Regular Article

Macroinsurance for microenterprises: A randomized experiment in post-revolution Egypt☆

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ARTICLE INFO

ABSTRACT

Firms in many developing countries cite macroeconomic instability and political uncertainty as major constraints to their growth. We conduct a randomized experiment in post-revolution Egypt to measure the impact of insuring microenterprises against this uncertainty. Demand for macroeconomic shock insurance was high, with a take-up rate of 36.7%. However, purchasing insurance does not change the likelihood a business takes a new loan, the size of the loan, or how they invest this loan. We attribute this lack of effect to microenterprises largely investing in inventories and raw materials rather than irreversible investments like equipment, suggesting that macroeconomic and political risk is not inhibiting their investment behavior. The challenges of introducing an innovative insurance product in an environment where microentrepreneurs had little previous insurance exposure are particularly evident in a second year, where take-up was extremely low following political events that came close to, but did not, trigger insurance pay-outs.

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1. Introduction

Policy uncertainty and macroeconomic instability are the two most common constraints to firm growth listed by firms in developing countries in the World Bank's Investment Climate Surveys, ranking ahead of taxes, regulation, corruption, and access to finance (World Bank, 2004). A large macro literature has highlighted the central role of uncertainty in investment decisions, especially as these investments become more irreversible. Increases in uncertainty temporarily increase the return to waiting for more information (Bernanke, 1983), increasing the option value of waiting to make investments (Dixit and Pindyck, 1994). The result is that higher uncertainty increases the region of inaction, in which firms are unwilling to hire and invest (or fire and disinvest), with business activity only picking up when uncertainty subsides (Bloom, 2009).

The macroeconomic consequences of uncertainty have received increased attention in developed countries in the wake of the global financial crisis (e.g. Bloom, 2014). Meanwhile, the Arab Spring has resulted in dramatic increases in political and macroeconomic instability in much of the Middle-East and North Africa regions, but to date there has been little research on the consequences of these changes on firm behavior. Moreover, in neither developed nor developing countries have there been policy efforts to provide new tools for firms to actively protect themselves against some of the risks entailed by this uncertainty.[1]

We use a randomized experiment to pilot a new product designed to provide insurance against macroeconomic and political shocks to microenterprise owners, and test whether this insurance changes firms' decisions to borrow and invest. We do this with clients of Egypt's largest microfinance organization, in the context of considerable uncertainty after the January 2011 revolution had brought about the fall of the Mubarak regime. Microenterprises dominate the firm size distribution in developing countries (e.g. Hsieh and Olken, 2014), and it has been hypothesized that smaller firms are more vulnerable to macroeconomic instability and policy shocks because they have less ability to diversify

[1] Shiller (1998) has proposed the creation of macro markets to help manage some of these risks, but to date there does not appear to have been implementation of any of these ideas.

and less access to mitigation mechanisms (World Bank, 2004).[2] Our experiment enables us to assess microenterprises' demand for insurance against uncertainty during one of the least stable periods in any country in recent history and measure how the provision of this insurance affects firm behavior.

The insurance product was offered to microfinance clients who were just about to pay off their current loan and were in the process of deciding whether or not to take a new loan, and if so, the size of the loan and how they would use this loan. In the first year that the insurance was offered, 36.7 of microentrepreneurs in the treatment group purchased the insurance. Despite this large demand for the insurance, we do not find statistically significant effects of offering insurance on the likelihood that a microfinance client obtains a new loan, the size of the loan obtained, or the value of new investments in capital stock made. If anything, purchasing insurance reduces the profits and revenues of the firm. We examine several potential explanations for this lack of effect. One of the most plausible explanations is that firms of this size largely use microfinance loans for working capital needs by purchasing inventory items. As a result, the degree of reversibility of these investments is relatively high, so the option value of waiting to make investments is low. Our results show that the reason for buying inventories rather than equipment does not appear to be inability to insure the risk of equipment investments.

The experience of this pilot also highlights the challenges of introducing a new insurance product in an environment in which few firms have had previous exposure to any separate insurance product. Baseline knowledge of the concept of insurance was low, and although credit officers explained the product, there was incomplete knowledge of the exact payout conditions and thresholds. As a result, when the product did not pay out after curfews were imposed following the military overthrow of President Morsi, dissatisfaction with the product from clients and loan officers led to an extremely low (3.3%) take-up rate in the second year the product was offered.

The product offered here is novel, and we are not aware of any previous attempt to provide such insurance to microenterprise. However, several international agencies and governments offer some types of political risk insurance to multinationals and to exporters, and we discuss the similarities and differences in Section 3.2.

In addition to providing the first evidence on the effect of insuring microenterprises against macroeconomic and political uncertainty, this paper contributes more broadly to a literature which considers the impact of insurance on small firms. Poor business owners in developing countries face enormous volatility in their incomes (Collins et al, 2009; Fafchamps et al, 2012). Yet very few insurance products exist to help them reduce this riskiness. The existing literature has largely focused on providing weather insurance to subsistence farmers (e.g. Cole et al, 2013; Cole et al, 2014; Gine and Yang, 2009; Karlan et al, 2014; Mobarak and Rosenzweig, 2013). Some of this work has struggled to get sufficient take-up of the insurance, with the research pointing to the importance of factors such as trust and experience with prior payouts as key determinants of insurance purchase. However, Karlan et al. (2014) do find that insurance results in significantly larger agricultural investments and riskier production choices. There has been considerably less attention given to the possibility of insuring the incomes of urban small business owners. Our paper provides a first step in this direction.

The remainder of the paper is structured as follows. Section 2 describes the context of our experiment in post-revolution Egypt, the study population, and the randomization process. Section 3 provides details of the insurance product offered, and its triggers and price. Section 4 examines take-up of this product, and Section 5 the impacts of receiving this insurance on firm decision-making. Section 6 discusses the reasons for a lack of effect, and our failed attempt to re-sell the product in a second year. Finally, Section 7 concludes.

2. Context, study population, and randomization process

2.1. Antecedents and motivation

We began working in Egypt in October 2009 with the aim of evaluating an expansion of microfinance into the poorest villages in Upper Egypt under a project to be financed through a World Bank loan. However, this project was abandoned as a result of the revolution that began on January 25, 2011 and ousted President Hosni Mubarak after almost thirty years in power.[3]

The period that followed involved several years of widespread economic and political uncertainty. Fig. 1 provides a timeline of some of the main events over our study period. In the immediate aftermath of the revolution, the Cairo and Alexandria Stock Exchange was closed for 55 days, and the government imposed curfews of up to 18 h per day. An interim government was formed under the control of the Supreme Counsel of Armed Forces, and there was a prolonged period of debate as a constitutional referendum was held. Large-scale protests continued to take place on a consistent basis in Tahrir Square. In the twelve months following the revolution, three Ministers of Finance resigned from their positions to protest the state of affairs of the Egyptian government. Tourist arrivals fell 33% compared to the year before the revolution, and currency reserves shrank, leading to prolonged negotiations with the IMF about an emergency loan package. On the political side there were several delays before parliamentary elections were held, and several leading candidates were disqualified from being able to stand in the Presidential election. In June 2012, Egypt democratically elected Mohamed Morsi, a candidate from the Muslim Brotherhood, a political party which had been outlawed under the former regime. However, a year later, in June 2013, protests called for his resignation, and on July 3, 2013, Morsi was ousted by the military.

In the context of so much uncertainty, microfinance organizations were reluctant to try to expand to new areas. Moreover, they expressed uncertainty about the likelihood of existing clients renewing their loans: on one hand they thought that the drop in business suffered by firms might increase their need for credit to cover day to day financing, but on the other hand they thought that firms may put off any larger investments until the economic and political situation was more stable. In a market research survey of 320 microenterprise owners in Alexandria, Cairo and Giza between December 2011 and January 2012, respondents expressed concerns about the likelihoods of food and subsidized goods inflation in the coming year, and of further decreases in tourism levels. Half of the sample said they would like to invest at least 5000 LE ($833) in new capital,[4] but 57% of the entire sample said they planned to delay investments until the economic and political climate regained stability.

2.2. Partner microfinance institution and selection of clients for the study

In this context there was interest from microfinance institutions (MFIs) in developing a new product to help their clients mitigate

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[2] The lack of panel data on firms has limited the empirical literature on how affected microenterprises are by large crises in developing countries. Exceptions are studies using labor force panels such as McKenzie (2004) who finds the self-employed in Argentina experienced increased rates of exit, and reductions in hours worked following the 2002 financial crisis; and Bosch and Maloney (2008) who find increased exits from self-employment in Mexico and Brazil during financial crises there.

