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Victor Pouliquen

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VICTOR POULIQUEN

The Impact of Economic Institutions on Small Firms in Developing Countries

Thèse dirigée par: Marc Gurgand

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A Elise,

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Victor Pouliquen

10 Novembre 2019

Résumé

Dans les pays en développement, les institutions économiques sont souvent défaillantes. Cela se traduit par des problèmes structurels tels que l'omniprésence du secteur informel, la corruption généralisée et l'incapacité des États à collecter les impôts. Cette thèse porte sur les politiques publiques permettant d'améliorer le fonctionnement des institutions économiques. Elle se focalise sur deux questions : (1) Quels sont les effets des politiques de réduction de l'informalité ? et (2) Comment les nouvelles technologies affectent la collecte des taxes ?

Le premier chapitre étudie à l'aide d'une expérimentation aléatoire l'introduction d'un statut légal facilitant la formalisation des petites entreprises au Bénin. Afin de rendre ce statut attractif le gouvernement l'a accompagné d'incitations supplémentaires créés pour amplifier les bénéfices potentiels de la formalisation. Nous trouvons que très peu d'entreprises se formalisent lorsqu'elles reçoivent uniquement de l'information sur le nouveau statut. Cependant, lorsque l'information est combinée aux incitations, la formalisation augmente de 16,3 points de pourcentage. En revanche, les effets sur les performances des entreprises sont limités, et le coût des incitations est supérieur au total des impôts qu'elles paieront pendant les 10 prochaines années. Enfin, nous montrons comment un ciblage sur les entreprises ayant des caractéristiques proches des entreprises déjà formelles améliorerait l'efficacité de ce type de programme.

Le second chapitre étudie l'impact de la formalisation sur les relations intra-ménages, toujours au Bénin. Dans ce contexte, la formalisation renforce les droits de propriété et clarifie au sein des ménages qui est le propriétaire légal de l'entreprise, et qui la gardera en cas de divorce. L'effet causal de la formalisation est identifié à l'aide de l'expérimentation aléatoire déjà utilisée pour le premier chapitre. Nous trouvons que les entrepreneurs s'étant formalisés ont plus de contrôle les ressources de leur ménage. Ils ou elles contribuent proportionnellement moins aux dépenses du ménage et transfèrent moins d'argent à leur partenaire. Deuxièmement, en utilisant un jeu comportemental dans lequel les entrepreneurs peuvent cacher un transfert monétaire à leur partenaire, nous trouvons que les femmes qui se sont formalisées cachent davantage à leur mari. A l'aide d'un modèle théorique, nous montrons que ce résultat est compatible avec l'idée que les femmes ne sont pas libres d'investir comme elles le souhaiteraient dans leur entreprise et doivent le faire secrètement. Notre conclusion est que la formalisation a des effets importants sur les dynamiques intra-ménage.

Le troisième chapitre utilise une expérimentation aléatoire conduite au Tadjikistan pour étudier l'impact d'un système permettant aux entreprises de déclarer leurs taxes en ligne plutôt que de soumettre un formulaire en personne. Nous trouvons que ce système réduit le temps passé par les entreprises pour remplir leurs obligations fiscales de 5 heures par mois. Nous ne trouvons pas d'effets sur le montant des impôts payés ni sur le versement de pots-de-vin. En revanche, l'absence d'effets moyens masque une importante hétérogénéité. Les entreprises le plus susceptibles de faire de l'évasion fiscale dans le système précédent payent davantage d'impôts quand elles déclarent en ligne, probablement car elles ne peuvent plus entrer en collusion avec les agents des impôts. À l'inverse, les entreprises qui étaient les moins susceptibles de faire de l'évasion, payent moins des taxes quand elles déclarent en ligne, suggérant qu'elles étaient forcées de payer plus d'impôts avant. Ces entreprises paient également moins de pots-de-vin, ce qui suggère que déclarer en ligne offre une protection contre le risque d'extorsion de la part des agents du fisc. Notre conclusion est que permettre la déclaration des taxes en ligne a rendu l'appareil fiscal à la fois plus efficace et plus juste.

Mots clés : Petites Entreprises, Informalité, Droits de Propriétés, Relations Intra-ménage, Taxation, Nouvelles Technologies, Paiement en ligne des Taxes.

Summary

In many developing countries, economic institutions are failing. This translates into structural problems such as widespread informality, rampant corruption and the impossibility for governments to raise taxes. This thesis study how economic policies affect economic institutions in developing countries. It focuses on two broad questions: (1) What are the effects of policies to reduce informality? and (2) how are new technologies reshaping the way governments collect taxes?

The first chapter uses a randomized experiment to study the introduction of a new legal status in Benin, created to make it easier for small firms to become formal. To make this new status attractive, the government added supplementary incentives designed to enhance the presumed benefits of formalizing. We find that few firms register when just given information about the new regime, but our full package of supplementary efforts boosts formalization by 16.3 percentage points. However, this formalization does not bring firms higher sales, profits or access to credit, and the cost of formalizing these firms exceeds the added taxation they will pay over the next decade. We show how better targeting of these policies towards firms that look more like formal firms to begin with can increase the formalization rate and improve cost-effectiveness.

The second chapter studies the impact of formalization on intra-household relationships, still in Benin. The idea behind this chapter is that formalization changes effective property rights by clarifying who in the household is the legal owner of the business and who will keep it in case of divorce. The causal effect of formalization is identified using the same random experiment used for the first chapter. We find first that formalization increases entrepreneurs' (both male and female) control over household revenue. They contribute proportionally less to household expenditures and to the personal expenses of their partner. Second, using a behavioral game, we find strong gender differential effects of formalization on the probability that entrepreneurs pay to hide a windfall transfer from their spouse. Female entrepreneurs are much more likely to pay to hide, while male entrepreneurs are much less likely to do so. Using a theoretical model, we show that this result is compatible with the idea that women entrepreneurs are constrained and cannot invest as much as they would like in their own business. Women who became formal hide the windfall transfer more because they have more property rights and want to invest more in their business. Our conclusion is that formalization has important effects on intra-household dynamics.

The third and final chapter of this thesis deals with the second question and examines how internet is changing the way taxes are collected. Specifically, we study the impact of electronic tax filing (e-filing) for small firms to replace in-person submission of paper-based forms to tax officials. We examine the impact of e-filing on compliance costs, tax payments, and bribes payments using experimental variation and data from Tajikistan firms. We find that firms that e-file have lower compliance costs, spending five fewer hours each month on fulfilling tax obligations. There are no significant average effects of e-filing on tax or bribe payments, but significant heterogeneity exists across firms by their baseline likelihood of tax evasion. Among firms previously more likely to evade, e-filing doubles tax payments, likely by disrupting collusion with officials. Conversely, among firms less likely to have been evading, e-filing reduces tax payments, suggesting that officials had previously required them to pay more. These firms also pay fewer bribes, as e-filing reduces opportunity for extortion. Our conclusion is that e-filing reduces compliance costs and makes the distribution of tax payments across firms arguably more equitable.

