Fintech Failure: Examining B2B and B2C Solutions for Two-Sided Platform Adoption

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Abstract

Across emerging economies, physical cash is the ubiquitous means of transaction for retailers and their consumers. Despite the widespread availability, affordability and benefits of Fintech solutions for digital payments in these regions, there is an observed failure by the vast majority of retail firms to accept digital payments. Our paper examines this puzzle to uncover causes and solutions for such two-sided platform adoption failure in offline retail contexts. Using evidence from a random audit of a nationwide 'Fintech-drop' public program in Mexico, we propose that two critical frictions constrain the adoption (i.e., initial take-up and usage) of two-sided Fintech platforms: (i) on the supply-side, platform onboarding is highly complex; and (ii) on the demand-side, retailers do not perceive enough consumer demand to justify adoption. We design two novel interventions in the business-to-business (B2B) and business-to-consumer (B2C) channels targeting the respective frictions and test their efficacy through a randomized controlled field experiment with 479 retailers in Guadalajara, Mexico. The B2B intervention increases successful Fintech solution adoption by 21.4 percentage points versus the control group, while the B2C intervention has an additional positive impact in increasing adoption rates by 13.4 percentage points versus the B2B group. The B2B intervention effect is driven by overcoming critical onboarding challenges to promote initial take-up of Fintech, while the B2C intervention effect is driven by growing local consumer demand to use digital payments when shopping. These results have implications for managers and policymakers promoting two-sided platform adoption and driving payment digitization in emerging economies.

1 Introduction

Using digital payments, a canonical two-sided platform connecting retailers on the supply-side with consumers on the demand-side, can be beneficial for both of these parties involved in the purchase. Accepting digital payments can help retailers gain market share, better track their business finances and access new financing opportunities (Dalton *et al.* 2023, Higgins 2019, L. Klapper 2023). For consumers, the safety, convenience and traceability of digital payments can help them better manage their finances (Demirgüç-Kunt, L. Klapper, *et al.* 2022). Yet across emerging economies, physical cash is still the dominant method of payment. In Africa, cash was used in 95% of retail transactions in 2021 (Bansal *et al.* 2022); and in our empirical setting of Mexico, cash prevails in small and large retail transactions alike – featuring in 91.5% of transactions under US $25 and 80.6% of those over US $25 (INEGI-ENIF 2022).

This prevalence of cash-based purchases is driven, in part, by retailers simply failing to accept any means of payment from consumers other than physical cash. For instance, only 1-in-10 of the 2.17 million Mexican small-scale retailers accepted card payments from consumers as of 2019 (INEGI-CE 2019)[1]. Since small-scale retailers account for the largest share of expenditure in these markets relative to other retail formats (Sverdlin Lisker 2023, Bronnenberg & Ellickson 2015), the consequence is that digital payments are missing in the large majority of retail purchases. In this paper, we aim to understand the reasons for this two-sided platform adoption failure and rigorously test solutions through a randomized controlled field experiment with hundreds of retailers.

The failure on the part of retailers to accept digital payments can not be explained by the absence of relevant financial technologies (Fintech) or a lack of access in emerging economies. There has been significant product innovation by Fintech companies to create digital payment solutions tailored to the needs of small-scale retailers, and these are widely available at a fraction of the cost of the typical bank point-of-sale terminal systems used at modern retailers worldwide (see Murthy *et al.* 2019 for a summary of these innovations across emerging economies). In Mexico, the relevant Fintech solution for this segment of small-scale retailers is a mobile point-of-sale (mPOS) device as illustrated in Figure 1. These are cheap, lightweight card readers that connect to smartphones via Bluetooth, and the associated smartphone application provides a user-friendly

[1]An even smaller proportion of small-scale retailers accepted less popular digital payment methods such as bank wire transfers, mobile wallet payments, or other forms of electronic payment (INEGI-CE 2019). In contrast, there is near-universal acceptance of payment cards at modern retailers in the same market, such as supermarkets and chain convenience stores (Higgins 2019).

interface to process payments. Several prominent Fintech companies, including one of Mexico's eight unicorns Clip, compete in this industry on dimensions such as price, transaction charges, distribution strategies and product features. Given these companies – along with the widespread availability and affordability of their solutions – have existed in Mexico for at least a decade, it is puzzling that the rate of successful adoption by retailers has remained so low. By successful adoption, we refer to both the initial take-up of the Fintech solution for digital payments and its ongoing usage in consumer transactions. The academic literature has yet to examine this puzzle empirically or propose effective solutions to overcome such 'Fintech Failure' and drive the diffusion of two-sided payment platforms in offline retail.

Our paper aims to fill this gap by highlighting the role of two crucial frictions constraining the successful adoption of these Fintech solutions for digital payments: (i) supply-side platform onboarding frictions faced by retail business owners; and (ii) demand-side frictions related to the uncertain and/or low levels of interest from consumers in digital payments. As Fintech solutions for digital payments represent two-sided platforms, their successful adoption requires both of these frictions to be addressed. The mitigation of supply-side frictions requires business-to-business (B2B) interventions, whereas the mitigation of demand-side frictions requires business-to-consumer (B2C) interventions. We test the causal impact of marketing levers on Fintech solution adoption (i.e., initial take-up and usage) by retailers. Specifically, we experimentally evaluate the effect of B2B after-sales services to overcome supply-side frictions and B2C marketing communications to overcome demand-side frictions. Our empirical investigation proceeds in two parts.

First, we build evidence on the importance of these underlying frictions by conducting a random field audit of N = 109 retailers that were beneficiaries of a nationwide 'Fintech-drop' program of the Mexican Ministry of Economy. This was a large-scale program to promote retailers' digital payment capabilities with an investment of US $585 per firm. Despite entirely subsidizing the Fintech solution and delivering it on-site to retailers along with advisory information on the benefits of adopting it, we found the program largely failed to meet its objective. Our audit showed that six months post-program, 88% of the treated retailers remained functioning as cash-only businesses and not receiving a single digital payment from their customer base. This high rate of adoption failure indicates that tackling fixed-cost barriers, logistical barriers in Fintech solution access, and providing information on benefits — all of which were fully addressed by the government program — is inadequate and there were likely other frictions that led to the Fintech Failure. In addition,

our systematic interviews of all adoption failure cases highlighted the role of the aforementioned supply-side onboarding frictions and demand-side frictions. Based on this rich descriptive evidence, we designed two novel marketing interventions in the B2B and B2C channels. These interventions, each targeting a different set of frictions, could be added to the government program for a small incremental cost of 2% to 12% (US $12 to $73) per firm.

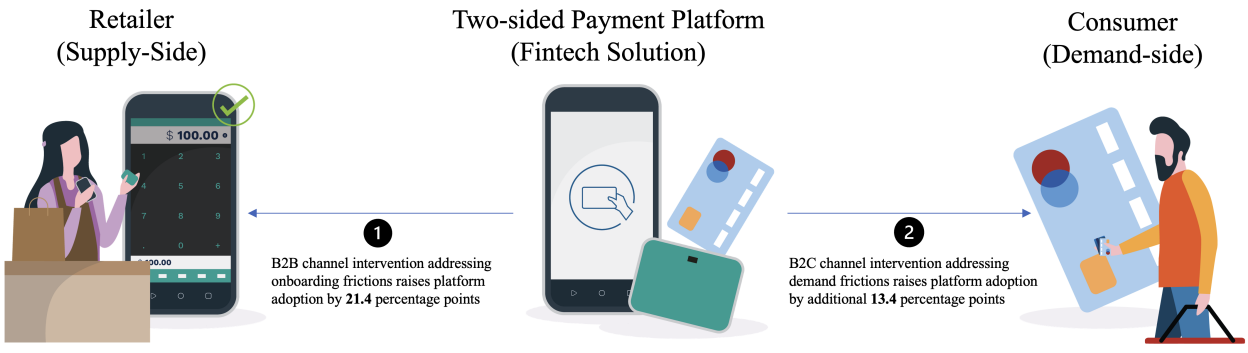
Next, we test the efficacy of these novel marketing interventions via a randomized controlled field experiment with N = 479 cash-only retailers in Guadalajara, Mexico. This field experiment serves the dual purposes of validating that the frictions reported during our audit are indeed important in explaining the extent of Fintech Failure observed and providing relevant policy solutions. The retailers were randomized into three groups: 159 firms were assigned to the *B2B Support Only* group; 162 firms were assigned to the *B2C Support Added* group; and 158 firms constituted a control group. Retailers in the *B2B Support Only* group were provided with the same Fintech solution as in the prior government program, but additionally received two hours (via two separate one-hour visits) of platform onboarding support from the B2B service agents of our partnering Fintech company. In addition to the B2B intervention, retailers randomized into the *B2C Support Added* group also received eight hours (via eight separate one-hour visits) of assistance on marketing the benefits of digital payments to customers, including installation of an advertising kit communicating the retailer welcomes digital payments. We then physically audited all firms in our sample 12 months post-intervention to assess Fintech adoption success in the long-term – measured as having at least one transaction with customers using digital payments in the most recent month prior to the audit. This is our main measure of successful adoption as in the absence of any consumer usage, retailers cannot realize the benefits of digital payments and technology abandonment is likely.

The results of this firm-level field experiment show significant positive effects of both interventions in promoting Fintech solution adoption and retail payment digitization. For the *B2B Support Only* group, the onboarding support from service agents increases successful adoption rates by retailers in the long-run to 53.5%, or by 21.4 percentage points relative to the control group (which had an adoption rate of 32.1%). This equates to a relative effect size of 66.6%. Our process evidence, derived from text analysis of intervention monitoring reports, shows in the absence of high-quality and customized onboarding support that the majority of retailers would have experienced at least one critical technological challenge derailing their adoption process. This data identifies over 40

distinct technological challenges resolved through the customized support of B2B service agents. Moreover, we document that for this group, there is a notable gap between having a working Fintech solution in-store (i.e., initial take-up) and using it in digital payment transactions with consumers (i.e., ongoing usage). Almost half of the adoption failure cases in the *B2B Support Only* group had a working Fintech solution in-store when audited, but there was no actual usage of it in consumer transactions.

Next, our field experiment demonstrates that the B2C channel intervention has an additional positive impact on successful adoption compared to the *B2B Support Only* group by addressing this ongoing consumer usage issue. We find that the B2C intervention increases successful adoption rates to 66.9%, or by 13.4 percentage points relative to the *B2B Support Only* group (which had an adoption rate of 53.5%). This translates into a relative effect size of 25.1% for the incremental improvement provided by the B2C intervention above that of the B2B intervention. In terms of process evidence, it appears that giving retailers extra assistance on marketing the benefits of digital payments to customers helped them boost local demand for transacting with payment cards. Indeed, using rich transaction-level data from our partnering Fintech company, we find evidence that in the 12 months following Fintech solution installation, the *B2C Support Added* group (compared to those in the *B2B Support Only* group) were 16.8 percentage points more likely to have a live customer transaction with cards each month and process 79.2% more card transactions from customers per month.

Figure 1: Fintech Solution for Retailers and Interventions to Drive Adoption



The findings of this study can inform managerial strategy for two-sided payment platforms, as well as public policies to promote financial inclusion and retail modernization. Payment networks and Fintech companies view small- and medium-sized retailers in emerging economies as a major

growth opportunity. For instance, MasterCard has committed to bringing 50 million small and medium enterprises (SMEs) into the digital financial ecosystem through various business support programs by 2025, with investments exceeding US $250 million (Ely 2020). Moreover, there is considerable policymaker interest in this space, exemplified by investments of US $8.7 million across thousands of firms (at US $585 per firm) by our partners at Mexico's Ministry of Economy in the program we audited for this research (Secretarıéa de Economıéa 2018). Beyond their benefits to firms and consumers, digital payments can help policymakers gain greater visibility over economic activity in the retail sector, enabling the design of more effective policies. Case in point is our field experiment, which designed (then tested) interventions that directly build on and enhance the efficacy of a real policy program which consumed substantial public and private funding.

This paper aims to contribute to several strands of literature. First, we add to the work in marketing and economics studying the adoption and diffusion of two-sided platforms. This literature has theoretically analyzed how indirect network externalities, referring to the positive effect of adoption of a platform by users on one side by that of users on the other side, can give rise to coordination failures (informally, the "chicken-and-egg" problem) that inhibits their widespread diffusion (Katz & Shapiro 1994, Rysman 2009, Caillaud & Jullien 2003). However, rigorous empirical studies on approaches to resolving this coordination problem are scarce (Boudreau 2021), focusing primarily on fully online marketplaces in advanced economies (Tucker & Zhang 2010). We investigate these coordination challenges for platform diffusion in offline retail on the other side of the global digital divide. This is an understudied setting in spite of the fact offline retail accounts for a high proportion of economic activity and supports the livelihood of a significant proportion of the population in emerging economies[2].

In addition, our study is the first to design and experimentally test (across hundreds of firms) a novel marketing strategy that targets *both* supply-side and demand-side frictions in the adoption of a two-sided platform: first, by removing all onboarding frictions between the retailers and the platform through B2B after-sales services; and then, by inducing retailers to shepherd the demand-side onto the platform through an advertising and communications campaign in the B2C channel. Our experimental results indicate that this joint approach has large effects. Thus, we complement the handful of papers that use observational data to estimate the magnitude of indirect network externalities arising from government policies targeting the demand-side only – such as

[2]For instance, around 15% of Mexico's labour force is occupied in the traditional retail sector (INEGI-ENOE 2017).

India's demonetization (Crouzet *et al.* 2023) and Mexico's roll-out of debit cards for their household benefits program (Higgins 2019).

Second, we contribute to research in development economics on technology adoption by firms. Within this small but growing literature, the closest studies to ours concentrate on: (i) the agricultural sector, where the unit-of-analysis is a farmer who typically does not interact with end-consumers; and (ii) the adoption of farming technologies such as seeds and fertilizers, which represent hard physical products (Duflo *et al.* 2004, Duflo *et al.* 2008, Duflo *et al.* 2011, Foster & Rosenzweig 2010, Emerick & Dar 2021). We extend the scope of this research by examining retail firms and a two-sided Fintech solution with hardware and software components, as well as a requirement for the retailer to be formally banked. These differences allow us to identify novel barriers explaining technology adoption failure, namely the sheer complexity of new technology onboarding processes for digitally-inexperienced entrepreneurs and the reliance on complementary usage decisions by external market players (i.e., consumers).

Finally, in the broader marketing literature, researchers have begun to identify impacts of marketing on societal well-being (Chandy *et al.* 2021), and in particular, financial inclusion. The extant literature has largely examined the role of marketing levers in financial inclusion for *individual consumers*, with a particular focus on increasing savings, credit, and insurance adoption (e.g., Garbinsky *et al.* 2021, Gaurav *et al.* 2011, Hershfield *et al.* 2020, Thaler & Benartzi 2004). We contribute to this literature by illustrating how tactical elements of the marketing mix can bring financial inclusion to small *firms* by driving their Fintech adoption.

The rest of the paper proceeds as follows. First, in our conceptual development, we derive hypotheses on which frictions constrain the adoption of Fintech solutions for digital payments, using evidence from our policy program audit and related academic literature. Next, we describe the field experiment design and data collected. Subsequently, we present the results and finally, we conclude with implications.

2 Conceptual Development

2.1 Insights from a Government Program Audit

We first illustrate the substantial challenge of encouraging emerging market retailers to successfully adopt (i.e., take-up and use) Fintech through an audit of a government program by Mexico's

Ministry of Economy's National Entrepreneurship Institute (Instituto Nacional del Emprendedor, or INADEM) titled "Fortalecimiento de Microempresas para Elevar su Productividad". This program (henceforth referred to as the 'Fintech-drop' program) targeted interested retailers with fewer than ten employees and who had a permanent physical location — a segment of retailers in emerging economies that are traditional yet established in their business purpose, serving as an important distribution channel by aggregate sales volume. For example, these retailers collectively account for 70% of food expenditure in Mexico (Sverdlin Lisker 2023).

The government 'Fintech-drop' program was designed to eliminate (or significantly reduce) the following adoption barriers such as: i) the fixed cost of investing in the Fintech solution in that the hardware and associated software was fully subsidized; ii) logistical barriers in physically obtaining the Fintech solution in that all components of the solution were hand-delivered to the owner at the business site by a consultant; and iii) lack of information on the benefits of transacting digitally using the Fintech solution in that the consultants provided advisory information on the benefits for firms to accept digital payments.

