows, and implicitly think in terms of factor models like the CAPM or APT for estimating expected returns, both of which seem plausible for such a group, then the cross-sectional variation in respondent valuation estimates, and hence in their intended withdrawals, will be independent of individual risk preferences. Nevertheless, risk preferences could, and apparently do, induce cross-sectional variation in expected interest rate changes.

Thus, our solution to the endogeneity problem is, in equation (2), to replace the personal characteristics vector q_i with the sub-vector $\hat{q}_i$ which excludes the Risk Tolerant and Impatient indicators

$$w_{ij} = \beta_r^* \cdot r_{ij} + p_j' \cdot \beta_p^* + \hat{q}_i' \cdot \beta_q^* + u_{wi}^* + \eta_{ij}^*, \tag{4}$$

and estimate this using the Risk Tolerant and Impatient indicators as instruments for r_{ij}.[17]

To check the suitability of the Risk Tolerant and Impatient indicators as instruments, we first assess their strength, as Staiger and Stock (1997) have shown that weak instruments can result in biased IV estimates and invalid inferences. Montiel Olea and Pflueger (2013) propose a weak-instrument test that is robust to heteroskedasticity, autocorrelation, and clustering. We implement this test by using OLS with clustered standard errors (at the respondent level) to estimate equation (1) including in q_i only the Risk Tolerant and Impatient indicators.[18] The results (untabulated) suggest that the the indicators for Risk Tolerant and Impatient are strong instruments. Specifically, the F-statistic value for these two variables is 6.67, which exceeds the 5% critical value of 5.66 under a 10% maximal bias of the IV estimator relative to OLS; the null of instrument weakness

[17] Tests revealed the other personal characteristic variables to be weak instruments.

[18] We do not use the conventional weak-IV test of Stock and Yogo (2005) because it cannot accommodate panel data and clustering.

can therefore be rejected.[19]

To assess the validity of our two candidate instruments, we apply an over-identifying restrictions (OIR) test to estimation of equation (4). In doing so, we estimate two versions. In the first, (columns (1) and (2) of Table 8), we include the personal characteristics sub-vector $\hat{q}_i$; in the second (columns (3) and (4)), we exclude all personal characteristics. As can be seen in the bottom two rows of Table 8, neither version can reject the null hypothesis that the model is correctly specified (the χ^2 test statistics are less than their critical values), consistent with the instrument set being valid.

Table 8 reveals that adjusting for the endogeneity of the expected interest rate change has a major impact on the relationship between intended withdrawals and expected interest rate changes: compared to the Table 6 models, the estimated coefficient for r_{ij} reverses sign and loses statistical significance. Finance professionals apparently decide on the reallocation of their asset portfolios without regard to the attractiveness of changes undertaken by their bank, consistent with the attractiveness of higher interest rates being offset by increased doubts about bank solvency. This suggests that bank efforts to maintain their deposit funding sources by raising interest rates may have little effect on such depositors — for finance professionals, the response to a banking shock appears to be price-inelastic.

A natural question is the extent to which the price-inelasticity of intended withdrawals holds uniformly throughout our data. It could be, for example, that the independence of intended withdrawals from expected interest rate changes is the result of offsetting positive and negative relationships. To address this issue, we repeat our IV estimation for each of the various sub-samples introduced in section 4.3. However, the results (see the online appendix) provide no evidence of offsetting positive and negative price elasticities: in every sub-sample, the intended withdrawal percentage is independent of the expected interest rate change, just as in the full sample. For finance professionals, observing their bank raising interest rates during a crisis appears to be a homogenous signal.

By contrast, instrumenting has no effect on the various relationships between intended with-

[19]Montiel Olea and Pflueger (2013) use a 10% maximal relative bias as the benchmark. We also repeat this test using the full set of respondent characteristics in equation (1), with similar results.