Keywords: Small Firms, Informality, Property Rights, Intra-household Relationships, Taxation, New Technologies, Electronic Tax Filing.

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Introduction Générale

Les sciences sociales et l'économie en particulier reconnaissent le rôle prépondérant des institutions pour le développement. L'économiste américain Douglas North, prix Nobel d'économie en 1993, en donne la définition suivante :

"Les institutions sont les contraintes établies par les hommes qui structurent les interactions humaines. Elles se composent des contraintes formelles (comme les règles, les lois, la constitution), des contraintes informelles (comme les normes de comportement, les conventions, les codes de conduite imposés) et des caractéristiques de leur application" (North, 1994).

Beaucoup de pays en développement ont des institutions économiques défaillantes. Cela se traduit par des problèmes structurels tels que l'omniprésence du secteur informel, la corruption généralisée, et l'incapacité des États à collecter les impôts. Les biens publics essentiels comme l'éducation, la santé ou la justice ne sont pas financés, la propriété privée n'est pas garantie et la confiance des citoyens envers leurs semblables est limitée. Dans ces conditions, le développement économique est très difficile.

Si la grande majorité des économistes s'accorde sur le rôle prépondérant des institutions économiques pour le développement, la façon dont ces institutions sont et doivent être créées pose question. Daron Acemoglu et James Robinson, à travers les nombreux exemples historiques présentés dans leur livre "Prospérité, puissance et pauvreté : Pourquoi certains pays réussissent mieux que d'autres ?" (2011), mettent en

avant l'importance de la démocratie pour la mise en place d'institutions favorisant le développement à long terme. Les travaux d'économistes tels que William Easterly, préconisent, quant à eux, de moderniser les institutions en les rendant plus transparentes, et en prenant davantage en compte les incitations individuelles des agents économiques (Easterly, 2001). De son côté, l'économiste Jeffrey Sachs, ancien conseiller spécial de l'ONU pour les objectifs du millénaire, avance que les institutions des pays en développement sont déficientes car ces pays sont pauvres. Selon lui, investir massivement dans l'éducation, la santé et les infrastructures devrait permettre de sortir de la "trappe" à pauvreté et de créer les bonnes institutions. Enfin, un autre courant de l'économie du développement, porté notamment par les travaux des récents lauréats du prix Nobel d'économie Abhijit Banerjee, Esther Duflo et Michael Kremer, propose dans une approche expérimentale de tester rigoureusement programme par programme et politique par politique comment les institutions peuvent être améliorées. [1]

Cette thèse s'inscrit particulièrement dans cette approche expérimentale. Elle contribue à ces recherches en étudiant l'effet de politiques publiques ayant pour but d'améliorer le fonctionnement des institutions économiques. Elle se focalise sur deux questions principales : (1) Quels sont les effets des politiques de réduction de l'informalité ? et (2) Comment les nouvelles technologies affectent la collecte des taxes dans les pays en développement ?

Les pouvoirs publics doivent-ils inciter les entreprises à se formaliser ?

Dans les pays en développement, la grande majorité des petites et moyennes entreprises sont informelles (La Porta and Shleifer, 2014). La prédominance de l'informel peut représenter un frein au développement. Pour les entreprises, l'informalité rend l'accès au crédit difficile et limite l'investissement. Pour l'État, cela complique la

[1] Voir par exemple "Richard T. Ely Lecture: The Economist as Plumber" Duflo (2017).

collecte des taxes nécessaires au financement des biens publics. De plus, lorsque les entreprises n'ont pas d'existence légale, le système judiciaire garantissant la propriété privée des entrepreneurs fonctionne moins bien, ce qui peut aussi décourager l'investissement. Selon l'économiste Péruvien Hernando de Soto, les habitants des pays en développement ''sont riches, mais riches d'un capital mort" (1989). Ils ne peuvent pas exploiter ce capital à cause d'un système de droits de propriété défaillant. Au cours des 15 dernières années, et sous l'impulsion de l'initiative Doing Business de la Banque Mondiale, de très nombreux gouvernements ont mis en place des réformes pour rendre la formalisation moins chère et plus facile à réaliser. Cependant, malgré ces réformes de simplification, la grande majorité des petites et moyennes entreprises reste informelle dans les pays les plus pauvres (Bruhn and McKenzie, 2014). Cela pose la question des efforts supplémentaires pouvant être entrepris par les gouvernements pour réduire l'informalité.

Le premier chapitre de cette thèse répond à cette question à l'aide d'une expérimentation aléatoire mise en place au Benin auprès de 3600 entreprises informelles. Cette expérimentation a été construite autour de l'introduction du statut de l'entreprenant, un nouveau régime légal créé pour faciliter la migration des petites entreprises vers le secteur formel, et mis en place simultanément dans 17 pays d'Afrique. Durant la phase pilote de ce projet, nous avons travaillé en partenariat avec le gouvernement du Bénin pour expérimenter trois interventions additionnelles, créées pour amplifier les effets positifs potentiels de la formalisation et rendre ce nouveau statut attractif. Dans un premier groupe de traitement, les entreprises ont reçu la visite d'un conseiller qui leur a présenté le nouveau statut, les avantages de la formalisation, et leur a offert de l'aide pour effectuer les démarches nécessaires pour se formaliser. Dans un second groupe, les entreprises ont reçu comme incitations supplémentaires l'accès à un compte bancaire à des conditions préférentielles ainsi qu'à des services de conseils et de formation en gestion. Le troisième groupe d'entreprises a reçu les mêmes incitations que les deux premiers

avec en plus un service de médiation fiscale en cas de problèmes avec le fisc. Enfin, en plus de ces trois groupes, une intervention supplémentaire basée sur la distribution de brochures d'information à une partie de notre groupe de contrôle, nous a permis de mesurer séparément l'effet d'être informé de l'existence du nouveau statut, sans recevoir d'incitation supplémentaires.