In addressing these barriers, the government program's design was theoretically rooted in the extensive literature on technology adoption in developing economies that emphasizes budgetary constraints (e.g., Foster & Rosenzweig 2010), logistical technology access (e.g., Bertrand *et al.* 2004) and lack of information on technology benefits (e.g., Bloom *et al.* 2013) as important barriers to tackle. Moreover, at a cost to the policymaker of MXN $10,000 (US $585) per firm[3] and a total national budget of MXN $150 million (US $8.7 million) to extend the program to over 10,000 firms, this program represents a well-funded push to digitize retail payments. This investment ensured that all program components were of a high quality; for example, senior consultants providing the Fintech solution to firms were from a high-capacity NGO with expertise in building trust with SMEs in Latin America. To ensure that retailers had all the complementary hardware for the mPOS device, the program also provided retailers with a smartphone and 12-month internet data plan (though, for all the firms in our sample across the government program audit and our own field experiment, these were largely redundant as business owners already had smartphones).

We audited a random sample of 109 retailers participating in the government 'Fintech-drop' program located in the municipality of Guadalajara, Mexico. This audit took place in the first

[3]Of this total amount, we estimate that MXN $6,000 was directly dedicated to promoting Fintech adoption (the cost of the solution and consulting hours), while MXN $4000 was dedicated to other consulting activities (INADEM 2018).

quarter of 2019, which was roughly six months post-program participation. In the audit, which took place on-site at the retail store, we first assessed whether the retailer was presently receiving digital payments from customers. In particular, we checked whether they had a functioning Fintech solution to accept digital payments that they knew how to operate and were accepting customer payments using the solution. The result of this assessment is presented in Panel A of Table 1. We found that the vast majority of retailers — 88.07% — were not receiving digital payments from customers and continuing to operate as cash-only businesses. Thus, our audit revealed that this program was largely unsuccessful in its goal of driving payment platform adoption despite overcoming budgetary, logistical, and information frictions documented in the prior literature. Given that we obtained access to a random sample of program beneficiaries, a simple extrapolation would imply that over seven thousand of the 8,100 firms in the region who had received this MXN $10,000 (US $585) investment failed to adopt and use the Fintech solution provided. This is the basis of our characterization of 'Fintech Failure' in the retail sector of emerging economies.

Thus, our first takeaway from this audit is that removing fixed cost barriers and providing information on the benefits of using the Fintech solution is inadequate. Moreover, "small situational barriers" discussed in the behavioral economics literature (Bertrand *et al.* 2004) were not playing a decisive role in inhibiting adoption[4], as evidenced by the failure of an expensive intervention that brought the Fintech solution to the doorstep of the business owner at no upfront cost to them. We are able to rule out the alternative explanations for this Fintech Failure such as poor program implementation or graft, which can plague policy programs in developing economies (Banerjee *et al.* 2017), as all but two firms reported they did indeed receive the Fintech solution for free and the information on benefits from their consultant[5].

In order to understand the frictions inhibiting Fintech solution adoption, we interviewed all 96 'failure cases', i.e., those not receiving digital payments. They were asked to explain the main reasons why they were not using the technology provided to them. We then coded these open-text responses and present them in Panel B of Table 1. In line with digital payments being canonical two-sided platforms connecting supply-side agents, i.e., retailers, with demand-side agents, i.e.,

[4]For example, Bertrand, Mullainanthan, and Shafir discuss that minor situational factors such as "a testy bus ride, challenging hours, or the reluctance to face a contemptuous bank-teller" can explain why many of the world's poor remain without a bank account (Bertrand *et al.* 2004, p. 4)

[5]INADEM did face these issues when implementing a similar program in another region of Mexico with another partner, where national auditors found that no Fintech solution had been disbursed and public funds worth US $14.5 million had been appropriated by the partner (Mexico News Daily 2021).

Table 1: Audit of Fintech Solution Adoption by Retailers in Government Program

PANEL A: OVERALL FINTECH FAILURE RATES	Number of Firms	Proportion
Total Firms Audited	**109**	**100%**
Success Cases: Receiving digital payments from customers	13	11.93
Failure Cases: Not receiving digital payments from customers	96	88.07
PANEL B: REPORTED FRICTIONS IN FAILURE CASES		
Total Failure Cases	**96**	**100%**
Supply-side Frictions	*59*	*61.46%*
1. Unable to complete registration on Fintech app (e.g., couldn't link bank account or upload required information)	10	10.42
2. Did not begin setting up any part of Fintech kit (e.g., lacks ability, time, or too overwhelmed to set up)	9	8.33
3. Poor network connection (e.g., ran out of data or wifi is too slow)	5	5.21
4. Could not download Fintech app (e.g., lacks ability to find or add a new app)	5	5.21
5. Lacks access to bank account (e.g., doesn't have a bank account or know IBAN number)	5	5.21
6. Unable to execute complex transaction (e.g., doesn't know special steps for large, or foreign, card payments)	4	4.17
7. Other idiosyncratic supply-side frictions (e.g., bluetooth connectivity issues, smartphone hardware issue, etc.)	21	20.8
Demand-side Frictions	*37*	*38.54%*
1. Customers did not ask for digital payment option (e.g., customers unaware of or uninterested in digital payment option)	26	27.08
2. Customers explicitly expressed cash preference (e.g., customers distrust digital payments or find them inconvenient)	11	11.46

Notes: Data was collected in Q1 of 2019 through structured interviews of N = 109 randomly selected retailers participating in the program "Fortalecimiento de Microempresas para Elevar su Productividad" (funded by Mexico's Secretaría de Hacienda y Crédito Público and implemented by a collaborating NGO) from the municipality of Guadalajara. Retailers were first categorized as "success" or "failure" cases based on whether they were receiving digital (card or mobile) payments from customers at the time of the audit, roughly six months post-program participation. Failure cases were then asked to report the main reason they were not receiving digital (card or mobile) payments from customers. The top 9 reasons reported by retailers are presented in the table, categorized by whether they pertain to the supply- or demand-side of the Fintech platform.

consumers (Rysman 2009), we found that there were two major sets of frictions reported: supply-side frictions that pertained to the retailer's challenges with onboarding onto the payment platform, and demand-side frictions that pertained to both retailer uncertainty over levels of demand from consumer to use digital payments, as well as the real lack of demand from consumers in using digital payments. This additionally maps on to our conceptualization of successful adoption requiring both initial take-up of the technology solution (which could be constrained by supply-side frictions) and ongoing usage (which could be constrained by demand-side frictions).

2.2 Hypothesis Development: Supply-side Frictions

61.46% of retailers reported supply-side frictions, with the two most common ones being that they were unable to complete registration on the mobile app for the payment solution or that they did not begin the process of setting up any part of the Fintech solution. For the former, the registration process in a number of cases was halted by the complexity of linking one's bank account to receive digital payments as deposits. While we only report the six most commonly stated supply-side frictions in Table 1, a total of 15 idiosyncratic supply-side frictions were identified from just 59 retailers (listed in Online Appendix A Table 16), which highlights the breadth and diversity of pitfalls when a retailer attempts to adopt a Fintech solution.

In the program we audited, the hired consultants who delivered the Fintech solution to the retailer were neither required nor trained to provide onboarding assistance. Rather, onboarding was presumed to occur via the standard operating procedures of the mPOS companies. However, our audit suggests that while the existing onboarding support provided by the mPOS companies was suitable for the segment of more modernized retailers who self-select into adoption without any intervention (e.g., the 10.84% of early adopters per the 2019 census), it fell short of what was needed for the vast majority of retailers who represent the subsequent targets for payment digitization. This perhaps was not expected by the program designers as these firm owners universally own and operate internet-connected smartphones that the mPOS devices integrate with.

Our hypothesis on the critical role of supply-side platform onboarding frictions is also informed by the broader literature on Fintech. Empirical studies of mobile money — a different digital payment tool that is technologically simpler in that it does not have a hardware component to set up nor requires the user to have a formal bank account — suggest that lack of "tech know-how" can *still* be an adoption constraint (Dalton *et al.* 2023). It is plausible that these frictions would be exacerbated for our Fintech solution that has more onboarding steps, a hardware component to charge and connect via Bluetooth, and regulatory requirements not only in terms of having a bank account but having the relevant paperwork on hand to link one's bank account within the Fintech application to receive payment deposits.

If these supply-side frictions are binding, we posit that an intervention in the B2B channel (i.e., between the Fintech platform and the retailer) that provides a customized after-sales service on platform onboarding can be effective in promoting Fintech adoption. Marketing researchers have highlighted through empirical studies based on observational data that both the presence

and improved quality of after-sales service affect individual consumer behavior — in particular, they drive product diffusion and reduce churn (Kundu & Ramdas 2022, Buell *et al.* 2016, Zeithaml *et al.* 1996). To the best of our knowledge, we are the first to rigorously investigate the impact of after-sales service in the B2B channel for hundreds of business clients in a policy-relevant context, via a randomized controlled trial.

2.3 Hypothesis Development: Demand-side Frictions

The remaining 38.54% of retailers reported that demand-side frictions were responsible for their failure to adopt the Fintech solution. In particular, two types of demand-side frictions were reported. The first was that retailers were never asked by their consumers to transact using digital methods and thus were uncertain about the demand for them to offer alternate payment methods. The second type of demand-side frictions were that retailers reported negative consumer perceptions about using digital payments, for instance, that they were unsafe (could lead to card cloning and theft) or inconvenient (requiring a change of habits in contrast to using cash). This indicated a genuine lack of demand from consumers to purchase using digital payments. These reported frictions could cause retailers to fail to complete the onboarding process described above (even if they had the ability to do so) or churn in terms of offering digital payment options by the time of our audit after an unsuccessful trial with consumers.

These demand-side frictions seem to be present in spite of the possible benefits to consumers from transacting using digital payments. For instance, the literature on mobile money provides robust empirical evidence that using mobile money as a substitute to cash enables consumers to increase their savings and engage in consumption smoothing (Mbiti & Weil 2015, Jack, Ray, *et al.* 2013, Jack & Suri 2014, Suri & Jack 2016, Wieser *et al.* 2019, Economides & Jeziorski 2017). These benefits can be expected to extend to any type of digital payment, such as the card payments we study. Digital payments are also safer for consumers and often provide valuable services such as purchase protection and insurance against theft or loss. Thus, in our context, the demand-side frictions may stem from consumers being uninformed on these possible benefits and/or unconvinced about their magnitude relative to the perceived costs of changing their habit of paying by cash.

We propose to tackle these potential demand-side frictions through an advertising and marketing communications intervention in the B2C channel. As part of this intervention, the retailer uses physical advertising to indicate to customers that they welcome digital payments and deploys

customized marketing strategies to communicate the availability and benefits of digital payment options to consumers. The objective of this intervention is to generate consumer demand to use digital payment by bridging information gaps and employing persuasive tactics to get consumers to change their cash habits. It can also uncover latent demand from the approximately one in three Mexican adults that have a debit or credit cards (Demirgüç-Kunt, L. F. Klapper, *et al.* 2015) by simply informing them of the focal retailer's acceptance, thus resolving retailer uncertainty over the level of consumer demand for digital payments. This aligns with the theoretical functions of advertising and marketing communications as both informative and persuasive (Bagwell 2007).

We further posit that such an intervention can reduce retailers' uncertainty regarding the benefits of digital payment adoption in the early phases after they first obtain the technology. This provides them economic incentives to maintain the Fintech solution post-onboarding and not churn even in the face of ongoing costs such as transaction fees for digital payments, additional tax liabilities, or the costs of troubleshooting any technical difficulties that arise. To the best of our knowledge, we are the first to experimentally investigate how advertising and marketing communications in the B2C channel can affect demand on a two-sided payment platform and in turn, drive platform adoption and usage by the supply-side.

2.4 Motivation for Randomized Field Experiment

Subsequently, we detail the field experiment we designed and executed to test the efficacy of these interventions in the B2B and B2C channel. The reasons for our empirical approach of a field experiment are two-fold. First, the field experiment would allow us to independently verify that the supply-side and demand-side frictions from our audit data are binding. In theory, the self-reported frictions our data described in the previous section could mask true reasons for the observed adoption failure such as retailers' desire to remain less visible in terms of sales transactions to tax (or other governmental) authorities or their preference for cash for economic reasons (e.g., avoiding the 3% to 5% transaction fee for digital payments) or psychological reasons (e.g., deep-rooted habits). We do not directly intervene in alleviating these alternative frictions as the literature shows that changing firm preferences for informality, of which cash usage is a key pillar, is difficult and costly (Bruhn 2013, De Mel *et al.* 2013, Floridi *et al.* 2020). They may also not disclose these

reasons to our research team due to a lack of trust or due to social desirability bias (Krumpal 2013)[6]. However, if we are able to present causal evidence from a randomized experiment that our B2B and B2C channel interventions do move the needle in increasing Fintech solution adoption, this would constitute objective evidence validating that the self-reported supply-side and demand-side frictions are indeed binding.

Second, we seek to rigorously estimate the *causal* effect of our interventions to inform policymakers and managers on how to successfully digitize payments, given their potential benefits. A field experiment enables rigorous casual testing of our interventions that entail incremental costs beyond the types of programs our focal policymakers are already willing to invest in.

3 Experiment Design

Our randomized field experiment with N = 479 retail firms in Guadalajara, Mexico took place from mid-2019 to late 2022[7]. The retailers in the sample were randomly assigned to one of three experimental groups: 159 firms were assigned to the *B2B Support Only* group, 162 firms were assigned to the *B2C Support Added* group, 158 firms constituted a control group who were recruited and audited in the same manner as the treatment groups but did not receive any intervention.

We note that the field experiment has a sequential design in that the *B2C Support Added* group also received the B2B channel intervention but were subsequently provided with the B2C channel intervention. We thus are able to causally estimate the incremental impact of adding B2C channel support by comparing Fintech adoption and usage outcomes for the *B2C Support Added* group versus the *B2B Support Only* group. We made this design choice for three key reasons. First, due to logical and logistical complementarities, we conceived of the B2C marketing efforts as a process subsequent to Fintech solution setup — for instance, it would be misleading to install advertising materials indicating digital payment transactions from customers are welcomed without a Fintech solution at the business. From the managerial perspective of Fintech solution companies, analogous advertising materials are included in boxes with the mPOS hardware to be

[6]Social desirability bias refers to tendency of survey respondents to under-report socially undesirable behaviors and over-report socially desirable ones, due to self-presentation concerns. In our context, retailers may infer that a socially desirable behavior is to accept digital payments (or that an undesirable behavior is to avoid taxes and fees), and hence, provide an excuse for why they do not do so, in terms of these supply-side or demand-side frictions.

[7]We fully complied with Mexico federal government and Jalisco state directives regarding the COVID-19 pandemic throughout the study and of our own accord, suspended all in-person research activities for this field experiment between March and December 2020.

placed post-setup. Second, for policy relevance, we conceived of both interventions as additive enhancements to existing government 'Fintech-drop' (or similar) policy programs that were being implemented rather than mutually exclusive to one another. Third, by setting up the same Fintech solution at all treated retailers, we are able to access digital payment transaction data for our full treated sample post-setup through our collaboration with the Fintech company. This provides us with rich, objective transaction data on Fintech adoption for both treatment groups, which we use in our empirical analysis to provide more detailed treatment effect statistics.

3.1 Sample Recruitment

We recruited our sample of firms through a team of enumerators who canvassed all commercial areas across the Guadalajara metropolitan zone and went door-to-door to all small-scale retailers that were visually identified (small-scale defined conventionally as having 0 to 10 employees). The team was instructed to approach any such retailer operating out of a permanent physical structure to speak to the business owner. In this conversation, enumerators checked the following eligibility criteria: i) whether the business had been operational for at least six months; and ii) whether the business was currently *not* accepting any digital payments from cards (debit or credit), mobile wallets, or QR-based payments. Upon verification that these criteria were met, the business owner was invited to participate in our research study to obtain the chance, via a random lottery, of receiving assistance with adopting Fintech solutions to accept digital payments from customers.

This recruitment process intentionally bears close resemblance to the one our policy partners used for the 'Fintech-drop' program audited in Section 2. We adopted identical eligibility criteria and consent processes to enhance the ecological validity of our study. The locations of our study firms are shown on the map in Appendix A1 Figure 5. Given the geographically comprehensive nature of our recruitment, we believe this sampling frame is fairly representative of the retail environment in Guadalajara, although it contains only retailers that expressed openness to receiving support for payment digitization. This selection was necessary for conceptual purposes. Policymakers often must target costly policy programs to recipients who would benefit the most from them to make efficient use of public funds. In both the government 'Fintech-drop' program and our study, this would be the firms who were not early adopters of relevant Fintech solutions but were still not fully closed-off to adoption. Our government program audit and its revelation of widespread Fintech adoption failure indicates that it is still important to tackle frictions for this segment.