[3] The Social Fund for Development (SFD) still attempted to launch this project after the revolution, leading us to conduct baseline surveys of 13,413 households and 2525 microenterprises in Menya. Two months after conducting this baseline, they abandoned the project. Data and survey instruments from this baseline are available in the World Bank's Open data library: http://microdata.worldbank.org/index.php/catalog/1972/study-description

[4] The exchange rate was 1USD = 6.0 Egyptian Pounds (LE) at the start of January 2012. The exchange rate has subsequently depreciated so that at the time of revision (May 2015), 1 USD = 7.6 LE.
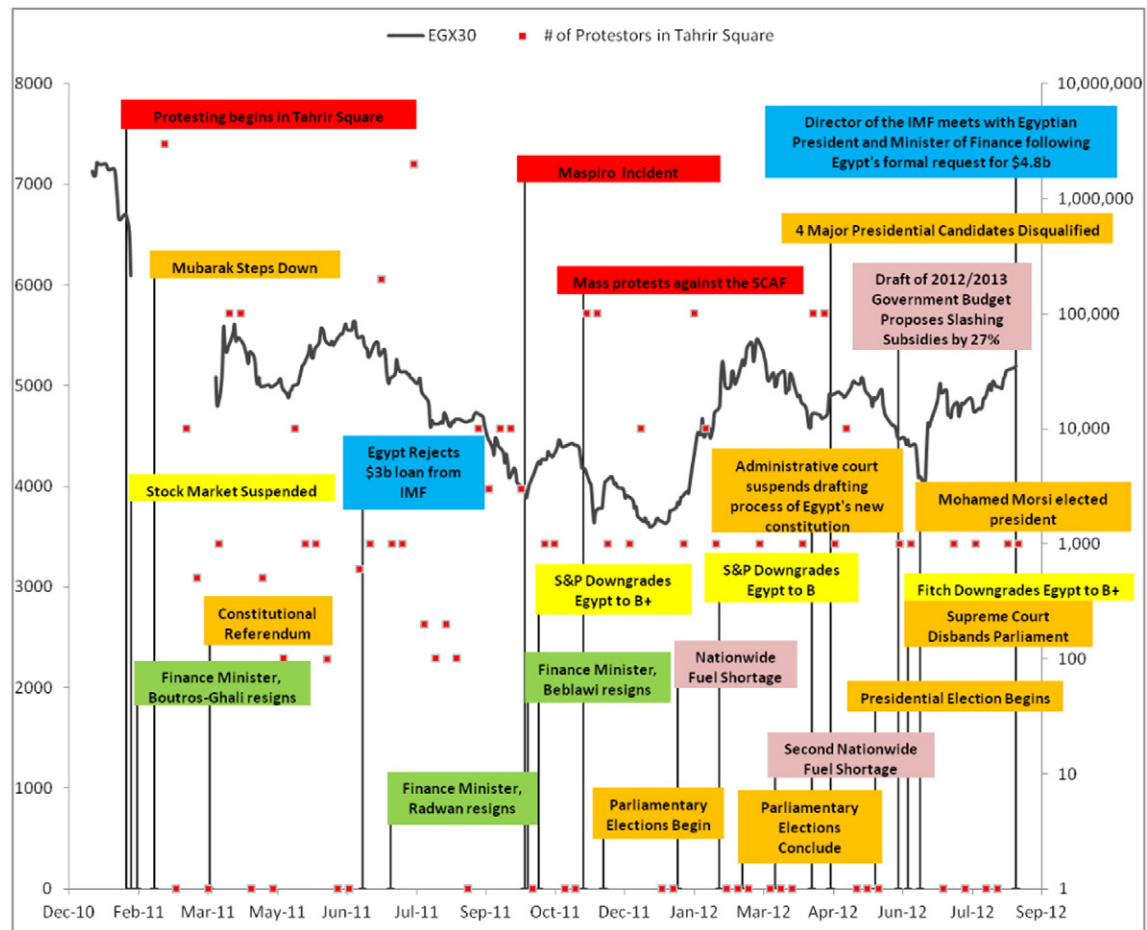
Fig. 1. Timeline of major events in Egypt through the 1st EPP offering window. Source: Own analysis from news sources. Red text boxes indicate major protests, orange national political events, yellow stock market events, blue Egyptian government interactions with the IMF, green resignations of Finance Ministers, and pink boxes represent issues related to government subsidies.

economic uncertainty. We discussed this possibility with several MFIs and decided to partner with Egypt's largest microfinance institution, Alexandria Business Association (ABA). ABA was founded in 1983, and had 210,000 active clients in 2012. The majority of ABA's loans are individual loans to micro and small enterprises (MSE), although it also has a smaller group loan program for subsistence enterprises. The average MSE loan size for repeat borrowers is approximately 5000 LE, with the majority of clients having loans of 10,000 LE or less. The standard loan's duration is 12 months, and is paid in monthly installments.

We wanted to focus on a relatively homogeneous sample of clients that were above the lowest (subsistence level business) loan sizes and who would be deciding to renew their loan or not in the next three months. The following eligibility criteria was set: clients had to be business owners in Alexandria, who were scheduled to make the last payment on their existing loan between April 15, 2012 and July 31, 2012, currently hold a loan between 1500 LE and 10,000 LE ($250–$1667), and who were not considered ineligible for a further loan due to delinquency or other reasons. These constraints allowed us to generate an experimental sample of 2980 clients. If clients choose to renew their loans, clients typically renew their loan within a month of paying off their previous loan, so the window for purchasing the insurance lasted until September 15, 2012, which is 45 days after the last microentrepreneur would have paid off his previous loan.

2.3. Baseline survey and randomization

A baseline survey of these clients was conducted in March 2012 by the Egyptian survey firm El Zanaty and Associates. The survey was

completed for 2961 clients (99.4%). We then grouped the sample which had completed the baseline into 32 strata based on gender and 16 different microfinance branch codes within Alexandria.[5] Within these 32 strata, we created matched pairs using an optimal greedy algorithm (King et al, 2007) to minimize the Mahalanobis distance between the values of 13 variables that we hypothesized may determine loan take-up and investment decisions. These 13 variables are defined in Appendix 1 and include the individual's anticipated likelihood of a macroeconomic shock occurring in the next year, their risk aversion, whether or not they are ambiguity neutral, how much they believe their sales fell in the immediate aftermath of the revolution, whether they are considering delaying investments in any machinery or equipment until the economic and political instability in Egypt is resolved, whether they expect to renew their loan, the amount of loan they expect to seek, and their profits in each of the last two months. We then randomly assigned the clients by computer to treatment (1481 individuals) and control (1480 individuals) within each pair. Data and questionnaires are available in the World Bank's Open Data library http://microdata.worldbank.org/index.php/catalog/2063.

Table 1 provides summary statistics by treatment status. Consistent with Bruhn and McKenzie (2009), the pairwise matching achieves balance between the two groups. We see that 36% of the business owners are female, with average age 44, and a mean time in business of just

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[5] The 16 branch codes consist of codes for 14 different branch offices, 1 code for clients who had transferred between branches, and 1 code for clients who had graduated from a sub-microlending program within ABA to microloans. This reflected the classification of these clients in ABA's administrative system.

Table 1
Summary statistics by treatment status.

	Control	Treatment	T-test p-value
Variables stratified or matched on			
Owner is female	0.36	0.36	0.928
Expected likelihood of a macro shock occurring	56.8	56.3	0.662
Higher risk aversion	0.49	0.47	0.451
Owner is ambiguity neutral	0.30	0.29	0.738
Sales fell 20% or more in 2 months after revolution	0.41	0.41	0.720
Sales fell 5–20% in 2 months after revolution	0.29	0.29	0.894
Considering delaying investments until country more stable	0.10	0.10	0.716
Expect to renew their loan	0.89	0.89	0.901
Expect to renew a loan of 3000 LE or less	0.27	0.28	0.750
Expect to renew a loan of 3001 to 5000 LE	0.26	0.27	0.844
Profits in February 2012	1190	1141	0.314
Profits in January 2012	1185	1118	0.182
Missing February 2012 profits	0.04	0.04	0.703
Missing January 2012 profits	0.04	0.04	0.512
Other variables			
Has at least one paid worker	0.24	0.23	0.690
Age of business (years)	9.28	9.47	0.598
Manufacturing firm	0.16	0.17	0.326
Retail firm	0.50	0.49	0.594
Value of tools, equipment, inventories, and cash on hand	31551	25463	0.184
Owner completed high school	0.20	0.18	0.132
Age of owner (years)	44.4	44.4	0.846
Sample size	1480	1481	

Note: T-test p-value is for t-test of equality of means across groups. Joint test of orthogonality p-value is 0.974.