Nous utilisons des données administratives sur la formalisation des entreprises ainsi que trois vagues d'enquêtes détaillées pour mesurer l'impact de ces différentes interventions. Deux ans après le début du programme, seulement 2% des entreprises du groupe de contrôle s'étaient formalisées. Informer les entreprises à l'aide de brochure n'a pas d'impact sur la formalisation. Cela montre que sans intervention supplémentaire, la grande majorité de ce type d'entreprise restera informelle, et ce même si elles sont informées de la possibilité de s'enregistrer gratuitement et facilement. En comparaison, les trois types d'interventions testés ont eu un impact statistiquement significatif sur la formalisation. L'ensemble d'incitations le plus simple offert aux entreprises du premier groupe a eu un impact de 9.6 points de pourcentage sur le taux de formalisation. Cet impact a été de 13 points de pourcentage pour le second groupe et de 16.3 points de pourcentage pour le troisième groupe qui a reçu l'ensemble complet des incitations. En revanche, la formalisation a eu des effets limités sur la performance des micro-entreprises. Leur chiffre d'affaire, leur niveau de profit et leur capacité à accéder à des crédits bancaires n'ont pas augmenté significativement. De plus, le coût des incitations nécessaires pour stimuler la formalisation est supérieur au montant total des impôts que paieront ces micro-entreprises pendant les 10 prochaines années en faisant l'hypothèse qu'elles payent complétement leurs impôts. Notre conclusion est que compte tenu de son impact limité sur les performances des entreprises et les recettes fiscales supplémentaires, la mise en place d'incitations telles que celles testées pour ce programme a peu de chance d'être efficace d'un point de vue financier. Nous montrons qu'un ciblage sur les entreprises ayant des caractéristiques proches des entreprises déjà

formalisées augmenterait l'impact sur la formalisation et améliorerait l'efficacité de ce type de programme. Avec un tel ciblage, le taux de formalisation atteindrait plus de 20% et le gouvernement recouvrirait les coûts du programme sous forme de revenus fiscaux au bout d'environ 6 ans. Cependant, nous n'avons pas trouvé d'impact de la formalisation sur les profits ou le chiffre d'affaire pour les entreprises ciblées de la sorte.

Ce chapitre contribue à une littérature actuellement relativement peu développée qui étudie différentes interventions visant à amener les entreprises informelles vers la formalisation. Des expérimentations contrôlées mises en place au Sri Lanka (de Mel et al., 2013), au Bangladesh (de Giorgi et Rahman, 2013), au Malawi (Campos et al., 2015), au Brésil (Andrade et al., 2016) et en Colombie (Galiani et al., 2017), ont ainsi montré que dans ces contextes particuliers, la simplification des procédures de formalisation et la diffusion d'informations aux entreprises sur cette simplification avait des effets très limités sur la formalisation. Le succès limité de ces programmes pour augmenter la formalisation implique aussi qu'il existe très peu d'études permettant de mesurer avec précision l'impact de la formalisation sur d'autres indicateurs comme les profits ou le chiffre d'affaire. Les seuls résultats disponibles proviennent d'une étude menée au Sri Lanka (de Mel et al., 2013) lors de laquelle certaines entreprises ont été payées pour se formaliser, et d'une étude menée au Brésil (Andrade et al. 2016) ou des inspecteurs des impôts ont forcé certaines entreprises à devenir formelles. Ces résultats concluent à l'absence d'effets significatifs sur l'accès au crédit ou sur les performances des entreprises. Nous trouvons dans ce chapitre des résultats cohérents avec cette littérature, dans un contexte africain où le niveau de développement est plus faible, le taux d'informalité plus élevé et où ce type d'étude est quasi inexistant. Une autre contribution importante de ce chapitre est de montrer que même en proposant des services additionnels sensés amplifier ses effets positifs théoriques, la formalisation n'augmente pas significativement la performance des entreprises. Une interprétation possible de ces résultats, est que les lourdeurs administratives et réglementaires ne constituent pas

la raison principale de l'informalité. Les entreprises choisissent de rester informelles car les avantages sont faibles comparés aux coûts des taxes supplémentaires (Maloney, 2004).

La formalisation des micro-entreprises a-t-elle un impact sur les dynamiques intra-ménages ?

La littérature qui étudie les relations intra-ménages souligne le rôle important des revenus individuels et du contrôle sur les actifs du ménage dans les stratégies d'investissement, l'offre de travail et la répartition des ressources au sein des ménages (Browning et al., 2014, Bertrand et al., 2015, Lundberg et al., 1997, Fafchamps and Quisumbing, 2002, Duflo, 2003, Doss, 2006, Anderson and Mukesh, 2009, Wang, 2014, Almas et al., 2018). Cette littérature montre qu'une augmentation du revenu individuel, du contrôle sur les biens du ménage, ou du montant des transferts reçus individuellement se traduit en général par davantage de pouvoir de négociation au sein du ménage et une meilleure situation individuelle. Le second chapitre de cette thèse est basé sur cette littérature. Il étudie l'impact de la formalisation sur la dynamique intra-ménage. L'idée de départ de ce chapitre est que la formalisation renforce les droits de propriété individuels au sein des ménages en clarifiant qui est le propriétaire légal de l'entreprise, et qui la gardera en cas de divorce.

Pour répondre à cette question, nous utilisons la même expérimentation aléatoire que celle utilisée pour l'étude décrite dans le premier chapitre, en restreignant notre analyse aux 2000 entrepreneurs informels qui sont mariés ou vivent en couple. Cette expérimentation nous offre un contexte particulièrement intéressant car au Bénin, la formalisation identifie clairement une et une seule personne comme propriétaire légal de l'entreprise. Les entreprises sélectionnées aléatoirement pour participer au programme et recevoir les incitations supplémentaires se sont davantage formalisées que celles qui n'y ont pas été incitées. Le taux de formalisation a augmenté de 14 points de

pourcentage parmi les femmes entrepreneurs et de 22 points de pourcentage parmi les hommes. Nous utilisons cette différence pour mesurer l'impact causal de la formalisation sur la répartition des revenus au sein des ménages, les décisions d'investissement et l'autonomisation des entrepreneuses. Il est important de souligner, comme nous l'avons vu au chapitre précédent, que la formalisation combinée aux incitations supplémentaires a eu des effets nuls ou limités sur les profits, le chiffre d'affaire ou l'accès au crédit des entreprises. Cela signifie, que nous pouvons interpréter la formalisation comme un choc sur les droits de propriété individuels dans un contexte où les effets sur d'autres indicateurs économiques sont limités. Nous avons mesuré les relations intra-ménages à l'aide de nos données d'enquêtes qui comprennent un jeu comportemental dans lequel les entrepreneurs peuvent choisir de payer pour cacher un transfert monétaire à leur partenaire. Ce jeu basé sur les travaux de Jakiela et Ozier (2016), nous permet de mesurer dans quelle mesure les entrepreneurs sont contraints par leur ménage pour l'utilisation de ce type de transfert. Spécifiquement, cela nous donne le montant qu'ils ou elles sont prêts à payer pour avoir plus de contrôle sur cet argent et réduire l'effet de la contrainte au sein de leur ménage.

Nous trouvons deux résultats principaux. En premier lieu, les entrepreneurs s'étant formalisés grâce au programme, ont plus de contrôle sur la façon dont les ressources de leur ménage sont dépensées. Ils ou elles contribuent proportionnellement moins aux dépenses du ménage et transfèrent moins d'argent à leur époux ou épouse. Deuxièmement, nous trouvons que l'impact de la formalisation sur la probabilité que les entrepreneurs cachent un transfert monétaire à leur époux ou épouse est différent pour les femmes ou pour les hommes. Les femmes dont l'entreprise a été formalisée grâce au programme veulent beaucoup plus cacher le transfert (50 points de pourcentage en plus), tandis que les hommes entrepreneurs le veulent beaucoup moins (27 points de pourcentage en moins).