Table 8: IV Regression Models of Intended Deposit Withdrawal Percentage

The dependent variable is the intended withdrawal percentage, which is regressed on the expected interest rate change, profile attributes, and respondent characteristics — see equation (4). To allow for possible endogeneity of the expected interest rate change, the Risk Tolerant and Impatient indicators are used as instruments. Estimated coefficients indicate the average percentage point reduction in deposit size following a 1-unit increase in the explanatory variable. All models use 3,279 non-missing intended-withdrawal answers obtained from 417 respondents, and are estimated using GLS (panel data linear regression with respondent random effects). The first stage of the IV estimation is not reported to conserve space. The models presented in columns (1) and (2) include the remaining respondent characteristics as control variables, but their estimated coefficients and standard errors are very similar to those appearing in Tables 6 and 7 and so are not reported here. Columns (3) and (4) do not include these characteristics. The Wald χ^2 is the test statistic value for joint significance of the explanatory variable coefficients. The OIR χ^2 is the test statistic value for the over-identifying restrictions test; under the null hypothesis of this test, the model is correctly specified. 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	26.05^{***}	37.64^{***}	30.54^{***}	42.39^{***}
	(9.10)	(10.1)	(6.94)	(8.02)
Expected interest rate change	-1.731	-1.776	-3.472	-3.486
	(5.23)	(5.30)	(5.19)	(5.17)
Deposit size (in $100K)	2.433^{***}	0.956^{**}	2.506^{***}	0.987^{**}
	(0.43)	(0.41)	(0.44)	(0.42)
Fraction at risk	65.22^{***}	29.45^{***}	66.40^{***}	29.56^{***}
	(5.62)	(5.23)	(5.57)	(5.31)
Insurance fund	-8.793^{***}	-12.01^{***}	-9.184^{***}	-12.49^{***}
	(1.54)	(1.81)	(1.53)	(1.79)
Low bank capital	12.17^{***}	1.271	12.68^{***}	1.447
	(1.75)	(1.42)	(1.72)	(1.43)
Fraction at risk × low bank capital		61.36^{***}		63.16^{***}
		(8.65)		(8.60)
Respondent characteristics included	Yes	Yes	No	No
R^2	0.078	0.086	0.040	0.048
Wald χ^2	480.4	507.2	452.6	482.8
$p-$value	0.000	0.000	0.000	0.000
OIR χ^2	1.247	1.223	0.508	0.490
$p-$value	0.264	0.269	0.476	0.484

drawal and account profile attributes: the Table 8 estimates are essentially unchanged from those in Table 6. For example, low bank capital per se does not result in higher intended withdrawals, but does have such an effect if accompanied by weak deposit protection (where a substantial fraction of the account is at potential risk of loss). And a high fraction at risk is associated with significantly higher withdrawals even at a well-capitalized bank.[20]

5.2 Runs

A final consideration is the magnitude of intended withdrawals. Perhaps higher interest rates have no significant effect on average withdrawal rates, but do affect the propensity to "run", i.e., to make a large withdrawal. To investigate this issue, we follow Iyer et al. (2016b) and introduce a new dependent variable set equal to 1 if the intended withdrawal amount exceeds 50% and 0 otherwise. Applying probit estimation to this binary dependent variable, we then re-estimate our various models (conceptual, reduced-form, and IV) and report the results in Table 9. However, these are very similar to those reported in earlier tables. First, although the propensity to run is strongly positively correlated with the expected interest rate change, this relationship disappears once endogeneity is accounted for using IV methods. Second, finance professionals' run propensity is increasing in the proportion of the deposit that is uninsured, is lower when the bank pays into a formal insurance fund, and is independent of bank capital for fully-insured deposits.[21]

6 Concluding Remarks

Can banks retain and attract the deposits of knowledgeable investors during a crisis by offering higher interest rates? In this paper, we have attempted to shed light on this question by applying conjoint analysis methods to data collected from a sample of 417 finance professionals spread

[20] We do not show the coefficient estimates for the personal characteristics in columns (1) and (2) as these simply replicate the findings of earlier tables: all are individually and jointly insignificant, and economically small.

[21] The models in columns (1) and (2) also include the respondent characteristics vector q_i. As in previous tables, their estimated coefficients are all economically small and are individually and jointly statistically insignificant; we therefore do not report these in Table 9.