Table 2
Firms' perceptions of major and severe issues for business operation and growth.

Issue	*Proportion of firms*
Political instability	0.310
Access to financing	0.290
Macroeconomic uncertainty	0.260
Corruption	0.234
Cost of finance	0.137
Transportation	0.091
Electricity	0.088
Telecommunications	0.067
Illegal competition	0.054
Smuggling/dumping	0.052
Licensing and operating permits	0.045
Tax rates	0.038
Price of land	0.037
Water	0.035
Regulatory policy uncertainty	0.033
Access to land	0.028
Tax administration	0.024
Skill and education of workers	0.021
Customs and trade regulations	0.011
Labor regulations	0.009
Legal system	0.008

Source: baseline survey.

over 9 years. Education levels are generally low: 43% of the sample have only completed primary schooling and only 19% have completed high school. The businesses being run cover a wide range of business types, with retail trade accounting for approximately half the sample. Only 23.5% of firms have at least one paid worker. The median firm earns 1100–1200 LE ($183–200) in monthly profits and possesses business assets in the form of equipment, tools, inventories, or cash on hand worth 28,500 LE ($4750). Most firms are informal, with only 23.2% having a business license.

Business owners were asked to recall how their business was affected in the first two months after the revolution. Only 6.5% of firm owners said their sales were above average during this period, whereas 41% said sales were down 20% or more, and 29% said that sales were down 5 to 20% compared to their average levels. Moreover, when asked which issues were problems for the current operation and growth of their businesses, political instability and macroeconomic uncertainty were ranked first and third respectively out of 21 issues (Table 2). Despite this concern about uncertainty, 89% said they intended to renew their loan, and only 10% said they were considering delaying investments until the country was more stable, which was lower than in our market research sample taken three months earlier. However, it may be the case that there are investments that firms haven't even thought of making in the absence of insurance against their riskiness, but would consider when offered insurance. Very few—only 13%—of those who said they were going to apply for a new loan were planning to use this loan for making any investments in machinery and equipment; the majority said they would use this loan for expanding their inventories. Our hypothesis is that more microenterprises would plan on making capital investments if they were not so worried about macroeconomic and political uncertainty.

3. The macroinsurance product

We worked with ABA to jointly design a new product that could be offered to clients in the treatment group to help protect them against macroeconomic and political uncertainty. ABA named the product the Economic Protection Plan (EPP) and offered it to clients in the treatment

group as they finished repaying their previous loan and were deciding whether or not to seek a follow up loan. The standard terms for a loan for clients in our sample was a 12 month loan paid in monthly installments with a flat nominal annual interest rate of 15.2%, which amounts to an APR of 27.0%.

Clients could only purchase the EPP conditional on renewing their loan (and on being in the treatment group). The premium and payout were then proportional to the loan value. The cost of the protection was 0.5% of the value of the new loan, with coverage for the 12 months of the loan. If a shock (defined below) covered by the insurance occurred during the loan period, the payout would be two months of loan principal installments—one to ABA to cover that month's loan, and one to the client to give them cashflow to compensate for potential loss in business from the shock. If a second covered shock occurred in a subsequent month, the EPP would pay out an additional month's loan installment. If no shocks occurred, there would be no payout. Thus the total payout would be just over 16.7% of the loan's value if one shock occurred, and just over 25% if two shocks occurred.[6]

3.1. Insurance payout conditions

The insurance would pay out if any one of the following five shocks occurred:

1) The Cairo Alexandria stock exchange (EGX 30 index) is suspended for five business days in a row.
2) A curfew of 14 h or more in Alexandria lasts for five business days in a row
3) Month to month headline CPI inflation rises to 4.0% or more
4) The official subsidized price of Benzene 80 or 90 gasoline surpasses 2 or 4 LE per liter respectively.
5) The official subsidized price of LPG gas cylinders surpasses 30 LE per cylinder

The shocks to be covered were chosen based on readily observable and verifiable indicators that were likely to move with large macroeconomic or political shocks and were particularly salient in the wake of the revolution. The stock exchange was suspended for 55 days between January 27, 2011 and March 22, 2011 following the revolution, and then also temporarily suspended for less than a day on two other occasions

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[6] The insurance would cover both the principal payment and interest payment in the loan installment.

in the year prior to the launch of this product. Between January 29, 2011 and February 6, 2011 the government instated a curfew that lasted 14 h or more, with this curfew then reduced incrementally over time and temporarily repealed on June 15, 2011. Between then and March 2012, there were several localized curfews in Cairo, but none in Alexandria.

The most prevalent macroeconomic concerns in the market research survey were inflation and the removal of subsidies on subsidized goods. The inflation threshold would have been triggered in January 2008 during the world food price crisis. Since the revolution, inflation has remained below 1.5% per month despite a depreciating Egyptian pound. In 2008, fuel subsidies cost the Egyptian government 7.1% of annual GDP. The subsidized price of Benzene 80, Benzene 90, and LPG had been set at 0.9 LE per liter in 1991, 1.3 LE per liter in 2006, 2.5 LE per liter in 1991, respectively. The prevailing market prices for all three fuels were significantly higher than our trigger thresholds—around 4.85 LE per liter for Benzene 80, slightly higher for Benzene 90, and 60 LE per liter for LPG (Kojima, 2013). Repeated IMF missions to Egypt to discuss an emergency loan after the revolution had emphasized the need to lower the fuel subsidies, but any attempt to remove fuel subsidies was viewed as politically difficult and fuel shortages were often accompanied by riots and strikes.

Some of these shocks would directly worsen business outcomes. The most direct would likely be a curfew, which would force the business to have shorter opening hours, reducing the chance to sell. Inflation is often considered good for borrowers, since it erodes the real value of the debt owed. However, business owners worried about inflation for two reasons. First, they were unsure about their ability to raise prices to cover all the increases in costs that would occur with inflation, and about the effect of inflation on their customers. Second, they were worried about inflation in their own role as consumers. LPG is the main energy source used for cooking by poor households in Egypt, and would be used by some businesses in their operation, and by most owners in their own houses. Only 9.4% of the sample owned a car, and 2.3% a motorcycle, so changes in gasoline prices would mostly affect them through increased raw materials prices rather than directly as consumers.

But in addition to direct effects, these indicators were chosen because of what their triggers would likely signal about overall macroeconomic and political shocks in Egypt. The EPP was designed to avoid overtly political triggers, since directly insuring against another revolution or coup was deemed too sensitive. But it was thought that if another revolution or large shock occurred, it would likely result in either a stock market suspension or curfews being imposed, while the removal of fuel subsidies might result in riots or might only occur if the macroeconomy had worsened to such an extent that the government would have no other option. We considered three other triggers: a large contraction in GDP, the Egyptian pound falling below a certain level against the US dollar, and the number of tourist arrivals in Egypt. GDP was not used because the data was not available at a monthly frequency, and ABA did not think its clients knew what GDP was; likewise, ABA considered the exchange rate and number of tourist arrivals less salient to its clients than the other thresholds.

3.2. Pricing this risk

The price of 0.5% of the loan value was set by ABA based on what it thought would be a price that its clients would be able to manage and a price that they would think they would charge if continuing this product in the future.[7] In order to understand what the actuarially fair price of such insurance would be, we need to know the

probability of a payout occurring. The situation here differs dramatically from rainfall insurance, in which a long-time series of a stationary process can be used to derive probabilities. In contrast, the situation here is one of Knightian uncertainty, in which agents must use subjective probabilities to assess risk. In our baseline and follow-up surveys, we elicited the subjective probabilities of the different trigger events occurring, using a meter stick to explain the concept of probability.[8] In addition, we also elicited these probabilities from World Bank economists in the Cairo country office and from ABA senior management.

Table 3 presents the mean and standard deviations of these subjective probabilities. Inflation is the event viewed as most likely to occur by both the study participants and the economic experts: at the time of launching the product, on average clients viewed there as being a 36% chance of this threshold being triggered in the next year, and economic experts as a 22% chance. The expected chance of at least one of the thresholds being triggered was at least 56.6% on average at baseline for the ABA clients, and 48.8% for the economic experts.[9] Based on these expectations, and a payout of 17% of the loan value if triggered, this would suggest an actuarially fair price of between 8.3 and 9.6% of the loan value—or 16 to 19 times the price actually charged. Although there was considerable uncertainty about what the likelihood of these events occurring is (as evidenced by the high standard deviations), it would appear that the insurance was heavily subsidized. Moreover, note that expectations of one of the triggers occurring in the next year were almost as high in the follow-up survey as in the baseline, suggesting that uncertainty had not fallen dramatically over the course of our study.