A l'aide d'un modèle théorique, nous montrons que ces résultats sont compatibles avec l'idée que la formalisation a deux effets : elle augmente le contrôle individuel sur les ressources du ménage, et elle augmente aussi les incitations à investir dans l'entreprise (sur laquelle l'entrepreneur à un contrôle accru). Pour les hommes, qui ont au départ plus de pouvoir sur les décisions d'investissement du ménage, l'effet sur le contrôle des ressources du ménage domine et ils veulent moins cacher les transferts car ils ont plus de maîtrise sur la façon dont l'argent sera dépensé. Pour les femmes, qui ont moins de contrôle sur les décisions d'investissement du ménage, l'effet sur l'investissement dans l'entreprise domine. Elles veulent davantage cacher les transferts pour pouvoir investir dans leur entreprise sur laquelle elles ont, du fait de la formalisation, de meilleurs droits de propriété. En accord avec cette idée, nous mesurons aussi une augmentation significative de l'investissement réalisé par les entrepreneuses dans leur entreprise qui utilisent leur épargne personnelle et réduisent les transferts qu'elles font en dehors de leur ménage pour pouvoir investir. Ce résultat est rassurant car il suggère que même si les femmes sont contraintes dans leurs décisions d'investissement (et sont prêtes à payer pour avoir plus de contrôle), elles trouvent quand même des moyens d'investir après la formalisation.

La conclusion de ce chapitre est que les droits de propriété individuels obtenus par la formalisation ont des implications importantes mais complexes sur les relations intra-ménages. Tandis que la formalisation augmente le contrôle sur les revenus du ménage pour les hommes et femmes entrepreneurs, nos résultats suggèrent également que les décisions d'investissement des femmes sont contraintes, ce qui peut limiter pour elles, les avantages potentiels de la formalisation. A notre connaissance, il s'agit de la première étude mesurant l'impact causal de la formalisation des micro-entrepreneurs à l'intérieur du ménage. En cela, ce chapitre établit pour la première fois un lien entre la littérature étudiant les effets de la formalisation sur l'économie (voir Bruhn et McKenzie, 2014 pour une revue de la littérature) et la littérature étudiant les relations

intra-ménage (voir Browning et al., 2014 pour une revue de la littérature).

Ce chapitre fait deux contributions supplémentaires. En premier lieu, il contribue à la littérature empirique qui étudie l'effet des réformes institutionnelles sur l'évolution des systèmes familiaux, l'autonomisation des femmes et les relations de genre (World Bank 2011, Duflo 2012, Aldashev et al. 2012, Platteau et Wahhaj 2014, Guirkinger et Platteau 2016), O'Sullivan 2017). Cette littérature qui étudie l'effet de réformes des lois sur la famille, l'héritage, le divorce ou les droits de propriété, trouve en général, des effets positifs sur la situation des femmes. Nos résultats sont cohérents avec cette littérature, même s'ils montrent aussi que les effets positifs de la formalisation peuvent être limités pour les femmes si leurs maris les empêchent d'investir dans leur entreprise formalisée. Ce résultat résonne aussi particulièrement avec ceux de l'étude récente de Bernhardt et al. (2019) qui montrent que les transferts monétaires donnés à des entrepreneuses sont très souvent investis dans l'entreprise de leur mari, expliquant potentiellement pourquoi ce type de transfert n'avait pas d'effet sur les entreprises appartenant à des femmes (de Mel et al. 2008, de Mel et al. 2009, Fafchamps et al. 2014). Cependant, Bernhardt et al. (2019) ne peuvent pas établir si cette décision est volontaire ou pas. Ce chapitre apporte des réponses à cette question en montrant que beaucoup d'entrepreneuses sont prêtes à payer pour avoir plus de contrôle sur les transferts. Cela suggère qu'elles sont contraintes dans leurs décisions d'investissement, et que lorsqu'elles investissent l'argent d'un transfert dans l'activité de leur mari, il ne s'agit pas d'un choix personnel. Ce résultat peut permettre d'améliorer la conception des programmes ciblant les entrepreneuses.

En second lieu, ce chapitre contribue à la littérature qui étudie comment les relations intra-ménages peuvent générer des inefficacités économiques. Cette littérature avance plusieurs raisons expliquant la création de situations inefficaces (Browning et al. 2014, Baland et Ziparo 2018). Une première explication est décrite dans des travaux

théoriques comme ceux de Lundberg and Pollak (2003), Chen and Woolley (2001) et Basu (2006) qui montrent que les comportements individuels stratégiques et non-coopératifs créent de l'inefficacité quand les membres du ménage anticipent un risque de divorce et n'arrivent pas à se coordonner. Une seconde explication vient des normes sociales qui peuvent entrainer des situations inefficaces. C'est le cas en particulier des normes qui empêchent les femmes de gagner plus d'argent que leur mari (Bertrand et al. 2015), des normes qui limitent les types d'activités pouvant être entrepris par les hommes et les femmes (Udry, 1996), ou encore des normes qui obligent les gens à redistribuer plus de revenus qu'ils ne le voudraient à leur proches (Platteau, 2000, 2014, Grimm et al. 2016). Les normes de redistributions sont particulièrement fortes dans les pays en développement et une littérature récente montre que beaucoup d'individus entreprennent des stratégies coûteuses pour réduire cette pression à partager. Cela inclut le fait de "faire semblant" d'être pauvre en contractant des emprunts inutiles (Baland et al. 2011), le fait d'investir dans des actifs qui ne peuvent pas être partagés (Falco et Bulte, 2011) ou encore le fait de cacher ses revenus (Ashraf2009, Jakiela et Ozier 2016, Boltz et al. 2019, Beekman et al. 2015, Squires 2018, et Almas et al. 2018). En accord avec cette littérature, nous trouvons que beaucoup d'entrepreneurs (un quart dans notre échantillon dans le groupe de contrôle) sont prêts à payer pour cacher leurs ressources à leur famille, ce qui suggère de fortes inefficacités. Une importante contribution de ce chapitre est de montrer que les lois encadrant les droits de propriété, comme le statut des entreprises formelles, ont un impact important sur les incitations à cacher. Cette étude est une des toutes premières à étudier ce qui détermine de façon causale le fait de cacher ses ressources personnelles à son époux ou épouse (Almas et al. 2018, constitue à notre connaissance la seule exception).

Comment les nouvelles technologies changent-elles la collecte des taxes dans les pays en développement ?