Another feature to note about our recruitment strategy is the spacing between retail firms in our sample. In our recruitment process, once a retail firm consented to be part of the study sample, enumerators were instructed in real-time to no longer recruit within a two-street radius surrounding that firm. The purpose of this was to minimize violations of the no-interference condition for causal inference, which requires that the potential outcomes for any unit should not vary with the treatment assigned to other units (Imbens & Rubin 2015). We aimed to minimize the possibility that two firms in the study sample were in each others' social network or otherwise easily observable to one another, within the logistical limits of achieving our intended sample size[8].

3.2 Baseline Audit

Once the business owner actively consented to study participation, they were required to complete a baseline survey—an on-site 90-minute business audit. Overall, 479 retailers completed the baseline survey and constitute the final sample to be randomized. In Appendix A2 Table 5, we illustrate the characteristics of the recruited sample at baseline. Where available, we also report the mean for each variable from the 2019 census on small retail businesses (i.e., 0 to 10 employees), to illustrate the representativeness of our sample. Per this census data, there are approximately 52,000 small retail businesses in the municipality, and thus our final sample accounts for 0.9% of this total, which is indicative of the scale of our randomized field experiment.

We summarize key features of our sample at baseline. 46% of business owners in our sample are female. The typical business owner is 44 years old and has completed high school or received higher education. Additionally, retailers in our sample are not subsistence-level businesses. The average business in our sample has owns assets valued at MXN $305,325 (US$17,833), and has a monthly sales turnover of MXN $46,901 (US$2,740). Thus, the 479 firms in our sample collectively accounted for US$15.3 million in annual retail sales, representing an important distribution channel for the municipality. Additionally, the mean values of employees and assets in our sample closely match population means calculated from the Census in 2019, highlighting the representativeness of our sample.

[8]We successfully implemented this recruitment strategy such that the average distance between a firm and its' nearest neighbor in our sample was approximately 400 metres, i.e. a 5 minute walk, which is substantial given the density of retail zones in urban areas of emerging economies.

3.3 Randomization

Randomization happened at the individual firm level with stratification on baseline profits (above- and below-median profits) and sector (retailing goods versus services). In Appendix A3 Table 6, we describe balance checks showing that randomization of firms into experimental groups was successful — the experimental groups were balanced on observable owner and business characteristics. To effectively manage logistics of a large-scale field experiment while navigating a pause due to a COVID-19 lockdown, our sample was recruited, randomized, and treated in staggered batches (9 roughly equally-sized batches in total). Regardless of which batch the firm was part of, randomization happened immediately prior to the scheduled intervention delivery, interventions were completed within three months of randomization, and the follow-up Fintech audit (described in Section 3.5) occurred roughly twelve months post-interventions and fifteen months post-baseline.

3.4 Intervention Implementation

B2B Channel Intervention. The B2B channel intervention replicated the government 'Fintech-drop' policy program and extended it with full onboarding support from a service agent. The service agents were local university students or graduates trained by our research team using the IT support training materials from our partner Fintech solution provider. The service agents were trained to deliver the same Fintech solution detailed in Figure 1 (mPOS device, payment app, smartphone, and 12-month 1GB data plan), to complete platform onboarding for the retailer and to teach the business owner and any relevant employee how to process digital payments using the solution provided. This was done over two visits, each lasting one hour. During the first visit, the full onboarding process is completed, which involves: i) activating the smartphone and data plan, ii) activating the mPOS device, iii) downloading and installing the payment solution app, iv) connecting to the mPOS device via Bluetooth, v) registering the business for an account on the app, and vi) linking the owner's bank account to the app to receive payment deposits. The first visit ended with training and hands-on practice in processing digital payments with the service agent role-playing as a prospective customer.

The second visit took place within a week of the first visit. The purpose of the visit was primarily to provide customized troubleshooting on any technology challenges that might have emerged since the first visit. Once this was complete, additional hands-on practice with processing payments

was provided until an hour had elapsed. This intervention had an incremental cost of MXN $300 (US$12) per firm (two hours of market wages for service agents, plus their transportation costs). Relative to the MXN $10,000 (US$585) government 'Fintech-drop' program this was inexpensive, accounting for about 3% of the costs of the program.

B2C Channel Intervention. The B2C channel intervention represented a push to encourage digital payment usage on the demand-side such that the business owner would have an incentive to successfully adopt the Fintech solution provided. Retailers assigned to this treatment group were offered two key pieces of assistance: i) a digital payment advertising kit consisting of an outdoor pop-up stand, poster, open-and-close sign, and point-of-sale area stand, conveying to consumers that the retailer welcomed digital payments (illustrated in Appendix A4 Figure 6); and ii) eight sessions (each lasting one hour) from a consultant focused on marketing digital payment options to consumers. As in the B2B intervention, the consultants were local university students or graduates—though to prevent intervention contamination, they were recruited and trained separately from the B2B service agents. In Appendix A4 Table 7, we summarize what the focus of each of the eight sessions was.

This intervention had an incremental cost of MXN $1250 (US$73) per firm which covered eight hours worth of market wages for consultants and the advertising kit materials. Relative to the MXN $10,300 (US$597) government 'Fintech-drop' program with B2B onboarding support, the incremental cost of this intervention was about 12.1% of the program budget.

Control Group. As part of the study recruitment process, the control group received a strong nudge to adopt a Fintech solution for digital payments—our study invitation, baseline survey, and consent process presented several arguments for why it would be beneficial to do so. Beyond this, they received no further intervention. We opted to maintain this 'pure' control group over one for whom we exactly replicated the government 'Fintech-drop' intervention (i.e., without B2B onboarding support), as we did not want to invest substantial public and donor funds on an intervention that we, a priori, believed to be ineffective based on our program audit. The control group was aware from the recruitment process that they may not receive any assistance (based on the outcome of the random lottery), and if they were selected to receive assistance, this would occur within three months of their recruitment. Because of this, they could infer that they were not selected to receive assistance. Thus, tracking the control group allowed us to observe the organic process of Fintech solution adoption for this segment, in the long-run, without any intervention.

During the study period, the mPOS devices constituting our Fintech solution were being heavily marketed to this segment through the door-to-door salesforce of several competing companies, including our partnering Fintech company. They were also available for purchase at all major modern retailers. Basic mPOS devices were priced around MXN $150 to $200 (US $9 to $11.50). This corresponds to 10% of the monthly revenue in the bottom 1st percentile of our sample and, therefore, was highly affordable. These are the market conditions that our control group was exposed to for organic, self-directed adoption.

3.5 Data Collection for Results

We collected data from three sources to measure the impact of our interventions: a Fintech audit at the business location twelve months post-intervention (used for main effect evidence), intervention monitoring reports from the service agents (used for process evidence on the B2B intervention) and administrative data from our partnering Fintech company on all digital payment transactions received by our treated sample (used for process evidence on the B2C intervention).

Fintech Audit 12 Months Post-Intervention (Main Effect Evidence). The Fintech audit was conducted for all retailers in our sample, including the control group, by independent enumerators who were blind to the experimental design and treatment status of the firm. Enumerators were supervised in the field by regional team leaders and a survey manager to ensure high data quality. The audit involved a 20-minute survey conducted with the business owner, with physical checks to verify responses. In this audit, we assessed each retailer's long-term success in adopting — i.e., both taking-up and using — the Fintech solution for digital payments.

B2B Intervention Monitoring Reports (Process Evidence for B2B Intervention). In order to understand how our B2B intervention impacted firms, we leverage rich data collected from our B2B service agents on their activities during the intervention. After completing each visit with a treatment group firm, B2B service agents immediately filled out a standardized monitoring report discussing their activities during the visit, including challenges encountered (from business owner attitudes to technological challenges) during the visit and solutions provided to challenges encountered. We code these text responses to provide descriptive evidence on how the B2B intervention impacted firms.

Admin Data from Fintech Company. (Process Evidence for B2C Intervention). During the B2B intervention, our field team set up mPOS devices at treated firms and created their accounts

with our partnering Fintech company. Using the account details, we were then able to obtain rich data from the company on all digital payment transactions (if any) received by each treated firm, provided that the firm consented to share this data with our research team[9]. While this data was unavailable for the control group, it is very useful to us in determining the causal impact of the B2C intervention on payment digitization for retailers over time relative to the *B2B Support Only* group. This administrative data allowed us to objectively observe the Fintech adoption journey in great detail for treated firms from both experimental groups, with no concerns of biases that afflict self-reported measures. For each of the treated firms, our dataset contained all the digital payment transactions received by their account in the first year and the following transaction details: date and time completed, the amount in pesos, and whether the transaction was completed or canceled. In total, this dataset includes 16,107 customer transactions totaling $3.8 million pesos (US$220,000), representing a unique window into the payment digitization journey for retailers in an emerging economy.

3.6 Sample Attrition and Business Closure

Prior to describing our results, we discuss why that attrition (i.e., non-response from a firm in a data collection round) and firm closure do not pose a threat to causal identification in our experiment.

In the Fintech audit twelve months post-intervention, attrition from our sample was low (we reached 94.2% of the 479 firms in our sample) and not systematically related to treatment assignment (see Appendix A5 Table 8). Additionally, the post-attrition sample of N = 451 firms reached during the audit remained balanced across experimental groups (see Appendix A5 Table 9). Beyond attrition, we found that a small proportion (22.3%) of the 451 firms randomized at baseline had not survived. This is comparable to the corresponding 18% to 21% statistic for small businesses in the United States over the same period (US Bureau of Labor Statistics 2022). Again, this is not a concern for causal identification as non-survival was not systematically related to treatment assignment (see Appendix A5 Table 8) and the operational sample of firms upon which our treatment effects are based remained balanced across experimental groups (see Appendix A5 10). Additionally, B2B intervention monitoring reports were available for 100% of this sample.

[9]This consent step was agreed upon with the partnering Fintech company to maintain the privacy rights of their clients even if those clients constituted our study sample.

Finally, we discuss 'attrition' in the administrative dataset from our partnering Fintech company. All firms who were assigned to a treatment group (i.e., not the control group) were eligible to be part of this dataset as they would have been offered the mPOS device via the B2B intervention. Out of these 321 eligible firms (159 assigned to the *B2B Support Only* group and 162 assigned to the *B2C Support Added* group), full transaction data was obtained for 256 firms, i.e., 79.8% of eligible cases. Thus, we were able to obtain wide coverage of our sample from this data source. Among the 20.3% (N=65) of firms for whom this data was unavailable, 11.2% (N=36) were non-compliers with the intervention and thus never had created an account with the company, 3.1% (N=10) had not survived by the time we reached out to obtain their consent to data sharing, and 5.9% (N=19) refused to share their data out of privacy concerns. Again, this is not a concern for causal identification as this attrition was not systematically related to treatment assignment (see Appendix A5 Table 8) and the operational sample of firms upon which our treatment effects are based remained balanced across experimental groups (see Appendix A5 11).

4 Main Effect: Analysis and Results

In this section, we examine the impact of our B2B and B2C channel interventions on firms' adoption of a Fintech solution to receive digital payments, per the on-site audit approximately twelve months post-intervention.

4.1 Measurement of Dependent Variables

We conceived of the Fintech adoption process as a three-stage funnel (or sequential process), where retailers could "fail" at any of the three stages. In line with the two-sided nature of digital payment platforms, the first two stages corresponded to the supply-side adoption steps, and the final stage corresponded to a demand-side usage step. Below we describe each stage and how we measured it, as these form the main dependent variables in our analysis.

Stage 1: Access to Banking Infrastructure (Supply-side). To pass this stage, enumerators ask the business owner if they have access to a bank account in which they could conceivably receive deposits of digital payments from customers. We noted that this bank account could belong to the business owner or an associate (e.g., their spouse, family member, business partner etc.), and that it could be a personal account rather than one specifically for the business. Additionally, access

simply meant that the business owner could obtain the necessary permission and information to receive deposits of digital payments from customers. The variable we use in our analysis is binary, coded as '1' if the business had access to any such bank account. This is a pre-condition to move to the next stage as it is essential in the setup of all major Fintech solutions to accept digital payments in Mexico.

Stage 2: Functioning Fintech Solution Present to Accept Digital Payments (Supply-side). Enumerators proceeded to verify this stage as follows: i) they determined through a physical check if the owner had the necessary hardware and software to accept card and other digital payments (i.e., an mPOS device of any brand or a substitute such as a traditional bank terminal or a computerized POS system) at the business location, ii) that all components of the Fintech solution were functional at the time of the audit (e.g., not discharged, in good working condition), and iii) the owner had the knowledge and ability to operate the Fintech solution comfortably to receive a digital payment. The variable we use in our analysis is binary, coded as '1' if all the above criteria were met for the business to have a functioning Fintech solution present to accept digital payments. This is also a pre-condition to move to the next stage.

Stage 3: Used in Consumer Transactions (Demand-side). As the final stage of successful adoption, enumerators asked the owner to report the rate of digital payment usage in consumer transactions in the previous month – i.e. what fraction of consumer transactions were done using a digital payment method as opposed to cash. Based on this measure, the variable we use in our analysis is binary, coded as '1' if the business had one or more customer transactions using digital payments in the last month. We consider retail firms who pass this stage to have successfully adopted a Fintech solution to accept digital payments from consumers[10].

We use this third stage (usage-based) variable as our primary metric for successful adoption, as opposed to the second stage variable of having a functioning Fintech solution present to accept digital payments, for a number of reasons. First, without any customer usage, it is highly unlikely that the retailer could obtain any benefits of simply having the device. All benefits, such as attracting new customers and better tracking one's business finances, rely on the assumption that consumers actually transact using digital payments. This is fundamental to the two-sided nature of any digital payment platform. Second, based on our field study detailed in Section 2.1, churn is highly likely without consumer usage in the long-term as the Fintech solution requires maintenance

[10]For robustness, we also vary the usage threshold in coding this DV as "1' to having at least 1 in 50 consumer transactions using digital payments.

from the retailer — they need to keep the card reader charged, update the associated software, and comply with new regulations, among other maintenance steps. Thus, we require a minimum threshold of consumer usage in our primary metric for successful adoption.

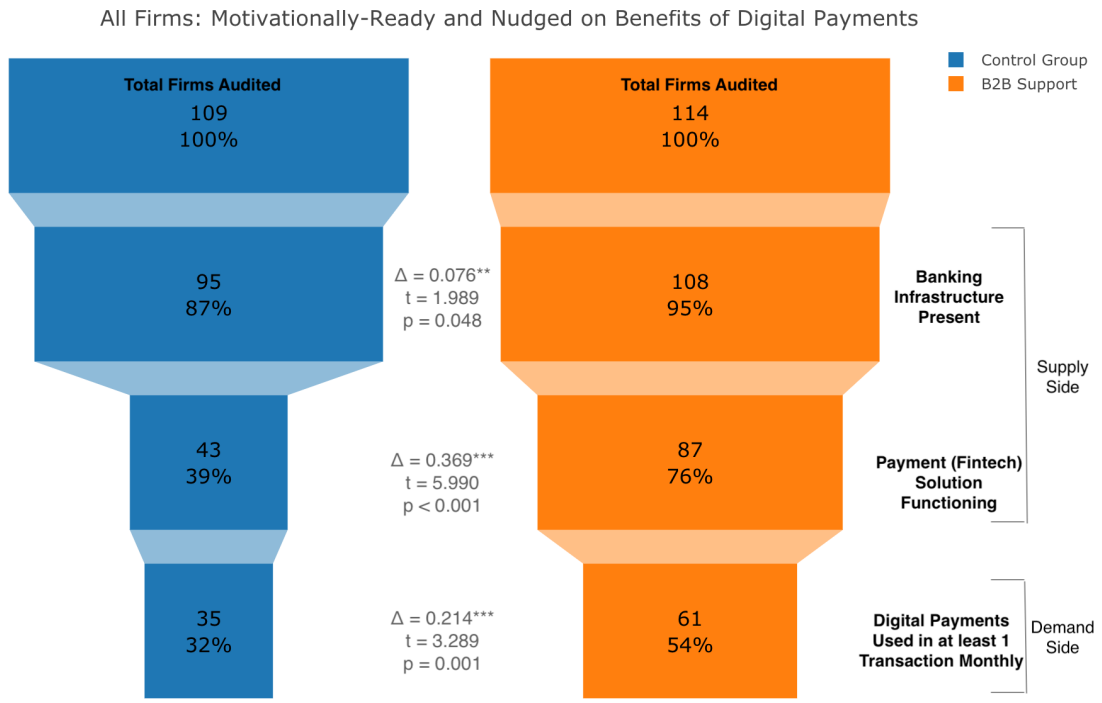
4.2 Model-Free Evidence: Fintech Failure Funnel

Our model-free evidence in Figure 2 depicts the three stages of adopting a Fintech solution to receive digital payments as a funnel and illustrates how this funnel varies by experimental group. We focus on Panel A of Figure 2 first, which contrasts the control group with the *B2B Support Only* group. Given that retail firms who pass through to the bottom of the funnel in our audit are considered successful adopters, we show that our B2B channel intervention has a positive and statistically significant effect on successful adoption. Specifically, being assigned to receive this intervention raises the likelihood of being a successful adopter in the long term (twelve months post-intervention) by 21.4 percentage points. This effect is large in magnitude: in relative terms, it represents a 66.9% improvement over the control group firms.