As a pilot intervention, any payout was to be made by ABA, using funds set aside by the research project. If taken to scale, an alternative would be to contract a re-insurance agency to cover the risk, with the re-insurance rates then helping determine pricing. We did not pursue this option because of the scale of our study and our concern about the potential sensitivity of insuring against these types of risk. An alternative form of scale-up would be for a multilateral organization like the World Bank that works in many countries around the world to be able to diversify the risks faced by firms in any one country by implementing these policies in multiple countries with weakly correlated political and macroeconomic risks.[10]

Indeed there is a growing industry that covers political risk, with over $100 billion dollars in investment insurance provided in 2012 (MIGA, 2014). The industry consists of three main categories of providers: national export agencies such as the U.S. Overseas Private Investment Corporation (OPIC) which provide insurance for firms from their home countries engaged in cross-border transactions; multilaterals such as the World Bank Group's Multilateral Investment Guarantee Agency (MIGA) which provide coverage for foreign direct investment in developing countries against risks such as expropriation of assets, restrictions on ability to convert foreign currency, government breaches of contract, and destruction of assets during occasions of civil war; and finally several private providers.

While this existing industry is similar in motive to our product, it differs in both the types of firms it sells the product to, and in the conditions for payout. To date the industry is almost entirely focused on protecting foreign companies from investing in developing countries. For multilateral organizations to offer such insurance to domestic firms, they would need either counterguarantees provided by the developing country government, or for firms to directly inform their

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[7] Ideally we would have randomized the price offered in order to examine how demand varies with price. We discussed this option, but given the newness of the product, the partner organization didn't want to add this additional level of complexity, and was worried about potential complaints arising from clients being charged different prices. The relatively small number of branches in our study then precluded randomization at the branch level.

[8] See Delavande et al. (2010) for a discussion of different methods for eliciting subjective probabilities in developing countries and evidence that this is feasible and yields useful information.

[9] We did not ask clients for the joint probability of these 6 events occurring, so calculate the maximum of their individual probabilities as a lower bound on their expectation of the joint probability. The economic experts were asked for the joint probability.

[10] Alternatively an organization like ABA could potentially aim to time average payments over multiple years, making insurance payments mandatory for its clients and using this to offset the business risk of defaults or delayed payments when a shock occurs.

Table 3
Expected likelihood of macroeconomic shocks occurring.

	Expectations of ABA clients in our study				Expectations of World Bank	
	At baseline		At endline		Economists and ABA management	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Suspension of stock exchange for 5 + days	21.7	24.7	10.9	18.6	11.4	9.6
Higher inflation than any other time in last 5 years	36.5	29.8	43.6	31.3	22.8	13.3
Increase in price of Benzene 80 to over 2LE/l	30.2	30.5	27.6	27	14.2	20.5
Increase in price of Benzene 90 to over 4LE/l	28.8	30.3	25.6	27.7	15.6	20.0
Increase in price of subsidized LPG to 30LE/cylinder	30.3	32.6	29	28.7	17.4	25.2
Curfew of 14 h or more	19.7	29.7	8.6	18.3	11.4	10.1
Any of the above 6 events occurring	56.6	32.7	51.6	31.2	48.8	28.0

Note: percent chance of event occurring given.

government that they were taking this insurance and overcome constraints on foreign exchange transactions to do so. In terms of product, the insurance provided to date has not been index insurance, but rather is insurance against realized losses from a particular event occurring—e.g. for the actual loss suffered by a business as a result of expropriation. As a result, pricing is negotiated separately for each contract, and payment typically takes 6 to 12 months after the loss has occurred and only after verification of the actual loss. Just as rainfall insurance offers a less costly index-based way of insuring small farmers against weather-related crop loss, we believe the political and economic index based insurance we pilot here potentially offers a scalable way of offering macroeconomic insurance to small firms.

3.3. Selling the EPP and insurance in Egypt

Insurance penetration is extremely low in Egypt, even relative to the low levels prevalent in other countries in the region. In 2012, total non-life insurance premiums were only 0.4% of GDP in Egypt, compared to a MENA average of 1.2%, African average of 1.1%, and a World average of 2.8% (AIG, 2013). Banking laws limit the provision of insurance, and as a result knowledge of insurance is relatively limited. In our baseline survey we asked respondents to explain what insurance is, with only 37% giving a response that suggested they understood (at least loosely) the concept. We then asked whether, if they purchased a one year fire insurance policy on their house, whether the money would be returned if there was no fire, and only 60% correctly answered no.

ABA does bundle compulsory credit life insurance into its loans, although this is described as a fee rather than insurance premium due to regulatory constraints on offering insurance. So part of the lack of knowledge may involve terminology. Nevertheless, the product launched was a novel one in an environment where individuals had relatively little exposure to separate insurance products. In order to ensure they would trust the product, all sales, marketing, and explanation of the product was handled by their credit officer, who they had at least one year of prior relationship with through applying for their loans and making their monthly payments.

3.4. What happened to these insurance triggers between 2012 and 2014?

The EPP was launched in April 2012 and sold through September 2012, covering clients for one year. The period of coverage therefore includes the Presidential election of June 2012, as well as the military taking over the government one year later. Despite the turmoil surrounding these events, none of six thresholds needed to trigger payout was reached, although several came close. Following the ouster of President Morsi, the stock-market was shut-down for one day. Nighttime curfews were imposed in other cities in late January and early February 2013 due to protests at that time, and then a three month state of emergency, and an 11 hour per day nighttime curfew was imposed for 10 days in Alexandria (and other cities) following the June/July 2013

military take-over which ousted Morsi.[11] The highest month to month inflation occurred in February 2013, at 2.5%, which was well short of the threshold. Fuel subsidies were not adjusted during the first year of coverage, but on July 5, 2014, the new Egyptian government of President Al-Sisi partially reduced fuel subsidies, raising the price of Benzene 80 by 78% to 1.80 LE per liter, which is just below the EPP trigger of 2 LE per liter. We therefore will be analyzing the impact of macroinsurance in a case where this insurance did not payout.

4. Take-up of insurance

The insurance was purchased by 548 out of the 1481 individuals in the treatment group (36.7%). Recall that it could only be purchased conditional on renewing the loan. In total 986 individuals in the treatment group renewed their loan, of whom 545 purchased the insurance (55.3%).[12] These take-up rates are high, which reveals demand for the product offered. Compliance with treatment status was high; only 5 individuals in the control group purchased the insurance, which happened during the first two weeks of the intervention when branch managers were still learning the system.

4.1. Modeling insurance take-up

Our pre-analysis plan set out a simple model of the insurance and borrowing decision.[13] For simplicity, assume there are two states of the world s, where $s = 0$ if one a macroeconomic shock that would be covered by the insurance does not occur, and $s = 1$ if it does occur.

The microfinance client's problem is to choose whether to borrow or not ($L = 1$ if borrow, $L = 0$ if do not), and whether or not to purchase the insurance ($I = 1$ if insured, $I = 0$ if not), where insurance can only be purchased if they borrow. Let z denote the premium for the insurance, $p(s)$ the perceived probability of the bad state occurring, $Q(L)$ the loss that the client will suffer to business profits if the crisis does occur,[14] A the perceived amount that they will receive from the insurance if the bad state occurs, $\pi(L)$ the profits they make from their business's activities, and r the interest rate on the loan. The insurance premium must be paid immediately, lowering current consumption, C, which is profits from the immediate period less any premium paid.

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[11] The curfew was from 7 pm to 6 am starting August 14. After 10 days it was shortened to 9 h per night, and then to 7 h a week later. The 11 hour curfew was retained on Fridays. Curfews of 4–5 h per night remained in place until 12 November 2013.

[12] Three individuals appear to have purchased the insurance and then canceled their loan renewal.

[13] The pre-analysis plan was registered in the J-PAL Hypothesis Registry, and is also available at: http://r4d.dfid.gov.uk/pdf/outputs/knowledgechange/61031-Pre-AnalysisEgyptMicroinsurance_dm_mg.pdf [accessed August 7, 2014].

[14] Gine and Yang (2009) suggest in their context that the losses in the bad state are limited due to limited liability, noting that the lender rarely seized assets in the case of non-payment. In Egypt the penal code contains a three-year jail term for failure to repay debt, and ABA has exercised this option before. We therefore believe limited liability is less relevant in the Egyptian case.