Les nouvelles technologies bouleversent la manière dont les administrations fournissent les services publics et interagissent avec les citoyens. Cette transformation touche de nombreux domaines comme la gestion des transferts sociaux, les procédures d'appels d'offres publics, ou encore les élections (World Development Report 2016). L'utilisation des nouvelles technologies permet en premier lieu d'améliorer l'efficacité des services publics. De plus, cela permet souvent aussi de lutter contre la corruption en automatisant les procédures, et en réduisant le pouvoir discrétionnaire des fonctionnaires. La collecte des impôts est un domaine dans lequel cette transformation est importante, en particulier dans les pays en développement. Dans ces pays, l'administration fiscale est souvent caractérisée par la forte fréquence des interactions entre contribuables et agents des impôts. Ces derniers sont en général chargés du contrôle des contribuables dans des contextes où les données nécessaires à un contrôle automatisé n'existent pas. Cela rend le système particulièrement vulnérable à la corruption. Les agents du fisc peuvent extorquer des pots-de-vin aux contribuables en les menaçant d'augmenter leurs impôts. Inversement, ces derniers peuvent aussi tenter de corrompre les agents du fisc en leur proposant des pots-de-vin en échange de réduction d'impôt. Ce type de problème peut contribuer à expliquer pourquoi les pays les plus pauvres n'arrivent pas à collecter des taxes suffisantes pour financer les services publics les plus basiques. Pour répondre à ce problème, de nouveaux gouvernements ont profité des avancés technologiques récentes pour introduire des systèmes de déclaration des revenus en ligne. Ces systèmes viennent remplacer les formulaires papiers soumis à des agents du fisc. En 2015, 32% des pays en développement avaient introduit ce type de système, chiffre en constante augmentation (World Bank, 2016). Etant donné la prévalence croissante de la possibilité de déclarer les taxes en ligne, il est important d'en comprendre tous les effets.

Le troisième et dernier chapitre de cette thèse apporte des réponses à cette question dans le contexte du Tadjikistan. Plus précisément, nous étudions l'impact d'un système

qui permet aux petites entreprises situées dans la capitale Douchanbé, de déclarer mensuellement leurs revenus en ligne. D'un autre côté, les capacités de contrôle automatique de l'administration étant limitées au Tadjikistan, les agents du fisc qui sont en contact direct avec les entreprises ont potentiellement une meilleure capacité à les contrôler pour limiter l'évasion fiscales. Si c'est le cas, introduire la déclaration en ligne pourrait au contraire réduire le montant des impôts collectés.

Nous utilisons une expérimentation aléatoire avec 1400 petites et moyennes entreprises pour mesurer l'impact (causal) de la déclaration en ligne sur le temps passé par les entreprises à déclarer leurs taxes, le montant des impôts payés et le paiement de pots-de-vin. Lorsque cette étude a débuté en 2015, ce nouveau système était déjà ouvert à toutes les entreprises mais son taux d'adoption était encore très faible. Peu d'entreprises connaissaient son existence, et les procédures pour s'enregistrer étaient complexes. A partir d'un design "par encouragement", nous avons administré à un échantillon d'entreprises tirées au sort une formation détaillée sur le nouveau système et offert une assistance logistique pour effectuer les démarches nécessaires à l'inscription. 93% des entreprises ayant reçu cette aide se sont inscrites pour déclarer leurs taxes en lignes. Dans le groupe de contrôle, ce taux a été seulement de 60%. Nous utilisons cette différence dans les taux d'adoption pour estimer l'impact de la déclaration en ligne.

Nous trouvons deux résultats principaux. Tout d'abord, en utilisant un score de risque calculé par l'administration fiscale pour estimer le risque qu'une entreprise fasse de l'évasion fiscale, nous montrons que celles qui choisissent d'adopter le nouveau système sont aussi celles qui étaient le moins susceptibles de faire de l'évasion. Ce résultat suggère que les entreprises faisant de l'évasion fiscale préfèrent interagir directement avec les agents du fisc, pour entrer en collusion et réduire leurs impôts.

Ensuite, en analysant l'impact sur les entreprises ayant adopté le système grâce

à notre assistance, nous trouvons que déclarer en ligne réduit le temps passé chaque mois pour remplir ses obligations fiscales de 5 heures par rapport à l'ancien système de la déclaration papier. Nous ne trouvons pas d'effets sur le montant total des impôts payés ni sur le versement de pots-de-vin. En revanche, l'absence d'effets moyens masque une importante hétérogénéité. Les entreprises qui étaient le plus susceptibles de faire de l'évasion fiscale dans le système précédent (d'après le score de risque utilisé par l'administration) payent davantage d'impôts quand elles déclarent en ligne, probablement car elles ne peuvent plus entrer en collusion avec les agents des impôts. À l'inverse, parmi les entreprises qui étaient auparavant les moins susceptibles de faire de l'évasion, déclarer en ligne réduit le montant des taxes payées, suggérant qu'elles étaient forcées de payer plus d'impôts dans l'ancien système. Ces entreprises paient également moins de pots-de-vin, ce qui suggère que déclarer en ligne offre une protection contre le risque d'extorsion de la part des agents du fisc. Il est important de noter que l'impact du nouveau système sur le montant des taxes payées en fonction du risque d'évasion a pour effet de réduire complètement l'écart initial entre les deux types d'entreprises. Les entreprises ayant un risque d'évasion élevé payaient moins d'impôt dans l'ancien système et en payent plus dorénavant, tandis que les entreprises ayant un risque d'évasion faible payaient plus d'impôts auparavant et en payent moins maintenant. La conclusion de ce chapitre est que dans le contexte du Tadjikistan, permettre aux entreprises de déclarer leurs taxes en ligne a rendu l'appareil fiscal à la fois plus efficace et plus juste.

Afin d'examiner la robustesse de nos résultats, nous utilisons des méthodes de Machine Learning qui nous permettent de confirmer que le score de risque que nous utilisons est effectivement une variable importante pour expliquer l'hétérogénéité de l'impact du programme. Nous suivons la méthodologie proposée par Chernozhukov (2018) et utilisons un Random Forest pour établir la présence d'une hétérogénéité importante et pour classer les entreprises de notre échantillon selon la taille de l'impact du programme prévu par cet algorithme. Nous trouvons, comme attendu, que les en-

treprises pour lesquelles l'impact prévu est élevé ont aussi un score de risque élevé (et inversement pour celles qui ont un score de risque faible).

Ce chapitre contribue à différents domaines de la littérature. Premièrement, il s'ajoute à une liste importante de travaux qui étudient le rôle de la technologie dans le renforcement des capacités des États. Des études récentes ont ainsi examiné l'impact de l'utilisation des nouvelles technologies sur la gestion des marchés publiques (Lewis-Faupel et al., 2016) l'organisation des élections (Fujiwara, 2015), la mise en place de programmes sociaux (Banerjee et al. 2017, Muralidharan et al. 2016). Dans le domaine de la fiscalité, Ali et al. (2015) et Eissa et al. (2015) étudient l'impact des machines permettant la facturation électronique des obligations fiscales en Éthiopie et au Rwanda. Bien qu'une grande partie de cette littérature dans tous les domaines identifie des effets positifs, nos résultats montrent que les nouvelles technologies peuvent aussi avoir des effets hétérogènes. De plus, nous montrons aussi que lorsque l'adoption est volontaire, les entreprises et les personnes sur lesquelles la technologie peut avoir le plus d'impact pour réduire la corruption ou l'évasion, peuvent aussi être les moins susceptibles de l'adopter.