Table 9: The Propensity of Finance Professionals to Run

This table presents average marginal effects from probit models in which the dependent variable equals 1 if the intended withdrawal exceeds 50% (0 otherwise). Column (1) is the conceptual probit model, analogous to equation (2) and Table 6. Column (2) is the reduced-form probit model, analogous to equation (3) and Table 7. Column (3) is the IV probit model, analogous to equation (4) and Table 8. All models include respondent random effects and employ 3,279 respondent-profile observations. All variables are defined in Table 1. Estimated coefficients indicate the average change in the propensity to run following a 1-unit increase in the explanatory variable. The Wald χ^2 is the test statistic value for joint significance of the explanatory variable coefficients. 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)
Expected interest rate change	0.074^{***}		-0.059
	(0.01)		(0.07)
Bank account profile characteristics			
Deposit size (in $100K)	0.008	0.012^{**}	0.011^{**}
	(0.01)	(0.01)	(0.00)
Fraction at risk	0.150^{**}	0.152^{**}	0.146^{**}
	(0.07)	(0.07)	(0.07)
Insurance fund	-0.090^{***}	-0.117^{***}	-0.125^{***}
	(0.01)	(0.01)	(0.01)
Low bank capital	0.007	0.018	0.022
	(0.02)	(0.02)	(0.02)
Fraction at risk × low bank capital	0.532^{***}	0.615^{***}	0.632^{***}
	(0.09)	(0.10)	(0.09)
Respondent characteristics included	Yes	Yes	No
Sample log-likelihood	−1,373	−1,463	−7,695
Wald χ^2	269.0	259.1	285.5
$p-$value	0.00	0.00	0.00

across six countries. Our results suggest that raising interest rates in response to a shock may have little effect on the withdrawal decisions of knowledgeable investors. Although expected interest rate changes and intended withdrawals are strongly positively correlated in our data, there is no evidence of a positive causal relationship once we control for potential endogeneity of responses. This finding is consistent with finance professionals interpreting interest rate rises in times of crisis as both "good" and "bad" news — the attractiveness of a higher interest rate is offset by the implicit signal of greater risk. Overall, we find no evidence that higher interest rates encourage

depositors to moderate their withdrawals.

When it comes to depositor protection, both generosity and appearances matter. Intended withdrawals by finance professionals are lower when deposit insurance covers a greater fraction of deposits. Withdrawals are also significantly lower when their bank participates in a pre-funded insurance scheme, even though they know that their country's insurance agency cannot fail. It may be that professionals associate pre-funding with prompt payment and are unwilling to bear the liquidity costs of delay.

Whether or not any of these results generalize to the retail depositor population, or to non-crisis situations, remains an open question. Nor are we able to shed on any light on depositor behavior in broader financial crises (e.g., the global financial crisis of 2007-09) and the resulting flow of funds between different kinds of financial institutions (including the shadow banking system), or on the moral hazard incentives that potentially cause such crises. All of these seem like potentially fruitful questions for future research.

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Appendix: Sub-Sample Analysis

Table A1: Conceptual Deposit Withdrawal Models: Respondent Country Sub-Samples

This table estimates equation (2) for respondent country sub-samples. Column (1) shows the results for the sub-sample of US respondents (the number of respondents in this sub-sample, N, is 298; the total number of non-missing intended withdrawal answers, NT, is 2,341). Column (2) shows the results for the sub-sample of respondents from countries other than the US ($N = 119$; $NT = 938$). Column (3) shows the results for the sub-sample of European respondents ($N = 69$; $NT = 540$). Column (4) shows the results for the sub-sample of NZ respondents ($N = 50$; $NT = 398$). See Table 6 in the text for additional details.