The discount rate is δ. We assume for simplicity that all net income is consumed:

The individual's expected utility if they do not borrow is then:

$$U(C) + \delta[p(s = 0)U(\pi(0)) + p(s = 1)U(\pi(0) - Q(0))]. \qquad (1)$$

Their expected utility if they borrow but do not take insurance is:

$$U(C) + \delta[p(s = 0)U(\pi(L) - rL) + p(s = 1)U(\pi(L) - Q(L) - rL)]. \qquad (2)$$

And expected utility if they borrow and also take insurance is:

$$U(C - z) + \delta[p(s = 0)U(\pi(L) - rL) + p(s = 1)U(\pi(L) - Q(L) - rL + A)]. \qquad (3)$$

They will therefore only take insurance if (3) > (2) and (3) > (1). This will be more likely the higher is the probability of the bad state $p(s = 1)$, the more they suffer losses when a shock occurs (higher $Q(L)$), the less they discount the future (high δ), the more risk averse they are (determining the shape of $U(.)$), the greater is the pay-out expected A, and the higher the profitability of taking a loan $\pi(L)$. We map each of these concepts to variables in our data, and then run a probit of insurance take-up as a function of these variables.

We consider two sets of variables to measure A. The first is the size of the loan they expect to borrow. Higher loan sizes should indicate higher expected net returns from insurance because the premium is less than the likely actuarially fair rate and pay-outs and premiums increase proportionally with loan size. However, A should also depend on their level of trust that a pay-out will occur, something emphasized in previous research on rainfall insurance (e.g. Cole et al, 2013). We proxy for their trust in ABA by the number of previous loan cycles they have had (while recognizing this variable could also be proxying for other unobservables). We expect the returns to taking a loan to be higher for individuals with higher returns to capital, which based on other studies with microenterprises (e.g. de Mel et al, 2008; McKenzie and Woodruff, 2008), we take to be males, with higher levels of human capital, who have less wealth, and less other options for obtaining credit.

This model forms our basic specification. However, since take-up is also likely to depend on how good the marketing is, which might differ across loan officers, we also add branch fixed effects as an additional control. The model also assumes that people understand what insurance is when making this decision—if not, we might expect people who don't understand the product to be less likely to take it. Therefore we control in a third specification for whether or not they understand insurance. Finally, Bryan (2013) argues that ambiguity aversion can reduce demand for partial insurance, with this effect varying with risk tolerance. We therefore also add whether an individual is ambiguity neutral, and this interaction with risk aversion, in a final specification.

4.2. Correlates of insurance take-up

Table 4 provides the results of this take-up analysis. Column 1 provides our basic specification motivated by the model above, while columns 2, 3, and 4 add these other controls to consider other explanations. Columns 5 and 6 condition on taking a loan, in order to describe which types of borrowers take up the insurance.[15] We see that take-up is not strongly correlated with most of these variables in the way predicted by theory. There is no statistically significant association with the expected likelihood of a payout occurring, discount rate, risk aversion, or individual characteristics that might predict the return to capital. Knowledge of what insurance is, and being ambiguity neutral also do not predict insurance take-up.[16] Instead we find a strong significant

positive association with the number of previous loans taken from ABA, which may indicate greater trust in ABA or just a greater tendency to take another loan. Columns 5 and 6 show no association with this variable conditional on taking a loan, suggesting the main channel here is through being more likely to take a loan. The more puzzling correlation is a negative correlation between take-up and saying that sales fell 5 to 20% immediately after the revolution. Take-up is lower for this group than for those who didn't experience a fall in sales, and also than those who experience a 20% or larger drop in sales. One possible explanation is that this level of exposure to shocks is correlated with sector and other attributes that also determine the returns to loans. However, while controlling for 32 different business sectors reduces the magnitude of the coefficient (from −0.231 to −0.108 in column 6), this variable retains its significance ($p = 0.015$ in column 6).

Thus despite high insurance take-up, which individuals purchase the insurance is not easily predictable from simple theory. One possible explanation for this would be that our survey variables do not proxy closely enough for their theoretical counterparts. This may be true of some of the measures, but seems unlikely to explain the complete lack of association with variables indicated by theory. A second possible explanation is that the theory ignores the potential value of the insurance for household adjustment to the shocks—for example, in helping protect the business owner's household against rising inflation. If the characteristics that explain the relative value of the insurance to the household differ from that of the business, and separability of household and business decision-making does not hold, this could generate the lack of relationship seen here. More generally there may be other omitted variables affecting take-up, whose exclusion means that the functional form is misspecified. Examples include the consumer biases and framing effects found to be important by Johnson et al. (1993) in explaining consumer purchase decisions. A final potential explanation is that business owners are not rationally calculating whether it is beneficial to take the insurance or not, but instead relying on recommendations from their loan officer, with the significant variables somehow picking up determinants of how much the loan officer recommends the insurance to them, and how much they follow the loan officer's guidance. However, although the branch effects are jointly significant, only one of the branch fixed effects is individually statistically significant, and the pseudo-R2 shows that adding these branch effects does not explain much of the variation in the data.

5. Impacts on firm decision-making

Theory suggests that the availability of insurance can affect the likelihood of an individual taking a loan, the size of the loan they take, and how they use the loan. We discuss each in turn, and then measure their impacts using a follow-up survey. The follow-up survey was taken in November 2012, 3 to 7 months after the insurance was offered for sale and loans renewed. The follow-up survey was able to successfully re-interview 2927 of the 2961 clients (98.9%). The attrition rate was 1.2% for control and 1.1% for treatment, with this difference between groups not statistically significant.

The follow-up survey directly asked clients why they had chosen to purchase the EPP. The modal answer was to provide protection in case they can't repay their loan during one of these events (68%), with only 0.6% saying they saw it as an investment opportunity, and 27% saying it was because their loan officer recommended it. 95% say they would have renewed the loan anyway, but 62% say they feel more comfortable making investment decisions now that they have the insurance.

5.1. Theoretical impacts on borrowing behavior

Our first hypothesis is that the offer of insurance will increase the likelihood of a client taking a loan. This will occur if there are parameter values such that (2) < (1) < (3) in the previously specified model. For example, this could occur if $\pi'(L) > r$ (i.e. that it is profitable to borrow in the

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[15] These last two columns were not contained in the pre-analysis plan, but were added to explore insurance take-up conditional on taking a loan.

[16] This is also true if we examine the association between take-up and these variables one-by-one, so the lack of association is not due to correlations between the set of explanatory variables.

Table 4
Determinants of insurance take-up among treatment group.

	(1)	(2)	(3)	(4)	(5)	(6)
	Marginal effects from probit estimation, Columns 1–4 unconditional, Columns 5 and 6 conditional on taking a loan
Expected likelihood of payout occurring	−0.087	−0.067	−0.084	−0.082	−0.057	−0.060
	(0.102)	(0.109)	(0.103)	(0.103)	(0.124)	(0.125)
High exposure to shocks	−0.006	−0.061	−0.005	−0.008	−0.060	−0.064
	(0.082)	(0.086)	(0.082)	(0.082)	(0.099)	(0.099)
Medium exposure to shocks	−0.233***	−0.199**	−0.234***	−0.231***	−0.265**	−0.264**
	(0.089)	(0.092)	(0.089)	(0.089)	(0.109)	(0.109)
Discounts the future heavily	−0.029	−0.058	−0.028	−0.026	0.033	0.030
	(0.068)	(0.072)	(0.068)	(0.068)	(0.082)	(0.082)
Risk averse	−0.015	0.001	−0.014	−0.037	0.058	0.059
	(0.068)	(0.069)	(0.068)	(0.081)	(0.082)	(0.082)
Expects to renew loan of less than 3000	0.050	0.025	0.048	0.048	0.039	0.043
	(0.085)	(0.088)	(0.085)	(0.085)	(0.105)	(0.105)
Expects to renew loan of 3000 to 5000	0.031	0.041	0.031	0.030	0.004	0.004
	(0.084)	(0.085)	(0.084)	(0.084)	(0.101)	(0.101)
Number of previous loans with ABA	0.039***	0.040***	0.039***	0.039***	0.003	0.003
	(0.008)	(0.009)	(0.008)	(0.008)	(0.010)	(0.010)
Female	0.099	0.113	0.098	0.098	0.053	0.053
	(0.072)	(0.076)	(0.072)	(0.072)	(0.086)	(0.086)
Completed high school	−0.067	−0.060	−0.064	−0.067	−0.097	−0.100
	(0.091)	(0.092)	(0.092)	(0.091)	(0.109)	(0.109)
High numeracy	0.046	0.053	0.045	0.047	0.091	0.093
	(0.072)	(0.075)	(0.072)	(0.072)	(0.087)	(0.087)
Wealth index	0.004	0.016	0.003	0.003	0.017	0.018
	(0.026)	(0.027)	(0.027)	(0.027)	(0.032)	(0.032)
No other sources of finance	−0.225*	−0.221	−0.226*	−0.223*	−0.180	−0.178
	(0.133)	(0.134)	(0.133)	(0.133)	(0.156)	(0.156)
Sees profitable investment opportunities	0.005	0.008	0.005	0.005	−0.070	−0.071
	(0.072)	(0.073)	(0.072)	(0.072)	(0.085)	(0.085)
Understands insurance			−0.031			0.062
			(0.081)			(0.100)
Ambiguity neutral				0.022		
				(0.100)		
Ambiguity neutral × risk averse				0.086		
				(0.148)		
Branch fixed effects	No	Yes	No	No	No	No
Pseudo-R2	0.020	0.035	0.020	0.021	0.009	0.009
Sample size	1475	1474	1475	1475	981	981