Deuxièmement, cet article contribue à la littérature sur la fiscalité dans les pays en développement. Jusqu'à présent, cette littérature s'est largement concentrée sur les réponses des contribuables à différents types d'incitation, sur le contrôle automatique des données, sur l'effet des audits fiscaux et sur les changements dans la politique fiscale (voir Slemrod 2017 pour une revue récente de cette littérature). Beaucoup moins d'attention a été portée à l'analyse de l'importance des interactions entre les agents du fisc et les contribuables. Les articles de Khan et al. (2016) et d'Amodio et al. (2017), qui étudient l'impact du système de rémunération des fonctionnaires sur la collecte des taxes et le paiement de pots-de-vin, sont deux exceptions notables. Ce chapitre aborde cette question sous un autre angle en étudiant l'effet d'une intervention qui

réduit mécaniquement les interactions entre agents du fisc et contribuables.

Troisièmement, et d'un point de vue plus large, ce chapitre contribue à notre compréhension des causes de la corruption et de l'efficacité des stratégies visant à la réduire (voir Olken et Pande 2012, pour une revue de cette littérature). Tout comme Sequeira et Djankov (2014), nous faisons une distinction entre la corruption par collusion et la corruption coercitive. Nos résultats suggèrent que les réactions des entreprises aux politiques publiques dépendent fortement du type de corruption caractérisant leurs relations avec l'administration.

Enfin, cette étude est parmi les toutes premières à mesurer l'impact causal de la déclaration des taxes en ligne. La seule autre étude à notre connaissance est celle de Kochanova et al. (2016) qui compare la situation avant et après l'introduction d'un système de déclaration en ligne dans différents pays à partir des données de l'Enquête Entreprises de la Banque Mondiale. Les auteurs trouvent qu'en moyenne la déclaration en ligne réduit à la fois le temps passé à déclarer les taxes et le paiement de pots-de-vin. Ils ne disposent cependant pas de données sur le montant des taxes payées. Notre étude qui utilise les résultats d'une expérimentation aléatoire nous a permis d'éviter les risques de biais de sélection, présents dans cette étude.

Chapter 1

Does Inducing Informal Firms to Formalize Make Sense? Experimental Evidence from Benin

This chapter is based on a joint work with Najy Benhassine, David McKenzie and Massimiliano Santini, all working at the World Bank.[1]

See also *Journal of Public Economics*, 157, 1-14, January 2018.

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Abstract

Efforts to bring informal firms into the formal sector are often based on a view that this will bring benefits to the firms themselves, or at least benefit governments through increasing the tax base. A randomized experiment based around the introduction of the entreprenant legal status in Benin is used to test these assumptions, along with supplementary efforts to enhance the presumed benefits of formalizing to firms. Few firms register when just given information about the new regime, but our full package of supplementary efforts boosts formalization by 16.3 percentage points. However, this formalization does not bring firms higher sales or profits, and the cost of formalizing these firms exceeds the added taxation they will pay over the next decade. We show how better targeting of these policies towards firms that look more like formal firms to begin with can increase the formalization rate and improve cost-effectiveness.

Keywords: Informality, Small Enterprises, Regulatory Simplification

JEL codes: O17, O12, D21, L26, H25.

1.1 Introduction

A large majority of micro, small, and medium-sized firms throughout the developing world operate in the informal sector (La Porta and Shleifer, 2014a). This is certainly the case in Benin, where the national statistics agency has estimated that the informal sector represents up to 70 percent of GDP and 95 percent of employment (INSAE, 2009). There are two main reasons why governments usually view these high levels of informality as a problem.[2] The first, spurred by the work of de Soto (1989), is the idea that informality is costly for the firms themselves, who are unable to access bank financing, public contracts, or government programs, and suffer from low productivity as a result. The second reason is the idea that a large informal sector represents lost tax revenues for the government. In response, many countries have implemented business entry regulation reforms designed to make it easier for firms to become formal (World Bank, 2016). However, even after these regulatory reforms, the majority of firms remains informal in many developing countries (Bruhn and McKenzie, 2014), raising the question of whether governments should undertake additional efforts to induce informal firms to formalize.

We use a randomized experiment with 3,600 informal businesses in Benin to help answer the question. We do this in the context of the launch of the *entreprenant* legal status, a simplified regime being offered to small informal businesses in 17 African states with the goal of making it easier for them to enter the formal economy. In the pilot phase of launching this new status, we worked with the Government of Benin to experimentally test three interventions designed to induce these informal firms to register. The first treatment group received in-person visits in which the new status was explained, the potential benefits verbally described, and advisors helped firms with paperwork as needed. A second treatment aimed to enhance the benefits of formalizing

[2] See, for example, Levy 2008; Farrell, 2004; Perry et al, 2007; and La Porta and Shleifer, 2014b.

by offering business training and support opening a business bank account. The third treatment built on the first two by also offering tax mediation services. A supplementary treatment provided information in the form of leaflets to test whether information alone had an impact.

We use administrative data on formalization coupled with two rounds of follow-up surveys to measure the impact of these treatments. Only 2 percent of the control group formalized over a two-year period, showing that, in the absence of any intervention, most informal firms stay informal. All three treatments had significant impacts on formalization, with the impacts larger as more supplementary services were offered: there was a 9.6 percentage points increase in registration in the first treatment group, 13 percentage points in the second, and 16.3 in the third, with these differences between groups all statistically significant. In contrast, information leaflets alone had no impact on formalization. We then measure the consequences of formalizing for these firms. Formalizing leads to increased participation in business training, more formal accounting, lower tax harassment, and less taxes paid (due to a tax exemption in the year after formalizing). However, formal firms are not significantly more likely to obtain business bank accounts or loan financing, do not gain more customers, and have no significant gains in sales, profits, or standard of living.

While the benefits of formalizing for firms are thus modest, the cost of the intervention is not. We calculate an average cost of US$1,200-2,200 per firm formalized. Even assuming 100 percent compliance with tax payments, and that firms achieve turnover growth at the very top of our estimated confidence interval, we calculate that it would take a decade or more for this additional tax revenue to cover the costs of formalizing. As such, our analysis suggests that while introducing a simplified registration system offers at least time-saving benefits for firms that want to formalize on their own, adding additional services or in-person visits to attempt to get additional firms to become for-

mal is unlikely to pass a cost-benefit test.

Although these results suggest it is not beneficial for governments to try to formalize all firms, better targeting may identify a subgroup for whom formalization makes more sense. We examine heterogeneity in impact according to key characteristics specified in a pre-analysis plan[3]. We find the formalization impacts of our treatments are higher for male business owners, those with more education, those operating outside the biggest market in Cotonou (Dantokpa), and those that we classified ex ante as being more similar to businesses already formal using species classification (De Mel et al., 2010). Targeting on these characteristics could increase formalization rates to over 20 percent, and lower the cost per firm formalized to $600-700, which could be recouped in tax revenues within 6 to 13 years. However, we still find no profits or sales benefit to these targeted firms of formalizing.