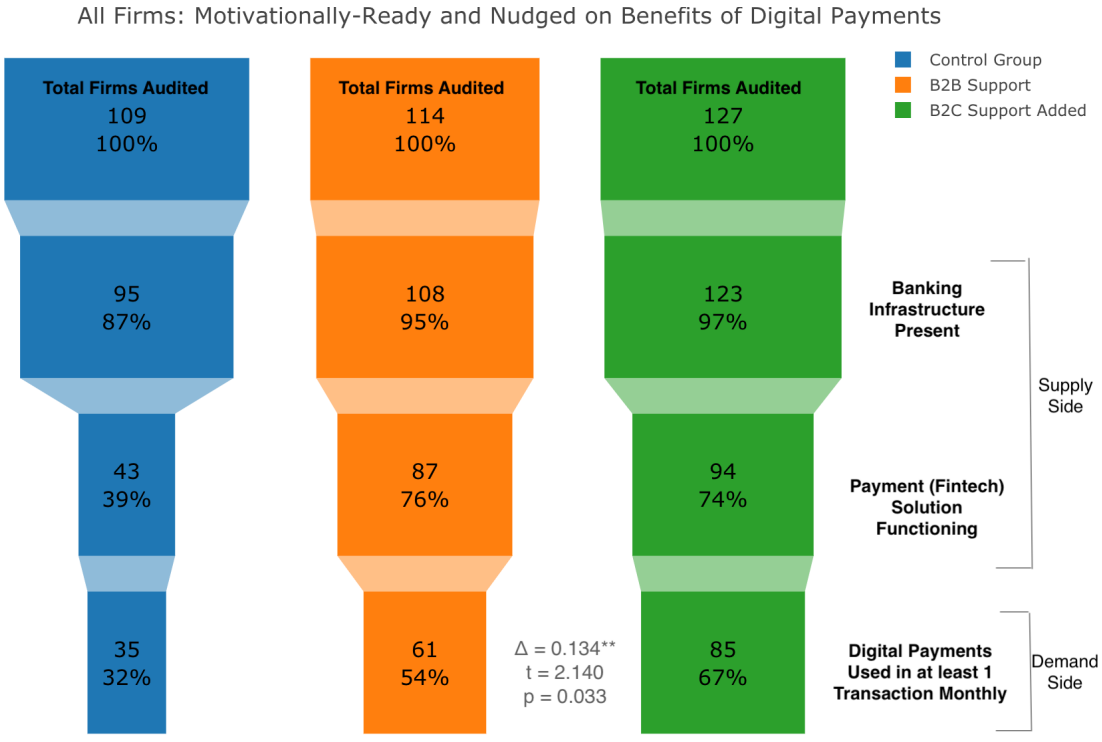
Looking further up the funnel, we are able to see the prior stages at which the divergence between the control group and the *B2B Support Only* group emerges. In the first stage, the *B2B Support Only* group is 7.6 percentage points more likely to have access to banking infrastructure to receive digital payment deposits, and this difference is significant at the 10% level. This may be because, in the B2B channel intervention, onboarding support included helping owners to open a bank account conveniently (the process could be completed entirely online) and inexpensively (no minimum deposit required) if they did not have access to one. The biggest divergence between the control group and the *B2B Support Only* group occurs in the second stage. 76% of the *B2B Support Only* group was physically verified to have a functioning Fintech Solution present in the business to accept digital payments during the audit, twelve months post-intervention, relative to 39% in the control group. This difference is statistically significant at the 1% level. Thus, our intervention nearly doubled this rate, with a relative effect size of 94.6%. Taken together, these results show that our B2B intervention goes a long way in alleviating supply-side frictions to successful Fintech adoption, which do seem to bind for the control group.

One notable feature of Figure 2 Panel A is that even for the *B2B Support Only* group, there is considerable drop-off between the second and third stage of the funnel. While 76.3% of the *B2B Support Only* group was physically verified to have a functioning Fintech solution present, only

Figure 2: **Fintech Adoption Funnel**—At what stages do retailers drop out and fail in their Fintech adoption journey?



(a) Comparing Control and "B2B Support Only" Groups



(b) Comparing Control, "B2B Support Only", and "B2C Support Added" Groups

53.5% had used it to receive digital payments in the last month. Per our theorizing, this could be due to demand-side frictions continuing to bind, even after supply-side frictions had been resolved to a large extent[11].

To understand the role of the demand side in greater detail, we describe Panel B, where we also illustrate the funnel for the *B2C Support Added* group. Up until the second stage of the funnel, the trajectory of the *B2C Support Added* group is almost identical to that of the *B2B Support Only* group, which is to be expected as the former also received the B2B channel intervention addressing supply-side frictions. But subsequently, a larger proportion of the *B2C Support Added* group is able to pass through to the final stage of successful adoption, which is to have used their functioning Fintech Solution in at least one consumer transaction in the last month. 66.9% of the *B2C Support Added* group are successful adopters, which represents a 13.4 percentage point improvement over the *B2B Support Only* group. This difference is statistically significant at the 5% level. In terms of relative effect sizes, this is again a substantial increase of 25% in the proportion of successful adopters relative to the *B2B Support Only* group. Thus, the model-free evidence indicates that our B2C channel intervention is effective in tackling demand-side frictions, which do seem to bind for the *B2B Support Only* group even after they have overcome supply-side frictions to have a functioning Fintech Solution present in their business.

4.3 Model-Based Evidence: Intent-to-Treat Effects

This model-free evidence is supported by our ITT regression analysis which estimates the model specified in Equation 1:

$$Y_i = \alpha + \beta_1 B2BSupportOnly_i + \beta_2 B2CSupportAdded_i + \ x_i'\gamma + \epsilon_i \tag{1}$$

Y_i is the main dependent variable for firm i: our measure of successful adoption of a Fintech solution, i.e., usage of digital payments in at least one consumer transaction in the last month. This corresponds to the final (third) stage of the funnel from the previous subsection. This dependent variable is binary, and for ease of interpreting coefficients, we use a linear probability model, though

[11]Indeed, the *B2B Support Only* group has a lower conversion rate from second to third stage (61 out of 87 firms, or 70.1%) than even the control group, where 35 out of 43 (81.3%) firms with payment solution functioning saw at least 1 digital payment transaction. This is intuitive — those in the control group that were motivated and able enough to get the payment solution functioning by themselves were likely to be a self-selected group who had more to gain in terms of the demand from their consumer base. In contrast, it is likely that the B2B intervention enabled a wider set of firms to get the payment solution functioning

our results are robust to using non-linear probit and logit models (see Appendix B Table 12).

Our main explanatory variables are $B2BSupportOnly_i$ and $B2CSupportAdded_i$, which are dummy variables indicating whether firm i was (randomly) assigned to the *B2B Support Only* group or the *B2C Support Added* group, respectively. x_i represents a vector of control variables measured pre-intervention, including baseline controls for owner and firm characteristics (gender; age; marital status; children status; education; average customer basket size; monthly sales; total employees; 5 sub-sector fixed effects, i.e., set of two-digit SIC codes) and nine strata dummies indicating which randomization/implementation batch the firm was part of. We report robust standard errors throughout. This specification confers numerous advantages and is recommended in the development economics literature (McKenzie 2012). First, by using the exogenous treatment assignment variables rather than endogenous treatment compliance variables, we provide ITT estimates that are unbiased for the average treatment effect. Second, by including control variables measured at baseline, we improve the precision of estimates and account for any group imbalances due to attrition or non-survival.

In Table 2, we report estimates of β_1 and β_2 from Equation 1. The estimates indicate a positive and statistically significant effect (at the 1% level) of our B2B and B2C interventions on successful adoption. We interpret the estimates in Column 2, which is our preferred specification as it includes control variables from baseline to improve precision. Firms assigned to the *B2B Support Only* group were 19.8 percentage points more likely than the control group during the audit (twelve months post-intervention) to have been successful adopters, which represents an average improvement of 66.6% over the control group that is statistically significant at the 1% level. Similarly, firms assigned to the *B2C Support Added* group were 33.0 percentage points more likely than the control group during the audit (twelve months post-intervention) to have been successful adopters, which represents an average improvement of 102.9% over the control group that is statistically significant at the 1% level. Moreover, the *B2C Support Added* group was 13.2 percentage points more likely than the *B2B Support Only* group during the audit (12 months post-intervention) to have been successful adopters, and this difference between β_1 and β_2 is statistically significant at the 5% level.

Robustness. In Columns (3) to (4), we show that these results are robust to an alternative dependent variable for successful adoption: we use a stricter usage threshold of having at least 2% of consumer transactions using digital payments. We consider this to be a fairly strict threshold overall, as the (self-reported) median usage of digital payments in our sample among those who had

Table 2: Impact of B2B and B2C Support Interventions on Success in Fintech Adoption

	In the last month ...			
	(1) ≥1 Digital Payment	(2) ≥1 Digital Payment	(3) ≥2% of Transactions with Digital Payments	(4) ≥2% of Transactions with Digital Payments
B2B Support Only	0.214***	0.198***	0.146**	0.133**
	(0.0649)	(0.0661)	(0.0633)	(0.0653)
B2C Support Added	0.348***	0.330***	0.268***	0.256***
	(0.0614)	(0.0621)	(0.0618)	(0.0628)
Biz/Owner Controls	No	Yes	No	Yes
Strata FE	No	Yes	No	Yes
Mean of DV: Control	0.321	0.321	0.275	0.275
Effect Size in %: B2B	66.64	61.65	52.98	48.35
Effect Size in %: B2C	108.4	102.9	97.40	92.85
P-Value: $\beta_{B2B} = \beta_{B2C}$	0.0336	0.0385	0.0579	0.0594
Obs.	350	350	350	350

Notes: Data underlying these regressions were collected during an audit 12 months post-intervention. Estimates presented are from linear probability model regressions of the DV on treatment assignment (i.e., intent-to-treat estimates). The DVs are binary indicators for whether a Fintech Solution to receive digital (card, mobile wallet, or QR-based) payments was successfully adopted by the firm. In Columns (1) and (2), the DV is whether at least one digital (card, mobile wallet, or QR-based) payment was received from a customer in the last month. In Columns (3) and (4), the DV is whether at least 1 in 50 customer transactions were completed using digital (card, mobile wallet, or QR-based) payments in the last month. The indicated regressions include: baseline controls for owner and firm characteristics (gender; age; marital status; children status; education; average customer basket size; monthly sales; total employees; 5 sub-sector fixed effects i.e., set of two digit SIC codes) and 9 strata dummies indicating which randomization/implementation batch the firm was part of. Robust standard errors are in parentheses. P-values are highlighted as: $p < 0.1^{*}$ $p < 0.05^{**}$ $p < 0.01^{***}$

a functioning Fintech solution present at the business was 1 in 20 (or 5% of) consumer transactions. These specifications also show very comparable effect sizes that are statistically significant at conventional levels. In Appendix B Table 12, we provide further tests to show that our effects are robust to the empirical choices in our preferred specifications. First, we show that results are similar—in statistical significance and economic interpretation—when we alter the regression sample to include nonoperational firms (coded as being unsuccessful in Fintech adoption) in Column (1). Next, we show the same when we use a double-selection lasso to choose control variables in Column (2). Finally, Columns (3) and (4) highlight similar marginal effects when we use probit and logit models instead of the linear probability model.

Thus, our interventions have robust positive effects on Fintech solution adoption that are statistically significant, persistent at least up to 12 months post-intervention, and large in magnitude.

This analysis corroborates our descriptive evidence from the government 'Fintech-drop' program audit that supply-side and demand-side frictions play a big role in the failure of Mexican retailers to transact using digital payments. Next, we present insights on why these marketing interventions in the B2B and B2C channels were successful in promoting Fintech solution adoption among retailers.

5 Process Evidence: B2B Channel Intervention

In order to understand why our B2B intervention was effective relative to the failed government 'Fintech-drop' program, we leverage rich data collected from our B2B service agents on their activities during the intervention. After completing each visit with a firm, B2B service agents filled out a monitoring report discussing their activities, including challenges encountered (from business owner attitudes to technological challenges) during the visit and solutions to challenges encountered. Upon analyzing this data, an empirical regularity that emerged was that the onboarding process was often not smooth — for the majority of treated firms, B2B service agents needed to provide customized troubleshooting support for a critical challenge encountered. By critical, we mean that if the challenge was left unsolved, Fintech solution adoption could not occur. In Table 3, we summarize our insights from this data.

5.1 Evidence on the Intensity of Onboarding Challenges

In Panel A of Table 3, we show that out of the 238 treated firms in our analysis sample, 51.68% encountered at least one critical supply-side challenge that would have derailed the entire Fintech solution adoption process, if not for customized troubleshooting help from B2B service agents. Thus, a standardized B2B service was sufficient in less than half of the total cases. We also highlight the intensity of these critical challenges in Panel A, showing that in a non-trivial amount of cases, i.e., 21.5% of firms treated with the B2B intervention, the firm faced more than one critical challenge that they would have to overcome. Qualitative field evidence from interviews suggests that facing these challenges was demoralizing to the business owners.

5.2 Evidence on the Variety of Onboarding Challenges

In Panel B of Table 3, we break down the critical supply-side challenges by variety instead of intensity. Noting that a total of 41 idiosyncratic supply-side challenges were reported, we report on

Table 3: Extra B2B Support for Critical Supply-Side Technology Challenges

PANEL A: RATE OF EXTRA B2B SUPPORT PROVISION	Number of Firms	Proportion
Total Firms Receiving B2B Channel Intervention	**238**	**100%**
Standardized B2B service sufficient	115	48.32
Customized B2B troubleshooting provided as faced critical challenge(s):	123	51.68
1 critical challenge(s) faced	*74*	*31.09*
2 critical challenge(s) faced	*29*	*12.18*
3 critical challenge(s) faced	*14*	*5.88*
4-6 critical challenge(s) faced	*6*	*2.52*
PANEL B: TOP 5 CRITICAL CHALLENGES AND THEIR SOLUTIONS		
Total Firms Receiving Customized B2B Troubleshooting	**123**	**100%**
1. Internet failures (for example: slow, patchy etc.) *B2B Support Solution: Resolve with TSP hotline or switch to Wifi*	47	38.21
2. No bank account to receive payment deposits *B2B Support Solution: Open bank account online with Afirme Bank*	42	34.14
3. Forgetful of, or slow in learning, how to process payments *B2B Support Solution: Provide extra practice and video tutorials*	16	13.00
4. Lacked basic knowledge of banking system *B2B Support Solution: Provide banking 101 training*	12	9.75
5. Processing payment takes $\geq$ 1 min *B2B Support Solution: Update smartphone OS and Fintech app*	9	7.32

Notes: Data was collected from B2B support agents during the B2B channel intervention (agents completed a report after each visit to a firm). Frequencies of challenges and support requirements are reported for firms included in the analysis in Section 3. A total of 43 critical challenges were identified, of which the top 5 are reported in Panel B.

the tip-of-the-iceberg, i.e., the top 5 challenges faced in terms of frequency. We also highlight the solutions to these challenges that our B2B service agents provided to show their complexity, variety, and customization. For instance, in the case of the top-reported challenge of internet failures, our B2B service agents provided multiple solutions depending on the context of the retailer, from contacting customer support for our telecommunications service provider, providing an alternative data plan that had better coverage for the specific locality, or helping the firm to connect to a local Wi-Fi network. In other cases, pedagogical challenges emerged. The third-most frequently reported challenge was that business owners were forgetful or slow in learning how to process digital payments. This was solved through extra practice and by providing firms with guided video tutorials via WhatsApp, which was identified as the most popular and accessible communication tool for our sample of business owners. The complete set of 41 critical supply-side challenges

experienced by our treated sample and the customized solutions created and deployed by our B2B service agents are summarized in Appendix C.