Notes:
Robust standard errors in parentheses.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

good state) and $\pi(L) - Q(L) - rL < \pi(0) - Q(0)$ (i.e. that the return on the loan is low in the bad state, so that if the bad state occurs paying the loan interest rate reduces consumption below what it would be if they had never borrowed), with the insurance reducing this hardship in the bad period. Extending the basic model to allow for different loan levels will then likewise offer the possibility that there are some individuals for whom a larger loan is desirable with insurance, but not without insurance.

Since take-up of the insurance is voluntary, in this base model it should never be the case that the offer of insurance reduces the likelihood of a client taking a loan, since he or she can always choose to borrow without insurance. However, borrowing could fall if clients think that purchasing the insurance is in fact compulsory if they take the loan, and have (3) < (1) even though (2) > (1).[17] It could also fall if the offer of insurance causes clients to revise their subjective probabilities of the likelihood of the bad state occurring, so that they think the likelihood of a crisis is higher after being offered the insurance and decide not to borrow at all as a result.

5.2. Testing the impact of insurance on loan take-up and loan amounts

To test this hypothesis we estimate the following ITT equation via OLS:

$$TakeupLoan = \beta_0 + \beta_1 OfferedEPP + X'_s\theta + \varepsilon \qquad (4)$$

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[17] Gine and Yang (2009) find individuals are less likely to take a loan when bundled with actuarially fair insurance than when the loan is sold separately.

where X'_s is a vector of dummies for the randomization pairs. We expect $\beta_1 > 0$ under standard conditions, although could find $\beta_1 < 0$ if either of the two conditions discussed above occur. This measures the impact of the offer of insurance on loan take-up. We also measure the impact of being offered the insurance on the size of the loan received by estimating the following equation

$$LoanAmount = \alpha_0 + \alpha_1 OfferedEPP + X'_s\vartheta + \mu PreviousLoanAmount + \varepsilon. \qquad (5)$$

This Ancova specification conditions on their previous loan amount to increase power.

Table 5 provides the results of estimating (4) and (5). 67.8% of the control group renewed their loans. We see in column 1 that the offer of macroinsurance had zero impact on the likelihood a client renewed their loan. The point estimate is extremely close to zero, and the confidence interval small (−3.8%, +3.1%), so the lack of effect is not due to low statistical power—we can rule out any sizeable increase in the likelihood of taking a new loan. Likewise there is no significant impact on the amount of loan received, whether considered unconditionally (column 2), or conditional on getting a new loan (column 3). Conditional on getting a new loan, the average loan size for the control group is 4901 LE ($817). The upper limit of the 95 confidence interval for treatment impact is only 6.6% of this amount, so again we can rule out all but the smallest increases in

Table 5
ITT impacts on loan take-up and loan size.

	Loan renewal	Loan amount	Loan amount conditional on renewal	Loan renewal	Took loan from elsewhere
Assigned to treatment	−0.004	19.2	−109.0	0.004	0.001
	(0.017)	(131.3)	(221.2)	(0.021)	(0.007)
95% confidence interval	[−0.038, 0.031]	[−238, 277]	[−543, 325]	[−0.037, 0.045]	[−0.012, 0.015]
Assigned to treatment × high chance renewal				−0.035	
				(0.049)	
High chance of renewing loan				0.195***	
				(0.043)	
Control group mean	0.678	3318	4901	0.641	0.033
Sample size	2944	2931	1974	2944	2961

Notes: robust standard errors in parentheses. Regressions control for pairs used in matched pair randomization.
*, **, and *** indicate significance a the 10, 5, and 1 percent levels respectively. Took loan from elsewhere includes loans from other microfinance organizations, banks, family or friends.

loan size. Fig. 2 shows the distributions of loan amounts are extremely similar for treatment and control, so the lack of average impact is not masking changes at other quantiles.

We might expect the offer of insurance to have no effect on loan take-up for individuals who were going to take a loan anyway. To test whether there is a larger effect for the group of clients who are less likely to renew without insurance, we estimate a pre-specified probit equation for the likelihood of renewing a loan among the control group. Appendix 2 contains this estimation. We then create a variable "high chance of renewal" if the predicted probability of renewal is above 80%. We then include this high chance of renewal and its interaction with treatment status in column 4 of Table 5. We see the high chance of renewal by itself is a strongly significant predictor of renewal, but that although the interaction with treatment status is negative as predicted, it is not statistically significant. Moreover, adding this interaction still results in a zero coefficient of the offer of insurance for the remainder of the sample. Our lack of ability to find an effect of being offered insurance therefore does not appear to be driven by individuals who were most likely to take a loan anyway.

Finally, in the last column of Table 5 we see that ABA is by far the most common source of loan financing for these individuals, with only 3.3% of the control group taking a loan from another microfinance organization, bank, or family and friends between March and November 2012. Treatment does not result in any significant change in this rate, so the offer of insurance does not lead to substitution from other sources of finance.
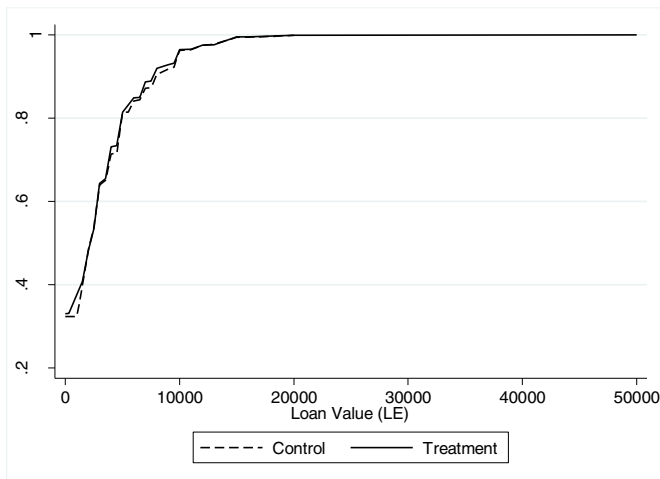

Fig. 2. CDFs of loan value by treatment status.

5.3. Impacts on investment behavior and firm profitability

There are at least three channels through which the offer of macroinsurance could theoretically affect investment behavior. A direct channel would be through greater access to finance, following the model set out above. In particularly, individuals with parameters such that $(2) < (1) < (3)$ would be predicted to take on a loan and make an investment with insurance, but not do so without insurance. However, we have seen in the previous section that this channel of more finance does not appear to operate in practice. However, a second channel is that macroinsurance may induce firm owners to make riskier investments with the same loan, since insurance helps protect them from the negative consequences of macroeconomic and political shocks that could otherwise make these investments appear too risky. If this is the case, then firms might be more likely to invest in new machinery or equipment, introduce new product lines, set up second businesses, or take on new workers. Finally, if household and firm decisions are not separable, the macroinsurance may reduce the need for precautionary savings at the household level, freeing up cash flow that could be used to finance new investments in the business.

To the extent that firm owners are investing more, or investing in riskier activities, we should then expect to see changes in business profits and sales. These changes may not just occur at the mean, but may be concentrated in the upper tail if the treatment causes a change in the riskiness of activities undertaken. However, if there is no change in investment behavior, individuals may be marginally worse off from taking insurance by the small cost of the premium. A second channel through which profits and revenues would be affected is when the bad state occurs—then the insurance payouts have additional positive impacts on the firm. However, since the insurance pay out was not triggered, we do not have this channel in operation here.