This work builds on a literature which tests different interventions designed to bring informal firms into the tax system. Providing information and removing the upfront cost of registration had no effect on tax registration in randomized experiments in Sri Lanka (de Mel et al. 2013), Bangladesh (de Giorgi and Rahman, 2013), Brazil (Andrade et al., 2016), Malawi (Campos et al., 2015), or Colombia (Galiani et al., 2017). We add evidence from Africa, where development levels are lower, and the informal sector larger still. One interpretation of this evidence is that burdensome regulations are not the main reason these firms are informal, but instead they are rationally choosing to be informal because the benefits of formalizing are low for them compared to the tax and other costs (Maloney, 2004).[4] The limited success of these

[3]This study was registered in the AEA RCT Registry on October 7, 2014, prior to any follow-up survey data being collected https://www.socialscienceregistry.org/trials/515

[4]Larger impacts on formalization have occurred in settings where firms could register for a status not directly linked to tax registration, such as a municipal license in Peru (Alcázar et al., 2010), and a business registration certificate in Malawi (Campos et al., 2015). Non-experimental evidence from a reform in Mexico to municipal registration is mixed as to whether this induced registration of existing informal firms. Bruhn (2011) and Kaplan et al. (2011) both find this reform increased formal registrations by 5 percent, but disagree as to the extent to which this came from registration of existing

studies in getting firms to formalize has meant there have been few opportunities to measure the benefits of tax registration for informal firms. Some evidence is available from Sri Lanka, where de Mel et al. (2013) paid firms to formalize, and from Brazil, where Andrade et al. (2016) used tax inspectors to force formalization. In neither case were firms able to benefit from many of the purported advantages of formal status, including access to business banking, participation in government training programs, receiving government contracts, or increased certainty over taxes. de Mel et al. (2013) find some impact of formalization on firm profitability, but this impact appears to be driven by a handful of firms for which profit increased substantially, with most firms experiencing no change. Our paper shows this finding of little benefit to informal firms from formalizing continues to hold, even when additional interventions were undertaken to attempt to increase these supposed benefits, and complements this with analysis on the taxation side, which was not present in these earlier studies. Moreover, because of the larger sample, we can provide the first guidance over targeting of such efforts towards firms more likely to respond.

1.2 Formalization in Benin

The seventeen OHADA (*Organisation pour l'Harmonisation en Afrique du Droit des Affaires)* member countries adopted a revised General Commercial Law in December 2010, which came into effect in May 2011. The new law, introduced the *entreprenant* status, a simplified legal regime specifically designed for small entrepreneurs, whose intended objective is to facilitate the migration of businesses operating in the informal sector into the formal sector. However, the law did not make explicit how the *entreprenant* status practically functioned, nor the specific combination of incentives that it would include, instead allowing each country to fill in the vacuum through ad-hoc secondary legislation and institutional changes. Benin, as a member of OHADA,

informal firms versus new entrants registering.

was the first OHADA country to implement the *entreprenant* legal status.[5]

The *entreprenant* status can apply to a physical person running a micro or small business involved in any type of activity. Formalization with this new status is easy, free of charge and takes only one business day. The introduction of the *entreprenant* status is part of a broader effort from the Government of Benin to simplify and reduce the costs of formalization. Reforms of other existing legal status were implemented a few months before the creation of *entreprenant* status, and included the creation of a one-stop shop for business registration, and a significant reduction of the registration costs associated with the main existing legal status. The registration cost for individual enterprises dropped from CFAF 65,000 (USD 109[6]) to CFAF 10,000 (USD 17) and from CFAF 225,000 (USD 378) to CFAF 17,000 (USD 29) for limited liability companies (only the *entreprenant* status is totally free of charge). For all statuses, the time to register was reduced to one business day. The only documentation required to become formal is a legal ID, and then firm owners fill out a short form, provide two pictures and sign a declaration saying that they were never imprisoned. As these reforms (including the creation of the *entreprenant* status) were implemented recently, information on the new conditions to formalize was not likely to be known by the majority of informal businesses operating in Cotonou at the time of the start of the program.

Formalizing in Benin means to choose a legal status and register at the GUFE (*Guichet Unique de Formalisation des Entreprises*), the one-stop-shop for formalization that gathers services of the chamber of commerce and of the tax administration. It offers some potential benefits (presented in Table A1) depending on the type of status chosen. Most of these potential benefits are related to the possibility to apply for bank services, or to access new markets like government and large companies' contracts. The

[5]Other developing countries often have a similar form of legal status, but these typically require more documentation and are usually not free as in Benin. See appendix 1 for a description of similar legal statuses in other countries in West Africa.

[6]Exchange rate on June 1, 2016 on oanda.com: 1 USD= CFAF 596.

entreprenant status gives access to all advantages except the rights to export and to access large public contracts. It explicitly targeted micro and small businesses managing one type of activity with a limited turnover.[7]

When they formalize, businesses get a unique fiscal identifier and are registered with the tax administration. Accordingly, the main potential cost of formalization is related to taxes. In Benin, the link between formalization and taxes is complex and varies according to the type of business. In theory, all businesses with a fixed location would pay taxes even if they were informal. But in practice, tax enforcement is easier for formal firms, since they have known addresses, can be sent tax notices, and can be found more easily, whereas tax collection from informal firms relies on field inspections from tax inspectors. When the program was launched the tax system applicable to most microentrepreneurs[8] was an assessment based on the rental value of the business premises. However, most informal firms do not have a lease contract proving rental value, and so taxes were based on the assessment of inspectors. Data from our baseline survey (see Table 1) show that formal firms were more likely to be paying taxes at all (84 percent paid versus 55 percent of informal firms), and paid a higher amount of taxes conditional on paying (an average of 17 percent of profits versus 9 percent). But both formal and informal firms express considerable uncertainty over the taxes they will pay, with more than 70 percent saying it is difficult to know in advance the tax they would have to pay.

After the entreprenant status and our interventions were launched, the government introduced a new tax regime for micro and small enterprises that shifted the tax basis

[7]The OHADA General Commercial Law defines the *entreprenant* as having an annual turnover below CFAF 30 million (USD 50,400) for trading activities, CFAF 20 million (USD 33,600) for crafting activities (artisans), and CFAF 10 million (USD 16,800) for services.

[8]The most common tax regime for microbusinesses was the "*Taxe Professionnelle Unique*" (TPU). Microbusinesses operating in specific sectors such as transportation, fabric merchant or businesses with a high level of revenue could also be contributing to three other tax regimes : "Taxe Unique sur les Transports Routiers" (TUTR), "*Régime du forfait des revendeurs de tissus et divers*", and "*Régime du bénéfice réel simplifié*".