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	20.84^{***}	-5.272	14.23	-31.92^{*}
	(7.51)	(12.8)	(16.4)	(18.2)
Expected interest rate change	11.80^{***}	13.96^{***}	11.25^{***}	16.76^{***}
	(0.92)	(1.30)	(1.49)	(2.35)
Bank account profile characteristics				
Deposit size (in $100K)	0.528	2.375^{*}	3.594^{**}	0.778
	(0.88)	(1.24)	(1.43)	(2.18)
Fraction at risk	27.28^{***}	92.05^{***}	72.11^{***}	123.1^{***}
	(9.74)	(13.8)	(15.6)	(24.8)
Insurance fund	-14.47^{***}	-12.44^{***}	-16.00^{***}	-7.905^{*}
	(1.71)	(2.40)	(2.78)	(4.20)
Low bank capital	-2.114	7.391^{*}	7.269	7.986
	(2.86)	(4.02)	(4.56)	(7.21)
Fraction at risk × low bank capital	83.24^{***}	34.71^{*}	27.60	43.35
	(13.2)	(18.6)	(21.1)	(33.2)
Individual respondent characteristics				
Age > 50	1.472	4.978	6.779	-5.450
	(4.41)	(10.1)	(12.4)	(18.2)
Female	-1.907	13.16	15.10	16.51
	(4.56)	(10.0)	(14.7)	(14.1)
Wealthy	1.335	16.52^{*}	-11.82	23.46^{*}
	(6.09)	(8.85)	(10.2)	(12.7)
Risk tolerant	-6.534	-3.093	-6.966	10.41
	(4.24)	(7.47)	(10.1)	(12.3)
Impatient	-2.418	-8.609	-6.715	-13.13
	(4.12)	(7.52)	(10.4)	(11.6)
Light bank supervision		-4.424	-6.715	
		(7.27)	(10.4)	
Sample log-likelihood	$-4{,}598$	$-1{,}749$	-974.2	-755.5
Likelihood ratio χ^2	611.4	448.7	270.5	196.7
$p-$value	0.00	0.00	0.00	0.00
Respondent random effects χ^2	731.1	406.5	322.0	97.09
$p-$value	0.00	0.00	0.00	0.00

Table A2: Conceptual Deposit Withdrawal Models: Strength of Bank Supervision Sub-Samples

This table estimates equation (2) for bank supervision sub-samples. Column (1) shows the results for the sub-sample of respondents from countries with lighter than average bank supervision, i.e., when Light bank supervision = 1 (the number of respondents in this sub-sample, N, is 71; the total number of non-missing intended withdrawal answers, NT, is 562). Column (2) shows the results for the sub-sample of respondents from countries with tighter than average bank supervision, Light bank supervision = 0 ($N = 346$; $NT = 2,717$). See Table 6 in the text for additional details.

Explanatory Variable	(1)	(2)
Constant	-27.58^{*}	21.62^{***}
	(14.4)	(7.05)
Expected interest rate change	17.67^{***}	11.51^{***}
	(1.95)	(0.83)
Bank account profile characteristics		
Deposit size (in $100K)	2.160	0.838
	(1.75)	(0.79)
Fraction at risk	109.4^{***}	33.36^{***}
	(19.8)	(8.73)
Insurance fund	-9.296^{***}	-14.79^{***}
	(3.37)	(1.53)
Low bank capital	6.889	−0.617
	(5.78)	(2.56)
Fraction at risk × low bank capital	36.74	75.32^{***}
	(26.5)	(11.8)
Individual respondent characteristics		
Age > 50	−13.51	1.990
	(15.2)	(4.21)
Female	4.711	−1.252
	(12.1)	(4.42)
Wealthy	25.27^{**}	0.903
	(10.8)	(5.72)
Risk tolerant	−4.046	-7.439^{*}
	(9.56)	(4.01)
Impatient	−10.51	−3.025
	(9.72)	(3.90)
Sample log-likelihood	−1,049	−5,302
Likelihood ratio χ^2	287.8	759.0
$p-$value	0.00	0.00
Respondent random effects χ^2	189.0	940.9
$p-$value	0.00	0.00

Table A3: Conceptual Deposit Withdrawal Models: Respondent Profile Attributes Sub-Samples

This table estimates equation (2) for sub-samples of respondent profile attributes. Column (1) shows the results for the sub-sample of withdrawal answers when deposit insurance is pre-funded (the total number of the non-missing answers, NT, is $1,647$). Column (2) shows the results for the sub-sample of withdrawal answers when deposit insurance is not pre-funded ($NT = 1,632$). Column (3) shows the results for the sub-sample of withdrawal answers when bank capital is above average ($NT = 1,640$). Column (4) shows the results for the sub-sample of withdrawal answers when bank capital is below average ($NT = 1,639$). See Table 6 in the text for additional details.