We test for these impacts by estimating both the ITT effect of being offered insurance, and the local average treatment effect (LATE) of actually receiving insurance. We estimate the ITT by estimating versions of Eqs. (4) or (5) with a variety of pre-specified outcome variables, using the Ancova specification in (5) when baseline data is available on the outcome of interest. The LATE estimates are then obtained by instrumenting take-up of insurance with the random assignment to treatment.

Table 6 presents the impacts on investment behavior. We see small and not statistically significant impacts of the offer of insurance on all six pre-specified outcome measures. We see that only 7.6% of the control group purchased new machinery or equipment, 3.4% introduced a new product or service, and 1.8% started a second business, with treatment having no impact on these outcomes. 14.5% of the control group hired a new worker, but treatment again has no significant impact on this outcome, nor does it on the level of inventories and raw materials held in the business. The 95% confidence

Table 6
Impacts of insurance on investment activities.

	Invested in new machinery	Amount on new machinery	Introduced a new product	Started a second business	Value of inventories & raw materials	Hired a new worker	Standardized outcome index
Panel A: ITT estimates							
Assigned to treatment	0.012	−54.1	−0.007	0.000	−822.0	0.008	−0.004
	(0.010)	(117.5)	(0.006)	(0.005)	(1768.2)	(0.013)	(0.018)
95% confidence interval	[−0.008,0.031]	[−284,176]	[−0.020,0.006]	[−0.009,0.009]	[−4293,2649]	[−0.017,0.033]	[−0.040,0.031]
Panel B: LATE estimates							
Purchased insurance	0.033	−114.0	−0.018	0.000	−2032.6	0.014	−0.012
	(0.027)	(305.9)	(0.017)	(0.013)	(2904.2)	(0.034)	(0.048)
Control mean	0.076	419	0.034	0.018	10045	0.145	−0.001
Sample size	2961	2961	2961	2961	2135	2961	2961

Notes:
Robust standard errors in parentheses. Regressions control for pairs used in matched pair randomization.
*, **, and *** indicate significance a the 10, 5, and 1 percent levels respectively.

intervals are narrow for the binary outcomes, indicating this lack of significant effect is not due to a lack of statistical power. Likewise a standardized index that is the average of z-scores of each of these first six variables also shows no impact on average investment behavior.

Since we find no impact on access to finance, and no changes in firm investment behavior, we do not expect to find the offer of insurance changing firm performance outcomes. Table 7 presents the estimated treatment effects on profits, revenues, employees, and household consumption. We truncate profits and revenues at the 99th percentile to limit the influence of outliers. However, in order to test whether insurance is leading firms to take riskier decisions that pay off only for a few firms, we not only test the impact on the mean, but also the likelihood of a firm being above the 95th percentile of the control firms' profits or revenues distributions. We find a small negative and not statistically significant impact of treatment on profits, and likewise small, negative, and not statistically significant impacts on the number of employees, owner's hours worked,[18] and on household consumption.

Surprisingly the impact on revenues is negative, and statistically significant at the 1% level. Moreover, the treatment effect is large in magnitude: the ITT is equivalent to a 12.6% reduction in revenue relative to the control group mean, while the LATE is equivalent to a 34.9% reduction. Appendix 3 provides the CDFs of revenues by treatment status, and shows the two distributions appear to separate slightly from around the 80th percentile upward, showing this treatment effect is not being driven by a few outliers.

It is unclear why we see this fall in revenues. One possible explanation is that it is a spurious finding, reflecting multiple testing. The lack of significant impact for profits, investments, inventory levels, hours, or employment is consistent with the idea that the size of the business hasn't changed. However, an aggregate index averaging over all the outcomes in Table 7 is statistically significant at the 10% level, although the magnitude is relatively small, with the ITT of 0.04 representing a 0.06 standard deviation effect size. It is unclear why or how treated businesses would produce less sales with the same measured inputs of employment and capital, since this would require owners to be changing their production decisions in unobserved ways that result in lower sales.

6. Discussion and epilogue

6.1. Why didn't the insurance increase loan take-up and investment?

The EPP was therefore unsuccessful in getting firms to borrow more and finance investments. We consider here six possible explanations for the lack of effect.

A first potential explanation is that the offer of insurance may have been seen by the treatment group as a signal that the macroeconomic and political environment was even more risky than they had thought, leading them to revise their expectations of the likelihood of the bad state occurring $p(s = 1)$. This could offset the positive effect of the availability of insurance. However, in our follow-up survey we asked again the subjective expectations of the business owners of at least one of the six trigger events occurring within the next year. The mean expected likelihood of a negative event occurring was 57.5% for the control group and 56.9% for the treatment group (p = 0.874). This suggests that the treatment group has not changed its expectations of the likelihood of a bad state relative to the control.

A second potential explanation is that of basis risk, which occurs if the insurance is not protecting business owners against events that matter to them. However, we did see that most business owners said they had suffered a loss in sales after the revolution, suggesting these types of shocks do matter for business sales. However, it could be argued that the fact that the insurance didn't pay out at all in 2012/13 despite the turmoil in Egypt during this time indicates that its coverage against these types of macro and political risks were only partial. Nevertheless, since it appeared that clients thought the insurance was more than actuarially fair in terms of pricing, even partial insurance coverage should be predicted to lead to some additional investment taking place.

A third, related explanation is that the insurance coverage may not have been large enough in the sense of covering enough of the losses accrued if the bad state did occur. Again this should act to moderate the size of the investment response, but not eliminate it completely. Moreover, we note that the amount of coverage offered (16.7% of the loan value if the shock occurs in a single month) would cover 60% of the month's profits, which is far more than the fall in sales reported by most firms after the revolution. In addition, the amount of coverage is far more than the token amounts of coverage purchased in the rainfall insurance experiments of Cole et al. (2013). We therefore do not believe this is the main reason for the lack of investment response, but acknowledge it could be a contributing factor. However, insurance which would cover the full value of the loan would be very expensive for clients, and would be likely to overinsure them given that firms are unlikely to lose the entire value of their investment in many cases.[19]

A fourth potential reason could be that microenterprise owners did not respond to the insurance because they did not trust that it would pay out if a bad shock occurred. The literature on rainfall

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[18] Note hours worked was not included in our original pre-analysis plan, but was added as a result of a query from the editor and referees.

[19] Gine and Yang (2009) offer rainfall insurance tied to agricultural loans that provides partial or total coverage of the amount of the loan depending on the amount of rainfall, but the cost of this product ranges from 16 to 33% of the loan value, and they find it reduces loan take-up.

Table 7
Impacts of insurance on profits, revenue, employment, and consumption.

	Profits	High Profit	Revenue	High Revenue	Number Employees	Any worker	Owner's Hours	Monthly Consumption	Aggregate Index
Panel A: ITT estimates									
Assigned to treatment	−59.7	−0.009	−737.2**	−0.020***	−0.024	0.008	−0.655	−7.55	−0.041*
	(46.5)	(0.008)	(286.917)	(0.007)	(0.051)	(0.018)	(0.824)	(28.37)	(0.022)
Panel B: LATE estimates									
Purchased insurance	−148.7	−0.021	−2030.8***	−0.056***	−0.098	−0.001	−2.197	−19.25	−0.116*
	(122.1)	(0.020)	(769.548)	(0.019)	(0.134)	(0.046)	(2.203)	(78.68)	(0.059)
Control mean	1385	0.054	5813	0.055	0.928	0.468	45.8	1948	0.021
Sample size	2910	2910	2908	2908	2908	2908	2916	2947	2961

Notes:

Robust standard errors in parentheses. Regressions control for pairs used in matched pair randomization.

High profit and high revenue defined as being above the 95th percentile of the control group.

  * Significant at the 10% level.

 ** Significant at the 5% level.

*** Significant at the 1% level.

insurance has found strong effects of trust on demand (e.g. Cole et al, 2013; Karlan et al, 2014). However, the insurance was marketed and sold by ABA microfinance officers, who had long-standing relationships with clients, and with whom trust levels were high. It was ABA, and not an unknown entity, that was providing the guarantee of payouts. While those who had longer standing relationships with ABA were more likely to take another loan, the fact that the number of previous loans does not predict insurance take-up among those who decide to renew a loan is consistent with the idea that trust levels in ABA were reasonably high for all clients.

A fifth potential reason is that clients simply did not understand the product. As we noted, insurance penetration in Egypt was very low, and as noted, at baseline knowledge of what insurance is was low for many clients. Our follow-up survey indicates incomplete knowledge of the payout conditions and thresholds, although clients were more likely to say payout would occur for shocks covered by the insurance than if tourism, the Egyptian pound, or their own personal sales fell. Interacting treatment with baseline knowledge of insurance shows no significant interaction effects. Our sense then is that firm owners had a general sense of being covered for risk, even if they did not know the precise details, and that as a result, lack of knowledge cannot explain the complete lack of impact.