Such extensive, customized B2B troubleshooting would not be available to the control group firms serving as the counterfactual in our treatment effect estimation. We review the B2B onboarding and troubleshooting processes of the top mPOS companies in the marketplace—i.e., the support the control group firms would have to rely on post-purchase. For standardized onboarding support, a physical instruction manual is provided to complete the following cumbersome setup steps: i) activating the mPOS device, ii) downloading and installing the Fintech solution app, iii) connecting one's smartphone to the mPOS device via Bluetooth, iv) registering the business through an account on the app, v) inputting all required information such as a photo of the owner's national ID card, the average monthly sales and profits of the business, and a list of top products sold as well as their prices, and vi) linking the owners bank account to the app to receive payment deposits. For any challenge encountered (a deviation from the standardized process), the salient resources provided are the in-app FAQs, a chatbot, or the company's customer support line. These are all resources that control group firms would actively have to seek out and be motivated to navigate through, instead of giving up on adoption.

Hence, our descriptive evidence highlights two key insights. First, the onboarding process for a new Fintech solution to accept digital payments is not trivial and simple to navigate for retailers. It requires strong motivation (with uncertain benefits ex-ante), persistence, and technology savvy on the part of the business owner. This might explain why only 39% of the control group were able to pass through to the stage of the funnel that required them to have a functioning Fintech solution present and operable on-site. Second, providing customized and extensive B2B onboarding support can overcome these supply-side frictions, leading to a near-doubling in this rate for treated firms.

6 Process Evidence: B2C Channel Intervention

To shed light how the B2C channel intervention impacted successful adoption by treated firms, we leverage the rich administrative data on digital payment transactions from our partnering Fintech company. In Section 4, we showed initial evidence from our Fintech audit that the B2C channel had a statistically and economically significant effect on a main adoption DV— a binary variable indicating whether the retailer had received a consumer transaction using digital payments in the

month prior to the audit. We now supplement this with objective data on other usage-related DVs, such as the number of consumer transactions using digital payments, measured exhaustively throughout the first twelve months since the mPOS device was installed at the treated business.

6.1 Measurement of Dependent Variables

The admin dataset contained all the digital payment transactions received by treated firms in the first year after device installation. For tractability in analysis, we aggregate this raw transaction data into a panel dataset where each row corresponds to a firm-month pair, with 'month' referring to the number of months elapsed post-installation of the Fintech solution rather than calendar month. This is to enable like-for-like comparisons of usage over time, given that firms received their intervention at different points throughout early 2020 to early 2022. Additionally, prior to aggregating transactions at the monthly level, we drop any transactions that constituted practice with the service agent during the B2B channel intervention: these could be detected in the dataset as we trained service agents to make practice transactions with a specific monetary amount (MXN $20.17) and then cancel the transaction. Thus, in this panel, we track treated retailers' monthly usage of the Fintech solution for digital payments with actual consumers in their first year. Below we describe the six dependent variables we model using this data, each of which captures different substantive aspects of Fintech usage.

Monthly Active Usage (Binary). Two of our dependent variables (DVs) are binary indicators for whether the Fintech solution was actively used in that month, with active usage operationalized in two different ways: (i) as whether at least one digital payment was received from a customer; and (ii) as whether at least four digital payments were received (i.e., an average of one per week).

Monthly Number of Transactions (Integer). Two of our DVs are based on the monthly number of digital payment transactions received from customers, operationalized in two different ways: (i) as levels i.e., number of transactions winsorized 2.5% on both tails in each time period; and (ii) as logs i.e., the inverse-hyperbolic-sine transformation applied to the number of transactions.

Fintech Success Index (Continuous). Our final set of DVs aggregate the four DVs described above. We standardize each of the four constituent DVs in each time period, using the *B2B Support Only* group as the basis for standardization. This standardization ensures that all variables are scaled to be comparable to one another. To create the first index, we simply average the four standardized DVs. To create the second index, we extract the predicted scores for the first

principal component of the four standardized DVs (which explains 83% of the variation per our PCA). Conceptually, these DVs represent composite indices that capture how successful the retail firm has been at using the Fintech solution to receive digital payments each month. We use these composite indices as combining outcomes improves statistical power to detect effects that go in the same direction (Drexler *et al.* 2014). Moreover, using these indices addresses potential concerns around multiple hypothesis testing, as they help us demonstrate that our results are not predicated on any single outcome variable.

6.2 Model-Free Evidence

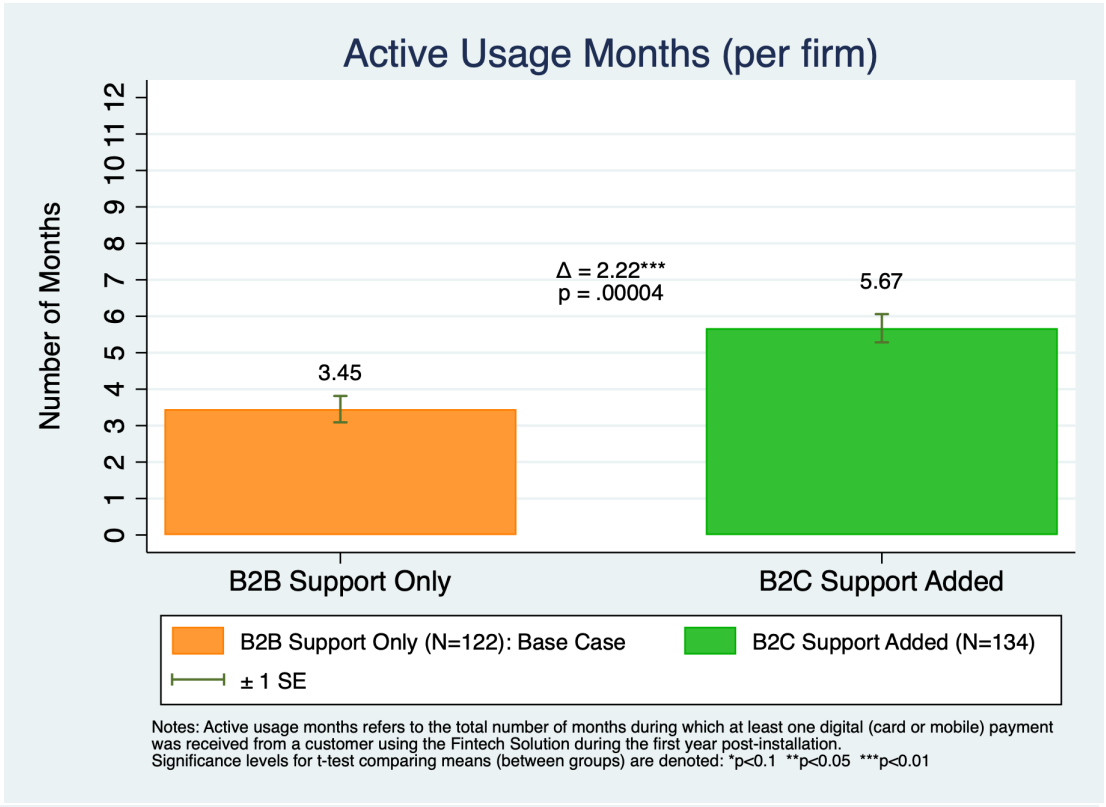
In Figures 3 and 4, we provide model-free evidence that the B2C channel intervention increased the usage of digital payments in consumer transactions, both in terms of the number of businesses using digital payments, and their intensity of usage.

In Panel A of Figure 3, we plot the number of active usage months by the experimental group, where 'active usage months' refers to the total number of months during which at least one digital payment was received by the firm from a consumer. While firms in the B2B Support group had 3.45 active usage months on average in the first year post-installation, this figure increased to 5.67 for the *B2C Support Added* group. In Panel B of Figure 3, we plot the proportion of retailers who were active users each month over the course of the first year post-installation. We see that both experimental groups started off with roughly 80% of active users in the first month (30 days) post-installation, but the *B2B Support Only* group significantly dropped off subsequently, while the *B2C Support Added* was able to maintain a higher rate of active users. Between six and twelve months post-installation, around 25% of businesses in the *B2B Support Only* group were active users compared to 40% in the *B2C Support Added* group[12].

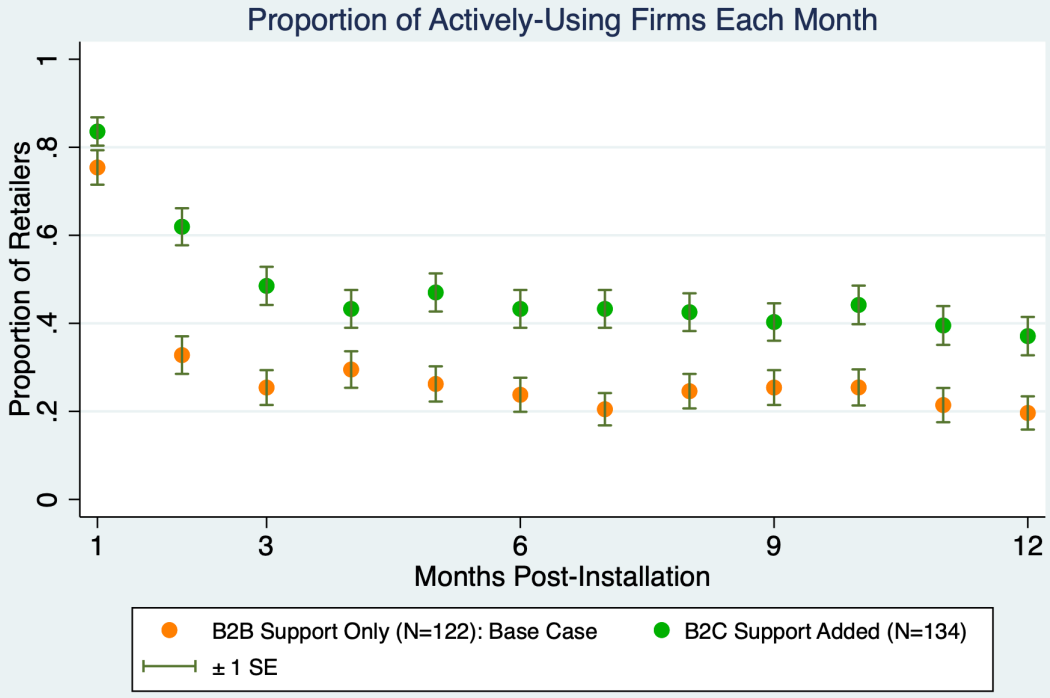
We show this pattern of results also applies to the monthly number of digital payment transactions per firm in Figure 4. Panel A shows that firms in the *B2B Support Only* group averaged 3.01 digital payment transactions using the provided Fintech solution per month in the first year post-installation, and this figure significantly increased to 5.4 for the *B2C Support Added* group.

[12]We note that this binary dependent variable is not easily comparable in magnitude to the similarly defined 'Successful Usage' variable in our Fintech audit for a number of reasons: i) the average magnitudes reported are not based on the same sample (for example, this admin data includes firms that eventually became non-operational but excludes non-compliers from treatment while the Fintech audit data excludes firms found non-operational during the audit but may include non-compliers to treatment); and ii) the Fintech audit data measures 'Successful Usage' across all Fintech solutions adopted by firms while this admin data measures usage of only one Fintech solution we provided to firms.

Figure 3: Impact of B2C Support on Active Fintech Usage

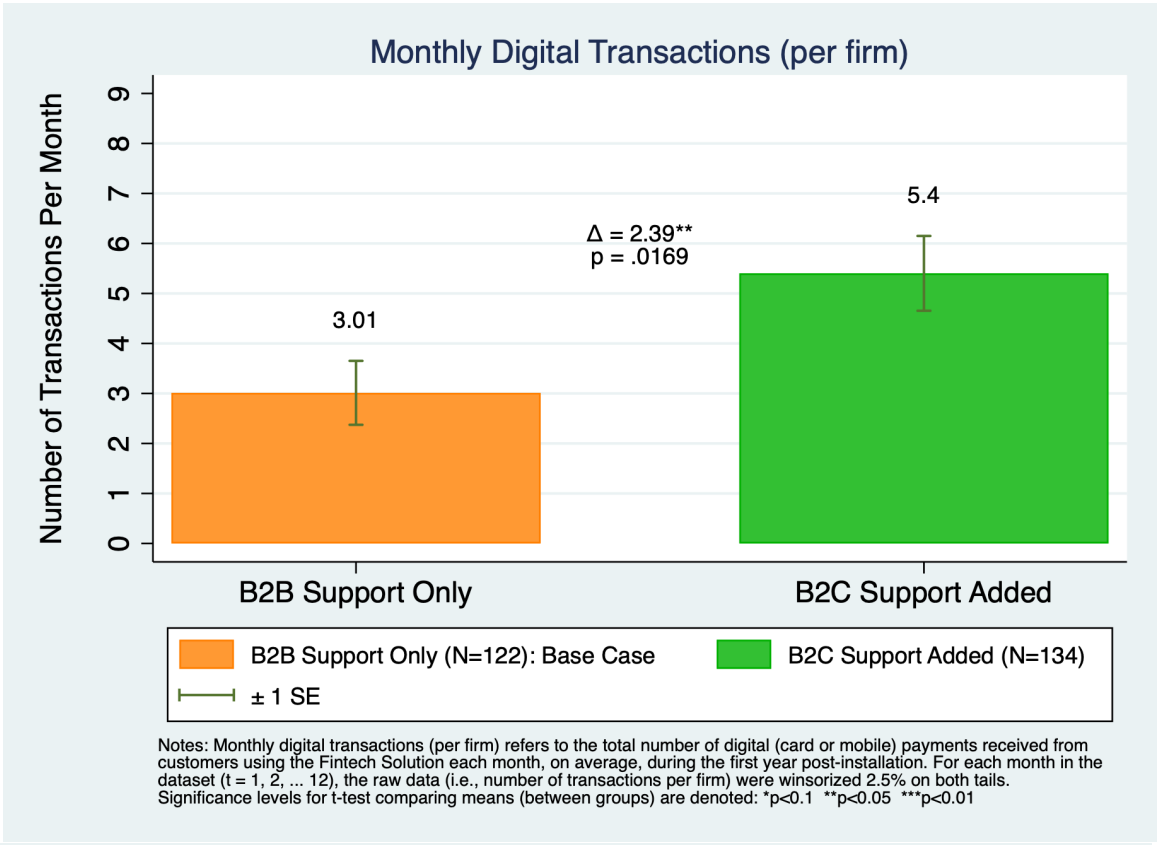


Notes: Active usage months refers to the total number of months during which at least one digital (card or mobile) payment was received from a customer using the Fintech Solution during the first year post-installation.
Significance levels for t-test comparing means (between groups) are denoted: *p<0.1 **p<0.05 ***p<0.01

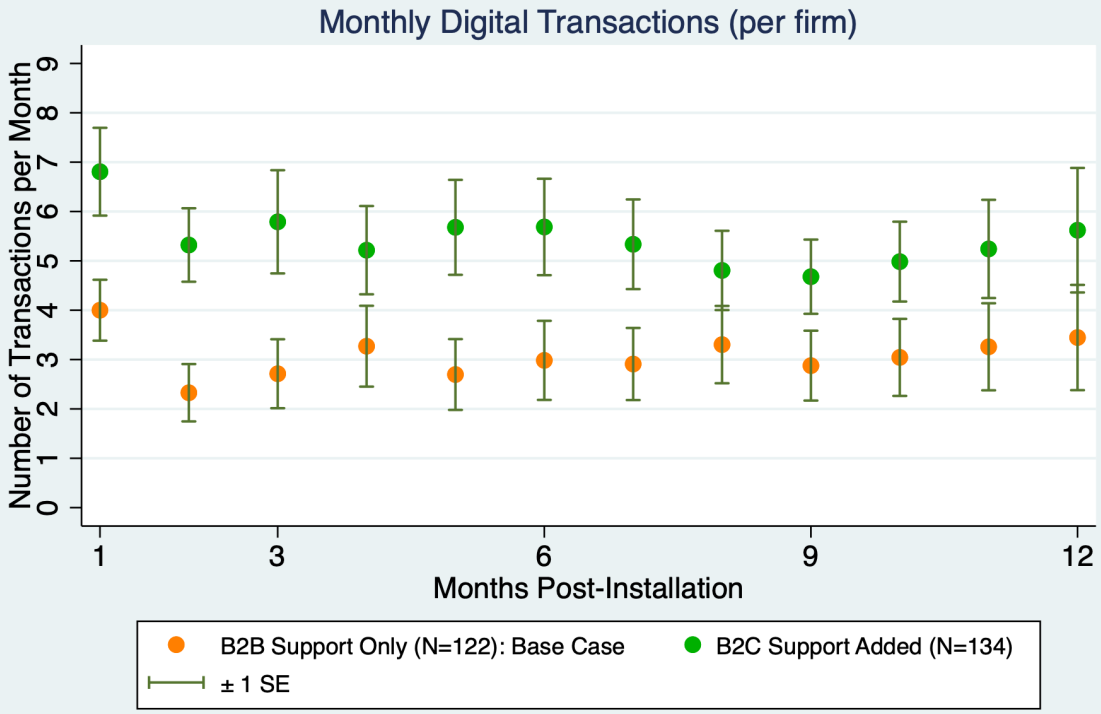


Notes: An retailer is categorized as 'actively-using' in a month if they received at least one digital (card or mobile) payment from a customer using the Fintech Solution in that month.