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	-14.19^{**}	-89.71^{***}	-73.94^{***}	15.15^{**}
	(6.53)	(14.8)	(15.7)	(6.64)
Expected interest rate change	12.68^{***}	9.331^{***}	11.59^{***}	11.67^{***}
	(1.11)	(0.91)	(1.00)	(1.02)
Bank account profile characteristics				
Deposit size (in $100K)	4.450^{***}	2.375^{*}	23.76^{***}	2.388^{**}
	(1.02)	(3.77)	(4.04)	(0.95)
Fraction at risk	97.62^{***}	227.6^{***}	180.4^{***}	114.4^{***}
	(7.36)	(21.7)	(23.4)	(6.87)
Low bank capital	-3.721^{*}	62.19^{***}		
	(2.13)	(6.32)		
Insurance fund			27.28^{***}	-19.13^{***}
			(6.71)	(1.99)
Individual respondent characteristics				
Age > 50	0.820	1.536	0.783	0.835
	(4.32)	(4.20)	(4.07)	(4.39)
Female	3.946	-4.579	1.158	-1.879
	(4.43)	(4.30)	(4.17)	(4.50)
Wealthy	5.462	6.907	6.064	6.866
	(5.31)	(5.14)	(5.00)	(5.39)
Risk tolerant	-6.261	-4.555	-5.045	-6.358
	(3.93)	(3.81)	(3.69)	(3.99)
Impatient	-0.812	-6.914^{*}	-3.468	-4.477
	(3.85)	(3.74)	(3.63)	(3.91)
Light bank supervision	3.147	4.095	3.556	3.021
	(5.28)	(5.14)	(4.95)	(5.39)
Sample log-likelihood	$-3,149$	$-3,359$	$-3,296$	$-3,237$
Likelihood ratio χ^2	553.0	287.5	353.4	624.3
$p-$value	0.00	0.00	0.00	0.00
Respondent random effects χ^2	351.7	464.1	354.5	422.6
$p-$value	0.00	0.00	0.00	0.00

Table A4: IV Deposit Withdrawal Models: Respondent Country Sub-Samples

This table estimates equation (4) for respondent country sub-samples, with the expected interest rate change instrumented using the Risk Tolerant and Impatient indicators (except in column (3) — see below). The first stage of the IV estimation is not reported to conserve space. Column (1) shows the results for the sub-sample of US respondents (the number of respondents in this sub-sample, N, is 298; the total number of non-missing intended withdrawal answers, NT, is 2,341). Column (2) shows the results for the sub-sample of respondents from countries other than the US ($N = 119$; $NT = 938$). Column (3) shows the results for the sub-sample of European respondents ($N = 69$; $NT = 540$); to avoid instrument weakness, we use all respondent characteristics as IVs in this case. Column (4) shows the results for the sub-sample of NZ respondents ($N = 50$; $NT = 398$). See Table 8 in the text for additional details.

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	44.62^{***}	28.33^{***}	26.21^{*}	29.42^{***}
	(8.56)	(10.26)	(14.71)	(9.93)
Expected interest rate change	-4.246	3.121	5.820	0.959
	(5.84)	(5.68)	(8.97)	(4.56)
Deposit size (in \$100K)	0.383	2.258^{***}	2.909^{**}	1.201
	(0.50)	(0.75)	(1.21)	(1.06)
Fraction at risk	17.58^{***}	59.00^{***}	47.91^{***}	71.87^{***}
	(6.51)	(7.63)	(8.88)	(14.20)
Insurance fund	-12.19^{***}	-11.33^{***}	-12.49^{***}	-8.949^{**}
	(1.87)	(2.93)	(4.49)	(3.71)
Low bank capital	-1.007	5.601^{**}	4.780	6.326^{*}
	(1.68)	(2.76)	(3.73)	(3.61)
Fraction at risk × low bank capital	73.14^{***}	35.11^{***}	25.17^{**}	48.98^{***}
	(10.89)	(10.54)	(11.71)	(18.08)
R^2	0.030	0.238	0.243	0.225
Wald χ^2	302.6	233.9	150.5	99.9
$p-$value	0.000	0.000	0.000	0.000
OIR χ^2	0.164	1.305	4.951	0.082
$p-$value	0.685	0.253	0.422	0.775