A final potential reason is just that microenterprises of this size do not often make the types of long-term investments with irreversibility that might be delayed by macroeconomic and political uncertainty. Table 8 reports on how those who renewed their loans said that they had spent the loan. On average firm owners say they spent 76% of the loan on inventories, compared to just 8 to 10% on equipment (and 7% on household needs). We see no significant treatment effect on how the loan was spent. While there are reasons to be concerned with such self-reporting of loan use (e.g. Karlan et al, 2013), having most of the loan spent on inventories and raw materials is consistent with the responses of microenterprises to small grants (de Mel et al, 2008), and to work showing that the monthly repayment structure of microfinance discourages lumpy investments (Field et al, 2013). Using a loan for working capital purposes is likely to generate returns in a relatively short time frame, and to be more easily reversed if a shock occurs (e.g. by selling off stock, or reducing the rate of re-stocking) than is the case with investments in new machinery or other capital. As such the investment behavior of microenterprises may not be very sensitive to macroeconomic and political risk.

6.2. Epilogue

In May 2013 we agreed with ABA to offer the EPP for a second year, with a purchase window between May 15, 2013 and January 30, 2014.[20] We offered the product to 645 clients from our initial sample (some from treatment and some from control to determine whether behavior differed in a second year), as well as to 493 clients with larger loans (of between 10,000 and 75,000 LE) to see whether larger microenterprises, who might be more likely to be making equipment purchases or larger investments, were more responsive to the insurance. In order to further reduce concerns about lack of knowledge, ABA decided to host information sessions with financial literacy training to better explain insurance to clients before the product was offered to them.

However, attendance at these information sessions was low (157 clients attended over 19 sessions) due to political uncertainty and concerns about street protests in late May 2013. We also had our research assistant meet one-on-one with each client to explain the product. However, just as this new phase was getting launched, the protests leading up to the overthrow of President Morsi took place. As noted above, the stock market was shut for one day, and curfews of 11 h were imposed. These events were not enough to trigger payout of the original policies, but ABA loan officers apparently received calls and complaints from clients who had purchased the EPP and thought that they would get a payout when curfews were imposed. This had a doubly negative impact on subsequent sale of the EPP. First, clients who had previously purchased it, or people who knew someone who had, viewed it as a case of insurance against large economic and political shocks not paying out when a large economic and political shock had occurred. Second, the EPP loan officers then saw the policies as something causing them problems (through more client complaints), and so were much more reluctant to sell or recommend the policies to clients.[21] As a result, only 37 of the 1138 clients offered the EPP in this second year purchased it (3.3%). With such a low take-up rate, we are unable to examine the impact of this insurance on the investment behavior of clients in the second year.

7. Conclusions

Despite Egyptian microenterprises' reports of declining sales following the revolution, and of political instability and macroeconomic uncertainty as major constraints to the growth of their businesses, we do not find an impact of offering macroinsurance to these microenterprises. Although take-up of the macroinsurance product

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[20] After covering 100% of the risk of payout through the research project in the first year, we agree to co-share the risk with ABA in the second year, with the goal of transitioning this towards a self-sustaining product offering for them.

[21] ABA did not want us to offer commission incentives to loan officers for fear of them pressuring clients to buy the policies and did not want to change the payout triggers or payout events for the second year.

Table 8
How loan recipients say they spend the loan.

Category	Percent of loan spent on category		
	Control mean	Treatment mean	p-Value
Equipment	7.8	10.2	0.289
Inventories	77.2	75.6	0.426
Education	0.2	0.4	0.525
Household needs	6.6	7.4	0.688
Weddings	1.3	1.6	0.391
Other	6.9	4.9	0.426

was relatively high in the first year it was offered and Egypt was experiencing considerable political and economic uncertainty, insurance neither changed the likelihood microenterprises renewed a microfinance loan, nor changed the size of this loan, nor led to any changes in investment behavior. If anything, receiving insurance may have reduced firm revenues. We consider several reasons for this lack of impact, and find the most plausible to be that microenterprises largely use microfinance loans for inventories and raw materials, which are reasonably short-term, easily adjusted, investments. It does not appear that uninsured macro and political risk is preventing them from otherwise making lots of profitable machinery, equipment, and other lumpy capital investments.

Our analysis found that macroinsurance did not change the investment behavior of firms. Nevertheless the product was still purchased by 37% of the microenterprises it was offered to in the first year. One reason is that even if it has no impact on investment behavior or on outcomes in states of the world where it doesn't pay out, such insurance could still be valuable to them by helping them to cope with shocks when they do occur. We are unable to measure the impact of this, or value of this aspect of insurance to the firm, since the insurance did not pay out in our case. This lack of pay-out following a military take-over and considerable economic and political shocks appears to have dampened the demand for this product for a subsequent year, and highlights the challenges of pay-out recency and trust in generating a new market for insurance services (Cole et al, 2014). Given the enormous volatility in incomes for microenterprise owners in developing countries, we hope the lack of impact of this product does not deter further policy and research efforts to develop better ways to help insure urban microenterprises against some of this risk. This should include further experimentation with the price offered, extent of coverage provided, and other product components.

Appendix 1. Variables used in determining pairwise matches for randomization.

- Minimum expected likelihood of payout defined by the maximum expected likelihood of any individual macroeconomic shock
- Risk aversion defined as 1 for anyone who chooses business 1 through 4 and 0 for anyone who chooses business 5 through 8 in the Binswanger lottery
- Ambiguity neutral defined as 1 for anyone who chooses the bag with an unknown proportion of green and white marbles and 0 for anyone who chooses the bag with a specified number of green and white marbles
- High exposure to shocks defined as decrease in sales of 20% or more immediately after the Egyptian revolution in February and March 2011
- Medium exposure to shocks defined as decrease in sales of 5 to 20% immediately after the Egyptian revolution in February and March 2011
- Considering delaying investments defined as 1 for yes and 0 for no
- Not expecting to renew defined as a dummy variable
- Expecting to renew a loan less than 3000 LE defined as a dummy variable
- Expecting to renew a loan between 3001 and 5000 LE defined as a dummy variable
- Self reported profits in February 2012
- Self reported profits in January 2012

- Missing profit data in February 2012 defined as a dummy variable
- Missing profit data in January 2012 defined as a dummy variable

Appendix 2. Probit to fit likelihood of renewing loan among the control group.

| Appendix 2: Predicting loan take-up in control group	
Marginal coefficients from probit estimation	
Expected likelihood of payout occurring	−0.043
	(0.117)
Risk averse	0.017
	(0.072)
High exposure to shocks	−0.139
	(0.090)
Medium exposure to shocks	−0.074
	(0.096)
Considering delaying investments	−0.132
	(0.128)
Expects to renew loan	0.784***
	(0.123)
Expects to renew loan of less than 3000	−0.336***
	(0.096)
Expects to renew loan of 3000 to 5000	−0.177*
	(0.094)
Female	0.204**
	(0.088)
Manufacturing firm	0.065
	(0.111)
Retail firm	0.202**
	(0.087)
Number of previous loans	0.055***
	(0.011)
Age of business	−0.000
	(0.005)
Branch dummies	Yes
Sample size	1425

Robust standard errors in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Appendix 3. CDF of average monthly revenue at follow-up by treatment status
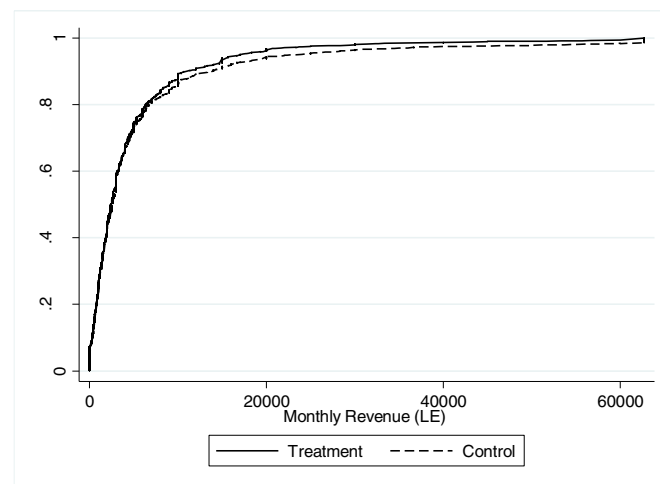
Appendix 4. Supplementary data

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