Figure 4: Impact of B2C Support on Number of Monthly Digital Payment Transactions



Notes: Monthly digital transactions (per firm) refers to the total number of digital (card or mobile) payments received from customers using the Fintech Solution each month, on average, during the first year post-installation. For each month in the dataset (t = 1, 2, ... 12), the raw data (i.e., number of transactions per firm) were winsorized 2.5% on both tails.
Significance levels for t-test comparing means (between groups) are denoted: *p<0.1 **p<0.05 ***p<0.01



Notes: Monthly digital transactions (per firm) refers to the total number of digital (card or mobile) payments received from customers using the Fintech Solution each month during the first year post-installation. For each month in the dataset (t = 1, 2, ... 12), the raw data (i.e., number of transactions per firm) were winsorized 2.5% on both tails prior to averaging by experimental group.

This increase in the number of digital payment transactions is not an artifact of outliers in the data. As previously mentioned, this dependent variable was winsorized 2.5% on both tails in each t prior to taking averages by experimental group across time. Moreover, when we plot this dependent variable over time by experimental group in Panel B, we see that the divergence between the *B2B Support Only* group and the *B2C Support Added* group was persistent over the first twelve months post-installation.

6.3 Model-Based Evidence: Panel Regressions

Next, we present results from the panel regression specified in Equation 2:

$$Y_{it} = \alpha + \beta B2CSupportAdded_i + x_i'\gamma + z_t'\delta + \eta_t + \epsilon_{it} \tag{2}$$

Y_{it} is the dependent variable of interest (e.g., the monthly number of digital payment transactions received) for firm i during month t post-installation of the mPOS device. Our main explanatory variable is $B2CSupportAdded_i$, which is a dummy variable indicating whether firm i was (randomly) assigned to the *B2C Support Added* group. The base case against which this group is compared is the *B2B Support Only* group. We estimate this panel regression model with random effects as opposed to firm fixed effects, as the main explanatory variable is invariant over time—the treatment status of the firm never changes in all the months post-installation. That said, we do not require firm fixed-effects for causal identification because our interventions were randomized across firms.

To improve precision and account for any group imbalance due to attrition, we include the following control variables. x_i represents a vector of control variables measured pre-intervention, including baseline controls for owner and firm characteristics (gender; age; marital status; children status; education; average customer basket size; monthly sales; total employees; 5 sub-sector fixed effects, i.e., set of two-digit SIC codes) and 9 strata dummies indicating which randomization/implementation batch the firm was part of. η_t represents time fixed-effects. Finally, z_t represents a set of control variables for seasonality in the DV. Specifically, we include calendar month fixed effects interacted with calendar year fixed effects. These capture differences in usage of digital payments in each calendar month-year pair (e.g., October 2021) which could arise due to factors like seasonal shopping demand, yearly trends, and time-varying shocks such as COVID-19 lockdowns. We report robust standard errors clustered at the firm level throughout.

Table 4 reports the results of these regressions, which support our finding from the Fintech audit that the B2C channel intervention mitigates demand-side frictions in promoting consumer usage of digital payments at the treated retail store. Columns 1–2 examine impacts on binary active usage variables, while Columns 3-4 examine impacts on the monthly frequency (i.e., number) of digital payments received. Columns 5-6 show the impacts on our overall usage (i.e., 'Fintech success') indices.

Across these columns, we see that the B2C intervention had large, positive, and statistically significant effects on increasing usage of the provided Fintech Solution for receiving digital payments from consumers. Each month, the *B2C Support Added* group had a 15 to 17 percentage point higher likelihood of using the Fintech solution actively (Columns 1-2), which corresponds to a 0.37 to 0.42 SD effect, significant at the 1% level, relative to the *B2B Support Only* group. Moreover, the B2C support group had 2.43 transactions more using digital payments each month (Column 3) — a 0.29 SD or 79% improvement, significant at the 1% level, relative to the *B2B Support Only* group[13]. Lastly, the impact of the B2C channel intervention on our overall Fintech Success indices, which aggregate these different measures of consumer usage of digital payments, is 0.42 to standard deviations (Columns 5-6) and significant at the 1% level.

Next, we interpret the overall economic magnitude of these effects. First, the *B2C Support Added* group — the most successful group in terms of digital payment usage — received 5.5 transactions (per Column 4) in digital payments each month on average, corresponding roughly to MXN $1100. This relatively low number underscores one of the major insights of our paper: in an economy with widespread firm informality (Bruhn 2013) where large swathes of the population are also financially excluded and unbanked (Demirgüç-Kunt, L. Klapper, *et al.* 2022), digitizing payments is a difficult and slow-moving endeavor. Even in advanced markets, consumer diaries indicate that cash remained the most frequently used instrument for consumer payments throughout the early 2010s, ranging from 82% of payments in Germany to 46% in the United States (Bagnall *et al.* 2014). That said, the relative effect sizes of our interventions are large: the *B2C Support Added* group shows a substantially higher rate of payment digitization than the *B2B Support only* group, which in turn adopted digital payments at a far greater rate than the Control group.

[13]In Appendix C Table 15, we model this DV using a Poisson regression with random effects, taking into account that the DV only has non-negative integer values. This robustness check yields a similar magnitude treatment effect for the *B2C Support Added* group that is again statistically significant at the 1% level

Table 4: Impact of B2C Support on Success in Fintech Adoption

	Monthly Active Usage (Binary)		Monthly No. of Transactions		Composite	
	(1) Had ≥ 1 Transaction	(2) Had ≥ 4 Transactions	(3) Levels: Winsorized	(4) Log: IHS	(5) Fintech Success Index (Avg.)	(6) Fintech Success Index (PCA)
B2C Support Added	0.168***	0.154***	2.427***	0.518***	0.383***	0.674***
	(0.0397)	(0.0363)	(0.880)	(0.130)	(0.0943)	(0.166)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Biz/Owner Controls	Yes	Yes	Yes	Yes	Yes	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes
Seasonality Controls	Yes	Yes	Yes	Yes	Yes	Yes
Mean of DV: B2B	0.293	0.159	3.065	0.693	2.96e-09	-0.369
SD of DV: B2B	0.455	0.366	8.390	1.275	0.913	1.605
Effect Size in SD	0.369	0.421	0.289	0.407	0.419	0.420
Effect Size in %	57.35	96.93	79.18	74.84		
Obs.	3019	3019	3019	3019	3019	3019

Notes: Estimates presented are from panel regressions of the DV on treatment assignment, with observations at the firm-month level (month referring to the number of elapsed months since the Fintech Solution was installed at the firm). The DVs in Columns (1)-(2) are binary indicators for whether the Fintech Solution was actively used in that month, with active usage operationalized in two different ways: in Column (1) as whether it was used to receive at least one digital (card or mobile) transaction from a customer and in Column (2) as whether it was used to receive at least four digital (card or mobile) transactions from a customer (i.e.,one per week). The DVs in columns (3)-(4) are based on the monthly number of digital (card or mobile) payment transactions received from customers, operationalized in two different ways: in Column (3) as levels i.e., number of transactions winsorized 2.5% on both tails and in Column (4) as logs i.e., the inverse-hyperbolic-sine transformation applied to the number of transactions. The DV in column (5) is the average of all the DVs in Columns(1)-(4) after they are standardized, with the B2B treatment group as the basis for standardization. The DV in column (6) is the predicted score for the first principal component of the four standardized DVs in Columns (1)-(4). The indicated regressions include: Time FE corresponding to the month post-installation, baseline controls for owner and firm characteristics (gender; age; marital status; children status; education; average customer basket size; monthly sales; total employees; 5 sub-sector fixed effects i.e., set of two digit SIC codes), 9 strata dummies indicating which randomization/implementation batch the firm was part of, and controls for seasonal effects (calendar month FE interacted with calendar year FE). Clustered standard errors (by firm) are in parentheses. P-values are highlighted as: $p < 0.1^{*}$ $p < 0.05^{**}$ $p < 0.01^{***}$

Moreover, in monetary terms, the B2C support group accrued MXN $445 more per month in consumer digital payments relative to the *B2B Support Only* group, which is slightly greater than the median monthly energy bill of MXN $400 in our sample. Thus, our interventions can be interpreted as initial pushes to move traditional retailers beyond cash as their only means of transacting. Their efficacy surpasses extant policy programs, such as the 'Fintech-drop' program, which have consumed substantial public funding. Future research can explore the policy instruments and market innovations that facilitate the transition to a mostly cashless retail sector.

Finally, we provide evidence in Appendix C Table 15 that these effects are not purely on the extensive margin — the B2C intervention does more than just convert potential 'never-users' (i.e., firms that never transact using digital payments post-installation) into 'users'. We replicate the analysis in Table 4 except excluding 'never-users' from both treatment groups. We still find that the B2C intervention had positive and statistically significant effects on increasing usage of the provided Fintech Solution in customer transactions. That said, the treatment effects estimated are smaller in magnitude as they only reflect the intensive margin of growing the volume of digital payments received from customers conditional on the firm already being a user.

7 Conclusion

This paper seeks to understand why traditional retailers fail to adopt digital payments, even as Fintech companies have created and marketed affordable solutions for them. Using descriptive evidence from the audit of a policy program in Mexico, we propose that two critical frictions constrain the adoption (i.e., initial take-up and usage) of two-sided Fintech solutions: (i) on the supply-side, onboarding remains too complex and challenging for business owners to navigate themselves; and (ii) on the demand-side, retailers do not perceive enough consumer demand to justify this adoption process. Next, through a randomized controlled field experiment, we show these frictions can be mitigated through marketing interventions. B2B support for retailers in platform onboarding increases successful Fintech adoption by 21.4 percentage points relative to the control group, which seems to be driven by how the intensive and customized service enabled retailers to overcome critical, idiosyncratic technological hurdles. In addition, extensive marketing of the digital payment option in the B2C channel can provide a further 13.4 percentage point boost in adoption rates over the B2B support, driven by growing consumer demand to pay digitally.

7.1 Implications for Managers

For companies in the Fintech sector (such as payment solution providers, payment networks, and financial service providers), our insights can inform the design of retail merchant acquisition strategies in emerging economies. Our results suggest that managers must recognize how the two-sided nature of digital payment platform yield two distinct set of challenges that can jointly depress platform adoption and thus, both need to be tackled to acquire traditional retail merchants.

On the supply-side, a direct implementation of our interventions could be possible through their on-the-ground B2B staff. Still, Fintech companies may be hesitant to incur the costs of providing such in-person support – especially for retailers that require more customized troubleshooting. In this case, our insights could be incorporated into the design of digital, scalable tools for retail merchant onboarding. For instance, a chatbot that integrates with WhatsApp (an app that retailers are very comfortable using) to pro-actively guide retailers in their onboarding journey could perhaps be effective. Moreover, the adoption challenges we uncover can also guide product innovation in the Fintech sector. As an example, we document extensive onboarding issues related to bank account integration. Fintech solutions that bypass such requirements (e.g., mobile money solutions from telecommunication service providers) and have simple verification processes could flourish with traditional retailers in emerging economies.

On the demand-side, companies in the Fintech sector do support retailers with marketing support for digital payments in the B2C channel to some extent – mPOS device boxes often come with branded stickers, stands, and posters indicating that the retailer accepts digital payments. Payment networks (e.g., Visa and Mastercard) similarly invest in installing such materials at retail stores. However, companies vary in the extent and intensity of these offerings, with some offering very limited B2C marketing support. Speaking to this managerial strategy, our study is the first to rigorously show the positive, causal impact of a strong B2C marketing push on digital transaction volume and frequency for traditional retailers who were entirely cash-dependent at baseline. Our intervention goes beyond installing these physical advertising materials to train retailers to be advocates of digital payments with customers through verbal pitches and promotional strategies. These are extra steps that can be implemented by companies. We show that such strategies could lead to large increases in adoption of digital payment solutions by retailers, providing a solution to the chicken-and-egg problem underlying Fintech adoption failures in this segment.

7.2 Implications for Policymakers

Globally, the widespread digitization of consumer payments in retail has brought considerable welfare benefits to firms and households alike (L. Klapper 2023). However, in their reliance on cash, traditional retailers in emerging economies and the customers they serve have been excluded from experiencing these benefits. Therefore, we hope to inform public policies on payment digitization in emerging economies. Specifically, we aim to share the following insights from our research. First, we stress the inadequacy of simply providing the Fintech solution (hardware and software components) for free without extensive onboarding support to the retailers. Second, we provide causal evidence that it is not futile to intervene with firms as long as the appropriate supply-side and demand-side frictions are tackled. Third, we highlight that any onboarding support on the supply-side should be customized given how idiosyncratic, yet inhibiting, the technological challenges are. A one-size-fits-all approach can be insufficient. Finally, we propose cheap extensions to extant policy templates that are effective – for instance, our B2B and B2C channel interventions represent 2% and 12% incremental costs per firm to the policymakers in this study.

The nascent academic literature on cashless payments has examined policies targeted at households or individuals, such as demonetization (Crouzet *et al.* 2023) or disbursement of social payments via debit cards (Higgins 2019). Prior to our study, little was known about how to design policies targeted at retail firms to increase their acceptance of digital payments. This is in spite of several historic and ongoing programs that focus on retail firms. Through our partnerships with governmental and non-governmental stakeholders, however, the insights from this study are being applied to enhance new initiatives and ensure the efficient use of public funds. For example, in the summer of 2023, the state of Yucatan launched a program based on the interventions we designed for this study. Investments in the pilot program alone exceeded US$270,000 (Sánchez 2023)[14].

7.3 Limitations and Future Research

While the marketing levers we study are effective in moving retailers beyond cash as their *only* means of transacting, the usage of digital payments in our sample is still low compared to cash usage. Thus, there is significant scope to study other frictions (and mitigating interventions) that inhibit retailers from further progress in their digitization journeys, both in terms of greater digital payment usage and the broader adoption of other two-sided platforms such as e-commerce

[14]More information on the implementation of this program can be found here.

marketplaces. For instance, future research could examine the role of pricing strategies, informality and tax avoidance, as well as behavioral biases in constraining digitization. Finally, the impacts of digital payments remain understudied. In the pursuit of further payment digitization, it is critical to understand how the adoption of these Fintech solutions by firms affects business outcomes, firm productivity in the retail sector of emerging economies, and how they spill over to competitor firms as well as local consumers.

References

1. Bagnall, J. *et al.* Consumer cash usage: A cross-country comparison with payment diary survey data (2014).

2. Bagwell, K. The economic analysis of advertising. *Handbook of industrial organization* **3,** 1701–1844 (2007).

3. Banerjee, A. *et al.* From proof of concept to scalable policies: Challenges and solutions, with an application. *Journal of Economic Perspectives* **31,** 73–102 (2017).

4. Bansal, S., Bionducci, L., Bruno, P., Denecker, O. & Klopcic, G. The Chessboard Rearranged: Rethinking the Next Moves in Global Payments. *The 2022 McKinsey Global Payments Report* (2022).

5. Bertrand, M., Mullainathan, S. & Shafir, E. A behavioral-economics view of poverty. *American Economic Review* **94,** 419–423 (2004).

6. Bloom, N., Eifert, B., Mahajan, A., McKenzie, D. & Roberts, J. Does management matter? Evidence from India. *The Quarterly Journal of Economics* **128,** 1–51 (2013).