Table A5: IV Deposit Withdrawal Models: Strength of Bank Supervision Sub-Samples

This table estimates equation (4) for strength of bank supervision sub-samples, with the expected interest rate change instrumented using the Risk Tolerant and Impatient indicators. The first stage of the IV estimation is not reported to conserve space. Column (1) shows the results for the sub-sample of respondents from countries with lighter than average bank supervision, i.e., when Light bank supervision = 1 (the number of respondents in this sub-sample, N, is 71; the total number of non-missing intended withdrawal answers, NT, is 562). Column (2) shows the results for the sub-sample of respondents from countries with tighter than average bank supervision, Light bank supervision = 0 ($N = 346$; $NT = 2,717$). See Table 8 in the text for additional details.

Explanatory Variable	(1)	(2)
Constant	27.94^{***}	48.93^{***}
	(10.50)	(10.20)
Expected interest rate change	1.403	-7.186
	(5.02)	(6.92)
Deposit size (in \$100K)	2.098^{**}	0.777
	(0.93)	(0.49)
Fraction at risk	67.29^{***}	21.85^{***}
	(12.06)	(5.92)
Insurance fund	-9.792^{***}	-13.75^{***}
	(3.00)	(2.23)
Low bank capital	5.888^{*}	0.431
	(3.29)	(1.60)
Fraction at risk × low bank capital	43.38^{***}	70.08^{***}
	(15.58)	(10.65)
R^2	0.224	0.006
Wald χ^2	149.6	341.3
$p-$value	0.000	0.000
OIR χ^2	0.044	0.519
$p-$value	0.834	0.471

Table A6: IV Deposit Withdrawal Models: Selected Profile Attribute Sub-Samples

This table estimates equation (4) for account profile sub-samples, with the expected interest rate change instrumented using the Risk Tolerant and Impatient indicators. The first stage of the IV estimation is not reported to conserve space. Column (1) shows the results for the sub-sample of withdrawal answers when deposit insurance is pre-funded (the total number of the non-missing answers, NT, is $1,647$). Column (2) shows the results for the sub-sample of withdrawal answers when deposit insurance is not pre-funded ($NT = 1,632$). Column (3) shows the results for the sub-sample of withdrawal answers when bank capital is above average ($NT = 1,640$). Column (4) shows the results for the sub-sample of withdrawal answers when bank capital is below average ($NT = 1,639$). See Table 8 in the text for additional details.

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	17.83^{***}	-48.83^{***}	-29.18^{***}	46.06^{***}
	(6.06)	(10.97)	(10.30)	(9.19)
Expected interest rate change	-0.017	-5.968	-1.497	-4.735
	(5.43)	(5.76)	(5.33)	(5.71)
Deposit size (in \$100K)	4.115^{***}	24.17^{***}	19.00^{***}	2.070^{***}
	(0.70)	(3.71)	(3.37)	(0.59)
Fraction at risk	68.68^{***}	191.87^{***}	136.29^{***}	91.48^{***}
	(6.46)	(24.16)	(20.29)	(8.70)
Insurance fund			20.93^{***}	-16.60^{***}
			(5.30)	(2.36)
Low bank capital	3.488^{**}	55.59^{***}		
	(1.50)	(7.67)		
R^2	0.152	0.006	0.035	0.061
Wald χ^2	480.8	145.3	187.0	415.5
$p-$value	0.000	0.000	0.000	0.000
OIR χ^2	2.408	0.014	1.063	0.057
$p-$value	0.121	0.907	0.302	0.811