7. Boudreau, K. J. Promoting platform takeoff and self-fulfilling expectations: Field experimental evidence. *Management Science* **67,** 5953–5967 (2021).

8. Bronnenberg, B. J. & Ellickson, P. B. Adolescence and the Path to Maturity in Global Retail. *Journal of Economic Perspectives* **29,** 113–34 (2015).

9. Bruhn, M. A tale of two species: Revisiting the effect of registration reform on informal business owners in Mexico. *Journal of Development Economics* **103,** 275–283 (2013).

10. Buell, R. W., Campbell, D. & Frei, F. X. How do customers respond to increased service quality competition? *Manufacturing & Service Operations Management* **18,** 585–607 (2016).

11. Caillaud, B. & Jullien, B. Chicken & egg: Competition among intermediation service providers. *RAND journal of Economics,* 309–328 (2003).

12. Chandy, R. K., Johar, G. V., Moorman, C. & Roberts, J. H. *Better marketing for a better world* 2021.

13. Crouzet, N., Gupta, A. & Mezzanotti, F. Shocks and Technology Adoption: Evidence from Electronic Payment Systems. *Journal of Political Economy* **0,** 000–000. eprint: https://doi.org/10.1086/724847. https://doi.org/10.1086/724847 (2023).

14. Dalton, P. S., Pamuk, H., Ramrattan, R., Uras, B. & van Soest, D. Electronic Payment Technology and Business Finance: A Randomized Controlled Trial with Mobile Money. *Management Science* (2023).

15. De Mel, S., McKenzie, D. & Woodruff, C. The demand for, and consequences of, formalization among informal firms in Sri Lanka. *American Economic Journal: Applied Economics* **5,** 122–150 (2013).

16. Demirgüç-Kunt, A., Klapper, L., Singer, D. & Ansar, S. *The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19* (World Bank Publications, 2022).

17. Demirgüç-Kunt, A., Klapper, L. F., Singer, D. & Van Oudheusden, P. The Global Findex database 2014: Measuring Financial Inclusion around the World. *World Bank Policy Research Working Paper* (2015).

18. Drexler, A., Fischer, G. & Schoar, A. Keeping it simple: Financial literacy and rules of thumb. *American Economic Journal: Applied Economics* **6,** 1–31 (2014).

19. Duflo, E., Kremer, M. & Robinson, J. How high are rates of return to fertilizer? Evidence from field experiments in Kenya. *American economic review* **98,** 482–488 (2008).

20. Duflo, E., Kremer, M. & Robinson, J. Nudging farmers to use fertilizer: Theory and experimental evidence from Kenya. *American economic review* **101,** 2350–2390 (2011).

21. Duflo, E., Kremer, M. & Robinson, J. Understanding technology adoption: Fertilizer in Western Kenya, preliminary results from field experiments. *Unpublished manuscript, Massachusetts Institute of Technology* (2004).

22. Economides, N. & Jeziorski, P. Mobile money in Tanzania. *Marketing Science* **36,** 815–837 (2017).

23. Ely, S. *Mastercard Commits $250 million to Support Small Business' Financial Security* Apr. 2020. https://www.mastercard.com/news/press/press-releases/2020/april/mastercard-commits-250-million-to-support-small-business-financial-security/.

24. Emerick, K. & Dar, M. H. Farmer field days and demonstrator selection for increasing technology adoption. *Review of Economics and Statistics* **103,** 680–693 (2021).

25. Floridi, A., Demena, B. A. & Wagner, N. Shedding light on the shadows of informality: A meta-analysis of formalization interventions targeted at informal firms. *Labour Economics* **67,** 101925 (2020).

26. Foster, A. D. & Rosenzweig, M. R. Microeconomics of technology adoption. *Annu. Rev. Econ.* **2,** 395–424 (2010).

27. Garbinsky, E. N., Mead, N. L. & Gregg, D. Popping the positive illusion of financial responsibility can increase personal savings: Applications in emerging and western markets. *Journal of Marketing* **85,** 97–112 (2021).

28. Gaurav, S., Cole, S. & Tobacman, J. Marketing complex financial products in emerging markets: Evidence from rainfall insurance in India. *Journal of marketing research* **48,** S150–S162 (2011).

29. Hershfield, H. E., Shu, S. & Benartzi, S. Temporal reframing and participation in a savings program: A field experiment. *Marketing Science* **39,** 1039–1051 (2020).

30. Higgins, S. Financial Technology Adoption (2019).

31. Imbens, G. W. & Rubin, D. B. *Causal inference in statistics, social, and biomedical sciences* (Cambridge University Press, 2015).

32. INADEM, S. d. E. *Invitacion y Lineamientos de Participacion para Proveedores de la Vitrina de Formacion Empresarial y Tecnologia en Funcion de la Convocatoria 4.1 Fortalecimiento Para MIPYMES* 2018. https://www.inadem.gob.mx/wp-content/uploads/2018/08/Invitaci%C3%B3n-y-Lineamientos-de-Participaci%C3%B3n-para-Proveedores-de-la-Vitrina-de-Formaci%C3%B3n-Empresarial-y-Tecnolog%C3%ADa-en-Funci%C3%B3n-de-la-Convocatoria-4.1-Fortalecimiento-para-MIPyMES..pdf.

33. INEGI-CE, C. *Censos económicos 2019. Resultados Oportunos* 2019.

34. INEGI-ENIF, E. *Principales Resultados. Encuesta Nacional de Inclusión Financiera* 2022.

35. INEGI-ENOE, E. *Principales Resultados. Encuesta Nacional de Ocupación y Empleo. Cuarto Trimestre* 2017.

36. Jack, W., Ray, A. & Suri, T. Transaction networks: Evidence from mobile money in Kenya. *American Economic Review* **103,** 356–361 (2013).

37. Jack, W. & Suri, T. Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution. *American Economic Review* **104,** 183–223 (2014).

38. Katz, M. L. & Shapiro, C. Systems competition and network effects. *Journal of economic perspectives* **8,** 93–115 (1994).

39. Klapper, L. How digital payments can benefit entrepreneurs. *IZA World of Labor* (2023).

40. Krumpal, I. Determinants of social desirability bias in sensitive surveys: a literature review. *Quality & quantity* **47,** 2025–2047 (2013).

41. Kundu, A. & Ramdas, K. Timely after-sales service and technology adoption: Evidence from the off-grid solar market in uganda. *Manufacturing & Service Operations Management* **24,** 1329–1348 (2022).

42. Mbiti, I. & Weil, D. N. in *African successes, Volume III: Modernization and development* 247–293 (University of Chicago Press, 2015).

43. McKenzie, D. Beyond baseline and follow-up: The case for more T in experiments. *Journal of development Economics* **99,** 210–221 (2012).

44. Mexico News Daily, S. *Auditor says Business Group Embezzled Millions in Public Funds* Sept. 2021. `https://mexiconewsdaily.com/news/auditor-says-business-group-embezzled-millions-in-public-funds/`.

45. Murthy, G., Vidal, M. F., Faz, X. & Barreto, R. Fintechs and financial inclusion. *Focus Note. Washington, DC: CGAP, May. https://www. cgap. org/research/publication/fintechs-and-financial-inclusion* (2019).

46. Rysman, M. The economics of two-sided markets. *Journal of economic perspectives* **23,** 125–143 (2009).

47. Sánchez, A. *Ofrecen a comerciantes terminales para cobro con tarjeta para incrementar ventas* 2023. `https://www.lajornadamaya.mx/yucatan/218321/ofrecen-a-comerciantes-terminales-para-cobro-con-tarjeta-para-incrementar-ventas`.

48. Secretarıéa de Economiéa, S. *Convocatoria 4.1 Fortalecimiento Para MIPYMES* 2018. https://www.gob.mx/se/es/articulos/convocatoria-4-1-fortalecimiento-para-mipymes?idiom=es.

49. Suri, T. & Jack, W. The long-run poverty and gender impacts of mobile money. *Science* **354,** 1288–1292 (2016).

50. Sverdlin Lisker, D. *Essays on Development Economics* PhD thesis (Massachusetts Institute of Technology, 2023).

51. Thaler, R. H. & Benartzi, S. Save more tomorrow™: Using behavioral economics to increase employee saving. *Journal of political Economy* **112,** S164–S187 (2004).

52. Tucker, C. & Zhang, J. Growing two-sided networks by advertising the user base: A field experiment. *Marketing Science* **29,** 805–814 (2010).

53. US Bureau of Labor Statistics, B. Business Employment Dynamics (2022).

54. Wieser, C., Bruhn, M., Kinzinger, J. P., Ruckteschler, C. S. & Heitmann, S. The impact of mobile money on poor rural households: Experimental evidence from Uganda. *World Bank Policy Research Working Paper* (2019).

55. Zeithaml, V. A., Berry, L. L. & Parasuraman, A. The behavioral consequences of service quality. *Journal of marketing* **60,** 31–46 (1996).

Appendix A: Experiment Design

A1. Sample Recruitment

Figure 5: Map of 479 Firms in Sample, by Treatment Assignment

A2. Baseline Audit

Table 5: SUMMARY STATISTICS ON FIRM CHARACTERISTICS (FINAL SAMPLE)

Variable	Mean	St. Dev.	Min	Max	Census 2019 Mean
Owner Characteristics					
Age	44.31	12.90	19	78	
Age under 26	0.07	0.25	0	1	
Age 26 to 45	0.47	0.50	0	1	
Age over 45	0.46	0.450	0	1	
Highest Education Level (1 to 13)	5.81	1.78	2	10	
No Schooling	0.002	0.045	0	1	
Primary Schooling Only	0.06	0.23	0	1	
Secondary Schooling Only	0.49	0.50	0	1	
Post-Secondary Education	0.45	0.50	0	1	
Gender (Male=1)	0.54	0.50	0	1	
Married	0.58	0.49	0	1	
Number of Children	0.94	1.22	0	8	
Business Characteristics					
Number of Employees: Unpaid and Paid	1.32	1.62	0	10	1.34
Total Assets (Pesos)	305,325	486,882	15,000	2,354,200	255,688
Weekly Customers (1 to 12)	4.83	3.36	1	12	
Monthly Sales Estimate (Pesos)	46,901	54,247	3,000	250,000	
Monthly Profits Estimate (Pesos)	9,384	8,584	0	35,000	

Notes: This table presents summary statistics on all retail firms in the sample. The data was collected for N = 479 retail firms (prior to randomization) at the business location

A3. Randomization

Table 6 Columns 1–3 show the means of each variable for the control group, *B2B Support Only* treatment group, and *B2C Support Added* treatment group, respectively. In Column 4, we report the p-value from analysis of variance F-tests of equality of the three means. We find that across the 10 tests (for equality of three means), we fail to reject all null hypotheses of mean equality at the 10% level. In addition, the F-test for joint equality of balance variables is not significant for the relevant three group comparisons.

Table 6: BALANCE CHECKS FOR FIRMS RANDOMIZED AT BASELINE

	Control Mean	B2B Mean	B2C Mean	P-Value (F-Test)
Number of Employees: Unpaid and Paid	1.29	1.46	1.21	0.359
Total Assets (Pesos)	267,020	308,540	243,353	0.277
Weekly Customers (1 to 12)	4.75	5.05	4.69	0.588
Monthly Sales Estimate (Pesos)	49,597	45,787	45,371	0.748
Monthly Profits Estimate (Pesos)	10,017	8,949	9,197	0.513
Birth Year	43.44	45.31	44.19	0.429
Highest Education Level (1 to 13)	5.80	5.80	5.83	0.982
Gender (Male=1)	0.55	0.57	0.49	0.349
Married	0.59	0.60	0.57	0.783
Number of Children	0.98	0.91	0.93	0.897
Joint Equality F-Stat (Control v B2B)				0.796
Joint Equality F-Stat (Control v B2C)				0.218
Joint Equality F-Stat (B2B v B2C)				0.829

Notes: This table presents balance checks for the full sample of firms based on pre-intervention data on business and owner characteristics. The first three columns present average values by experimental group. The fourth column presents the equality of means F-test. The value displayed is the p-value for this F test where the null hypothesis is equality of three group means. Statistically significant p-values are highlighted by: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

A4. Intervention Implementation

Figure 6: B2C Kit: Open-and-close sign, Outdoor pop-up stand, Point-of-sale stand, Interior sign

Table 7: B2C Channel Intervention—Visit Outline

Visit Number	Activity
1	Introduction and installation of advertising materials
2	Develop pitch on value to consumer of using digital payments
3	Conduct market research on local consumer attitudes to digital payments
4	Plan three marketing strategies to nudge consumers to use digital payments
5	Execute the three marketing strategies
6	Evaluate success of the three marketing strategies and propose refinements
7	Implement refined marketing strategies
8	Conclude and reinforce value of continued consumer marketing efforts

A5. Attrition and Non-Survival

From the sample of N = 479 retail businesses randomized at baseline, we were able to reach 94.2% of the owners during the Fintech audit, twelve months post-intervention. Attrition from our sample was not systematically related to treatment assignment. Table 8 presents linear regression analysis to check for differential attrition between our three experimental groups. The results in Column (1) indicate that we do not find any evidence for differential attrition occurring in any of the treatment groups relative to the control group. In Table 8, we also examine whether business closure rates were systematically related to treatment assignment. We do so to check that business closure does not threaten the validity of our experimental inferences. For example, if small firms in the control group were less likely to survive than those in the treatment groups, we might not observe relevant counterfactual Fintech adoption and usage outcomes for treated firms across the full distribution of firm size. The results in Column (2) indicate that there is no evidence for differential firm closure in any of the treatment groups relative to the control group. Finally, we show that a firm's "attrition" from the dataset shared by our partnering Fintech company was not systematically related to treatment assignment in Table 8 Column (3).

Next, to demonstrate that the post-attrition sample is not unbalanced, we present in Table 9 balance checks for the sample of N = 451 firms that responded during the audit. Across the ten tests on balance variables (for equality of three means), we do not reject any of the null hypotheses of mean equality at the 5% level. Thus, we conclude that attrition is not a significant concern in our sample.

To demonstrate balance in the operational sample of firms upon which our treatment effects are based, in Table 10, we present balance checks for the operational sample of firms. Across the ten tests on balance variables (for equality of three means), we do not reject any of the null hypotheses of mean equality at the 5% level. Thus, we conclude that firm closure is not a significant issue in our sample either.

Finally, to demonstrate balance in the sample of firms present in the administrative dataset, in Appendix A Table 11, we present balance checks for this sample. Across the 10 tests on balance variables (for equality of three means), we do not reject any of the null hypotheses of mean equality at the 5% level.

Table 8: Attrition and Non-Survival by Treatment Assignment

	Fintech Audit		Admin Data
	(1) Attrition (Yes = 1)	(2) Non-Operational (Yes = 1)	(3) Data Unavailable (Yes = 1)
B2B Support Only	-0.0141	-0.0240	
	(0.0271)	(0.0496)	
B2C Support Added	-0.0277	-0.0725	-0.0667
	(0.0262)	(0.0472)	(0.0457)
Biz/Owner Controls	Yes	Yes	Yes
Strata FE	Yes	Yes	Yes
Mean of DV: Control	0.0759	0.253	—
Mean of DV: B2B	0.0566	0.240	0.233
Obs.	479	451	321

Notes: This table analyzes attrition and non-survival status by treatment assignment. The DV in Column (1) is a binary indicator coded '0' if the firm responded in the Fintech Audit (data obtained or non-operational status confirmed) and '1' for attriter if the firm did not respond in the Fintech Audit (no data obtained and could not reach in any way to confirm operating status). The DV in Column (2) is a binary indicator coded '0' if the firm was operational at the time the Fintech Audit was conducted and '1' if the firm had closed by the time the Fintech Audit was conducted. The DV in Column (3) is a binary indicator coded '0' if the firm was part of the administrative data sample and '1' if the firm was not part of the administrative data sample (dropped out of receiving Fintech solution or did not provide consent to share data). The indicated regressions include: baseline controls for owner and firm characteristics (gender; age; marital status; children status; education; average customer basket size; monthly sales; total employees; 5 sub-sector fixed effects i.e., set of two digit SIC codes) and 9 strata dummies indicating which randomization/implementation batch the firm was part of. Robust standard errors are in parentheses. P-values are highlighted as: $p < 0.1^{*}$ $p < 0.05^{**}$ $p < 0.01^{***}$

Table 9: BALANCE CHECKS FOR FIRMS RESPONDING AT FINTECH AUDIT

	Control Mean	B2B Mean	B2C Mean	P-Value (F-Test)
Number of Employees: Unpaid and Paid	1.30	1.45	1.20	0.381
Total Assets (Pesos)	297,922	359,501	278,263	0.337
Weekly Customers (1 to 12)	4.83	5.08	4.71	0.629
Monthly Sales Estimate (Pesos)	48,857	44,889	45,722	0.800
Monthly Profits Estimate (Pesos)	10,063	8,950	9,211	0.502
Age	43.59	45.45	44.51	0.463
Highest Education Level (1 to 13)	5.72	5.81	5.81	0.884
Gender (Male=1)	0.55	0.55	0.49	0.411
Married	0.60	0.61	0.57	0.676
Number of Children	0.96	0.90	0.95	0.906
Joint Equality F-Stat (Control v B2B)				0.710
Joint Equality F-Stat (Control v B2C)				0.322
Joint Equality F-Stat (B2B v B2C)				0.826

Notes: This table presents balance checks for the sample of firms who responded in the Fintech Audit (data obtained or non-operational status confirmed) based on pre-intervention data on business and owner characteristics. The first three columns present average values by experimental group. The fourth column presents the equality of means F-test. The value displayed is the p-value for this F test where the null hypothesis is equality of three group means. Statistically significant p-values are highlighted by: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Table 10: BALANCE CHECKS FOR FIRMS OPERATIONAL AT FINTECH AUDIT

	Control Mean	B2B Mean	B2C Mean	P-Value (F-Test)
Number of Employees: Unpaid and Paid	1.25	1.57	1.29	0.279
Total Assets (Pesos)	320,267	403,366	286,948	0.220
Weekly Customers (1 to 12)	5.01	5.29	4.74	0.467
Monthly Sales Estimate (Pesos)	54,895	48,335	50,522	0.690
Monthly Profits Estimate (Pesos)	11,067	9,533	9,740	0.366
Age	44.33	45.31	44.75	0.851
Highest Education Level (1 to 13)	5.65	5.84	5.82	0.667
Gender (Male=1)	0.58	0.55	0.49	0.360
Married	0.60	0.62	0.55	0.448
Number of Children	1.03	0.91	0.91	0.725
Joint Equality F-Stat (Control v B2B)				0.915
Joint Equality F-Stat (Control v B2C)				0.472
Joint Equality F-Stat (B2B v B2C)				1.055

Notes: This table presents balance checks for the sample of firms who were operational at the time the Fintech Audit was conducted, based on pre-intervention data on business and owner characteristics. The first three columns present average values by experimental group. The fourth column presents the equality of means F-test. The value displayed is the p-value for this F test where the null hypothesis is equality of three group means. Statistically significant p-values are highlighted by: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Table 11: BALANCE CHECKS FOR FIRMS IN TRANSACTION DATA SAMPLE

	B2B Mean	B2C Mean	P-Value (F-Test)
Number of Employees: Unpaid and Paid	1.54	1.25	0.161
Total Assets (Pesos)	374,060	283,146	0.176
Weekly Customers (1 to 12)	4.79	4.88	0.820
Monthly Sales Estimate (Pesos)	45,854	46,591	0.911
Monthly Profits Estimate (Pesos)	8,869	9,258	0.703
Age	45.27	43.95	0.411
Highest Education Level (1 to 13)	5.84	5.87	0.869
Gender (Male=1)	0.54	0.49	0.373
Married	0.59	0.57	0.711
Number of Children	0.91	0.93	0.881
Joint Equality F-Stat (B2B v B2C)			1.055

Notes: This table presents balance checks for the sample of firms who were in the transaction data sample, based on pre-intervention data on business and owner characteristics. The first two columns present average values by experimental group. The third column presents the equality of means F-test. The value displayed is the p-value for this F test where the null hypothesis is equality of the group means. Statistically significant p-values are highlighted by: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Appendix B: Robustness of Main Effects

Table 12: Robustness Checks for Impact of B2B and B2C Support Intervention

	(1) Includes Non-Operational	(2) Probit	(3) Logit	(4) Lasso for Control Variables
B2B Support Only	0.165***	0.190***	0.189***	0.214***
	(0.0540)	(0.0605)	(0.0603)	(0.0649)
B2C Support Added	0.306***	0.319***	0.317***	0.348***
	(0.0532)	(0.0539)	(0.0533)	(0.0614)
Biz/Owner Controls	Yes	Yes	Yes	No
Strata FE	Yes	Yes	Yes	No
P-Value: $\beta_{B2B} = \beta_{B2C}$	0.0130	0.0290	0.0289	0.0329
Obs.	451	350	350	350

Notes: Data underlying these regressions were collected during a Fintech audit 12 months post-intervention. Estimates presented are from regressions of the DV on treatment assignment (i.e., intent-to-treat estimates) with observations at the firm level. The DV is whether at least one digital (card, mobile wallet, or QR-based) payment was received from a customer in the last month. In Columns (2) and (3), instead of coefficient estimates, marginal effects are reported (dy/dx) at mean values of X variables. Robust standard errors are in parentheses. P-values are highlighted as: $p < 0.1^{*}$ $p < 0.05^{**}$ $p < 0.01^{***}$

Appendix C: Process Evidence

41 CRITICAL CHALLENGES AND THEIR SOLUTIONS IN B2B INTERVENTION

Total Firms Receiving Customized B2B Troubleshooting	**123**	**100%**
1. Internet failures (for example: slow, patchy etc.)	47	38.21
B2B Support Solution: Resolve with TSP hotline or switch to Wifi		
2. No bank account to receive payment deposits	42	34.14
B2B Support Solution: Open bank account online with Afirme Bank		
3. Forgetful of, or slow in learning, how to process payments	16	13.00
B2B Support Solution: Provide extra practice and video tutorials		
4. Lacked basic knowledge of banking system	12	9.75
B2B Support Solution: Provide banking 101 training		
5. Processing payment takes $\geq$ 1 min	9	7.32
B2B Support Solution: Update smartphone OS and Fintech app		
6. Transaction declined due to "Invalid Credentials" error	7	5.69
B2B Support Solution: Reset account and wait 24-48 hours		
7. Lacked basic knowledge of banking applications	6	4.88
B2B Support Solution: Provide mobile banking 101 training		
8. Low attention span of entrepreneur	5	4.07
B2B Support Solution: Reschedule appointment, focus on training other employees		
9. Delays in registration process to accept foreign cards	3	2.44
B2B Support Solution: Resolve with Fintech app hotline		
10. Forgot email account password	3	2.44
B2B Support Solution: Reset password steps		
11. Bank requires visit to complete registration process	3	2.44
B2B Support Solution: Open bank account online with Afirme Bank		
12. SIM card phone number lost	3	2.44
B2B Support Solution: Resolve with TSP hotline		
13. Entrepreneur missing debit card to withdraw deposit	3	2.44
B2B Support Solution: Train to withdraw funds without debit card		
14. Entrepreneur wants to change email account	2	1.63
B2B Support Solution: Create new account in Fintech app		
15. Entrepreneur misplaced card reader or it got stolen	2	1.63
B2B Support Solution: Provide replacement card reader		
16. Smartphone slow due to many apps	2	1.63
B2B Support Solution: Delete unnecessary apps		

17. Smartphone not updated to latest OS	2	1.63
B2B Support Solution: Complete smartphone update		
18. Confusion between bank account number, debit card number, and IBAN number	2	1.63
B2B Support Solution: Explain differences and retrieve IBAN number		
19. Card reader battery issues	2	1.63
B2B Support Solution: Call Fintech app hotline to replace card reader		
20. Lack of understanding around default sales tax charges	2	1.63
B2B Support Solution: Explain sales tax system quickly		
21. No card transaction is processed	2	1.63
B2B Support Solution: Call Fintech app hotline to reset account		
22. Entrepreneur not approved for new bank account due to application inconsistencies	2	1.63
B2B Support Solution: Set up new bank account in spouse's name		
23. Smartphone battery failure	2	1.63
B2B Support Solution: Onboard on entrepreneur's personal phone		
24. Card processing failures after Fintech app update	1	0.81
B2B Support Solution: Re-install Fintech app and login again		
25. "Internal error message" during transaction	1	0.81
B2B Support Solution: Resolve with Fintech app hotline		
26. Transaction declined due to network error	1	0.81
B2B Support Solution: Resolve with Fintech app hotline		
27. Smartphone automatically downloads unauthorized apps	1	0.81
B2B Support Solution: Uninstall apps and clear cache		
28. Bank account change not approved for over 72 hours	1	0.81
B2B Support Solution: Resolve with Fintech app hotline		
29. Smartphone screen damaged	1	0.81
B2B Support Solution: Onboard on entrepreneur's personal phone		
30. Smartphone water damage	1	0.81
B2B Support Solution: Onboard on entrepreneur's personal phone		
31. Large transaction deposits not received by entrepreneur	1	0.81
B2B Support Solution: Assist entrepreneur to complete fraud verification steps in Fintech app		
32. Cannot find Fintech app in Play Store	1	0.81
B2B Support Solution: Update Play Store app		
33. Unable to login to Fintech app	1	0.81
B2B Support Solution: Call Fintech app hotline to reset account		
34. Intermittent electricity supply to charge hardware	1	0.81
B2B Support Solution: Assist with advice on portable charging		
35. Cards not detected in reader	1	0.81

B2B Support Solution: Call Fintech app hotline to replace card reader		
36. Mobile banking app not support by smartphone OS	1	0.81
B2B Support Solution: Open new bank account with supported provider		
37. Fintech app frozen	1	0.81
B2B Support Solution: Re-install app and try again		
38. Mobile (card-free) payments not being processed	1	0.81
B2B Support Solution: Resolve with Fintech app hotline		
39. Charger for card reader not working	1	0.81
B2B Support Solution: Call Fintech app hotline to replace charger		
40. Transaction cancellation not processed	1	0.81
B2B Support Solution: Resolve with Fintech app hotline		
41. Incorrect IBAN entered during registration	1	0.81
B2B Support Solution: Call Fintech app hotline to change IBAN		

Notes: Data was collected from B2B support agents during the B2B channel intervention (agents completed a report after each visit to a firm). Frequencies of challenges and support requirements are reported for firms included in the analysis in Section 3.

Table 14: Impact of B2C Support on Digital Payment Transactions Using Poisson Model

	(1) Monthly Number of Transactions (Winsorized)
B2C Support Added	1.075***
	(0.229)
Time FE	Yes
Biz/Owner Controls	Yes
Strata FE	Yes
Seasonality Controls	Yes
Obs.	3019

Notes: Estimates presented are from a Poisson regression (with random effects) of the DV on treatment assignment, with observations at the firm-month level (month referring to the number of elapsed months since the Fintech Solution was installed at the firm). The DV is the monthly number of digital (card or mobile) payment transactions received from customers, winsorized 2.5% on both tails. The regression include: Time FE corresponding to the month post-installation, baseline controls for owner and firm characteristics (gender; age; marital status; children status; education; average customer basket size; monthly sales; total employees; 5 sub-sector fixed effects i.e., set of two digit SIC codes), 9 strata dummies indicating which randomization/implementation batch the firm was part of, and controls for seasonal effects (calendar month FE interacted with calendar year FE). Clustered standard errors (by firm) are in parentheses. P-values are highlighted as: $p < 0.1^{*}$ $p < 0.05^{**}$ $p < 0.01^{***}$. The coefficient indicates that the difference in the logs of expected digital (card or mobile) payment transactions is 1.075 units higher for the B2C group compared to the B2B group.

Table 15: Impact of B2C Support on Success in Fintech Adoption: Excluding Never-Users

	Monthly Active Usage (Binary)		Monthly No. of Transactions		Composite	
	(1) Had ≥ 1 Transaction	(2) Had ≥ 4 Transactions	(3) Levels: Winsorized	(4) Log: IHS	(5) Fintech Success Index (Avg.)	(6) Fintech Success Index (PCA)
B2C Support Added	0.121***	0.139***	2.154**	0.437***	0.321***	0.566***
	(0.0427)	(0.0402)	(0.996)	(0.143)	(0.104)	(0.183)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Biz/Owner Controls	Yes	Yes	Yes	Yes	Yes	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes
Seasonality Controls	Yes	Yes	Yes	Yes	Yes	Yes
Mean of DV: B2B	0.371	0.201	3.875	0.876	0.135	-0.132
SD of DV: B2B	0.483	0.401	9.267	1.377	0.980	1.722
Effect Size in SD	0.250	0.347	0.232	0.317	0.328	0.329
Effect Size in %	32.65	69.35	55.59	49.91		
Obs.	2647	2647	2647	2647	2647	2647

Notes: Estimates presented are from panel regressions of the DV on treatment assignment, with observations at the firm-month level (month referring to the number of elapsed months since the Fintech Solution was installed at the firm). We exclude from the sample the firms that were never-users, i.e. not a single digital payment received using the Fintech Solution. The DVs in Columns (1)-(2) are binary indicators for whether the Fintech Solution was actively used in that month, with active usage operationalized in two different ways: in Column (1) as whether it was used to receive at least one digital (card or mobile) transaction from a customer and in Column (2) as whether it was used to receive at least four digital (card or mobile) transactions from a customer (i.e.,one per week). The DVs in columns (3)-(4) are based on the monthly number of digital (card or mobile) payment transactions received from customers, operationalized in two different ways: in Column (3) as levels i.e., number of transactions winsorized 2.5% on both tails and in Column (4) as logs i.e., the inverse-hyperbolic-sine transformation applied to the number of transactions. The DV in column (5) is the average of all the DVs in Columns(1)-(4) after they are standardized, with the B2B treatment group as the basis for standardization. The DV in column (6) is the predicted score for the first principal component of the four standardized DVs in Columns (1)-(4). The indicated regressions include: Time FE corresponding to the month post-installation, baseline controls for owner and firm characteristics (gender; age; marital status; children status; education; average customer basket size; monthly sales; total employees; 5 sub-sector fixed effects i.e., set of two digit SIC codes), 9 strata dummies indicating which randomization/implementation batch the firm was part of, and controls for seasonal effects (calendar month FE interacted with calendar year FE). Clustered standard errors (by firm) are in parentheses. P-values are highlighted as: $p < 0.1^{*}$ $p < 0.05^{**}$ $p < 0.01^{***}$

Online Appendix A: Government Program Audit

Table 16: All Frictions in Fintech Failure Cases among Government Program Beneficiaries

ALL FRICTIONS	Number of Firms	Proportion
Supply-side Technology Frictions	*59*	*61.46%*
1. Unable to complete registration on Fintech app (e.g., couldn't link bank account or upload required information)	10	10.42
2. Did not begin setting up any part of Fintech kit (e.g., lacks ability, time, or too overwhelmed to set up)	9	8.33
3. Poor network connection (e.g., ran out of data or wifi is too slow)	5	5.21
4. Could not download Fintech app (e.g., lacks ability to find or add a new app)	5	5.21
5. Lacks access to bank account (e.g., doesn't have a bank account or know IBAN number)	5	5.21
6. Unable to execute complex transaction (e.g., doesn't know special steps for large, or foreign, card payments)	4	4.17
7. Unable to use Fintech app post-registration (e.g., finds steps too complicated)	4	4.17
8. Unable to login to Fintech app (e.g., forgot password)	4	4.17
9. Problem with smartphone hardware (e.g., screen cracked, OS too slow)	3	3.13
10. Missing card reader (e.g., stolen or misplaced)	2	2.08
11. Couldn't connect card reader to smartphone	2	2.08
12. Did not receive equipment (e.g., did not schedule appointment correctly)	2	2.08
13. Smartphone stolen	2	2.08
14. Couldn't use bluetooth	1	1.04
15. Smartphone is 'locked'	1	1.04
Demand-side Frictions	*37*	*38.54%*
1. Customers did not ask for digital payment option (e.g., customers unaware of or uninterested in digital payment option)	26	27.08
2. Customers explicitly expressed cash preference (e.g., customers distrust digital payments or find them inconvenient)	11	11.46

Notes: Data was collected in Q1 of 2019 through structured interviews of N = 109 randomly selected retailers participating in the program "Fortalecimiento de Microempresas para Elevar su Productividad" (funded by Mexico's Secretaría de Hacienda y Crédito Público and implemented by a collaborating NGO) from the municipality of Guadalajara. Retailers were first categorized as "success" or "failure" cases based on whether they were receiving digital (card or mobile) payments from customers at the time of the audit, roughly six months post-program participation. Failure cases were then asked to report the main reason they were not receiving digital (card or mobile) payments from customers. All frictions reported by retailers are presented in this table, categorized by whether they pertain to the supply- or demand-side of the Fintech platform.