Table 1.1: Descriptive Statistics on Study Population

	(1) **SELECTED Sample**		(2) **All informal businesses**		(3) **Formal businesses**	
	Mean [SD]	N	Mean [SD]	N	Mean [SD]	N
Firm owner characteristics						
Female owner	0.629	3,596	0.632	7,089	0.419	608
	[0.483]		[0.482]		[0.494]	
Age of the owner	39.5	3,557	39.4	6,955	43.6	589
	[10.4]		[11.2]		[10.5]	
Business owner has some formal education	0.712	3,591	0.708	7,081	0.884	606
	[0.453]		[0.455]		[0.32]	
Business owner has some secondary education	0.409	3,596	0.38	7,090	0.74	608
	[0.492]		[0.486]		[0.439]	
Firm characteristics						
Trade	0.55	3,596	0.518	7,090	0.584	608
	[0.498]		[0.5]		[0.493]	
Services	0.262	3,596	0.277	7,090	0.26	608
	[0.44]		[0.447]		[0.439]	
Craft	0.16	3,596	0.17	7,090	0.09	608
	[0.366]		[0.375]		[0.287]	
Firm area in m²	18.7	3,590	18.3	7,078	52.5	606
	[43.5]		[50.8]		[106.5]	
Business connected to electricity network	0.619	3,594	0.605	7,085	0.898	608
	[0.486]		[0.489]		[0.303]	
Number of employee	1.175	3,596	1.03	7,090	2.961	608
	[1.687]		[1.603]		[4.59]	
The firm does any form of accounting	0.179	3,594	0.156	7,089	0.642	604
	[0.383]		[0.363]		[0.48]	
Amount of sales in an average week	60,561	3,596	82,630	6,639	542,167	528
	[56,508]		[298,695]		[4,434,990]	
Amount of profit in the last month	46,698	3,596	46,434	6,358	223,041	490
	[46,578]		[141,423]		[726,068]	
Firm owner owns a bank account	0.222	3,514	0.194	6,928	0.789	582
	[0.416]		[0.395]		[0.409]	
Firm pays taxes	0.547	3,560	0.466	7,005	0.836	597
	[0.498]		[0.499]		[0.371]	
Amount of taxes paid in the previous year	18,732	3,482	16,649	6,827	316,636	533
	[27,265]		[30,727]		[2,591,065]	
Thinks that it's difficult to know in advance how much taxes she will have to pay	0.744	2,665	0.764	4,921	0.725	520
	[0.437]		[0.424]		[0.447]	
Ratio tax/ annual profit for all businesses	0.051	3,482	0.072	6,174	0.128	445
	[0.089]		[0.174]		[0.221]	
Ratio tax/ annual profit for businesses paying taxes	0.094	1,870	0.165	2,859	0.169	372
	[0.104]		[0.286]		[0.313]	

Notes: sources: listing-baseline survey March 2014

from rental value of premises to turnover.[9] This was not known at the time of the launch of our interventions, so should not affect formalization decisions, but will affect projected future tax revenue from newly formalized firms. Figure A1 shows the project timeline and the date of introduction of this reform.

When they formalize, businesses which were not paying any tax before benefit from a full year of tax exemption (as we will see later, in practice this exemption was also applied to firms already paying tax). In addition, businesses which also register with the CGA (an association providing business counseling and account certification) can benefit from a reduction of 40% in the amount of taxes due for the following 3 years. As a result, the amount of taxes paid by firms which formalize may actually decrease in the short-term.

1.3 Evaluation design

1.3.1 The Intervention

Given the flexibility provided by the OHADA framework as to how the entreprenant status should be implemented, the Government of Benin was interested in knowing the most impactful and efficient way to operationalize the legal status. We worked with the government to design and test the following three packages of incentives to formalization, with the goal of understanding what would be the best combination of incentives:

[9] In December 2014, the Beninese Parliament adopted a new MSE tax regime. This regime introduced the Synthetic Professional Tax (TPS: *Taxe Professionnelle Synthètique*) which replaces the four taxes that micro and small businesses were subject to before the reform. This reform creates more predictability and transparency in the calculation of the amount of tax due. Our survey data and qualitative surveys suggest that entreprenants started paying under the TPS regime in 2017 based on their 2016 turnover.

Package A – Information on the *entreprenant* status and assistance in registering

The *Centres de Gestion Agréés* (CGA) is a semi-public organization that focuses on providing small and medium enterprises with business management, accounting, and tax consulting services.[10] They provided advisors who would visit selected firms in person. These advisors were professionals with Masters degrees and an average of eight years of professional experience (see appendix 1). They explained the benefits of becoming an *entreprenant*, and provided (i) a leaflet describing the *entreprenant* status, its advantages and requirements, (ii) one leaflet explaining the registration process at GUFE, and (iii) one leaflet explaining the different tax regimes applicable to *entreprenants* and how to calculate taxes due within each regime. They did not emphasize the short-term tax reductions during these visits, but rather the steady-state tax regimes that firms would now be part of. The informal businesses that decided to formalize needed to submit an application at GUFE to obtain the *entreprenant* card. When necessary, CGA advisors helped *entreprenants* with the formalization process at GUFE, including filling in the declarations and preparing all the required accompanying documents.

Package B – Provision of business services and trainings, and assistance in opening a bank account

The second package aimed to supplement the basic help in package A by facilitating access to the training services and to commercial banks, which are potential benefits of formalizing, but which many firm owners may not otherwise benefit from in practice. Following the first visit to each business, CGA advisors organized a second visit

[10] CGA business associations were introduced in 2001 by a law decree that defined their legal status. This status acknowledges their independence from the administration and the fact that they should respect professional secrecy. Outside this pilot program, CGA support services are not provided for free and firms have to pay annually CFAF 120,000 (or USD 200). The government was interested in learning through this evaluation whether there was value in scaling up or facilitating more access to these services, so the services they provide can be considered as government services that are a potential benefit of formalizing.

to deliver a 1-2 hour personalized training session. They then noted a variety of additional training sessions that business owners could access conditional on receiving the *entreprenant* card. They could sign up for training at CGA which included four workshops (a) basic accounting, (b) initiation to tax obligations, (c) financial education and (d) a fourth workshop where they could choose one of (i) basics of microenterprise management, (ii) initiation to sales development and access to markets, and (iii) basic of business plan development. Each workshop lasted three consecutive half-days. Once the business owner completed the four workshops with the CGA, he/she received an official diploma, and a sticker acknowledging that he/she received the training.

Firms receiving this package were also offered support from CGA to open a business bank account. The bank partners (Orabank and Bank of Africa) designed a specific banking product for the *entreprenant*, with dedicated services and simplified banking access conditions, including a debit card, bank account consultation with mobile phone, cash transfers, SMS-banking, internet banking and mobile money. The *entreprenant* bank accounts in both banks are cheaper than what businesses can usually get (around CFAF 1,000 per month, or USD 1.7, against CFAF 2,000, or USD 3.4) and do not require any initial deposit, whereas business bank accounts usually do in Benin. CGA advisors assisted the *entreprenant* to open a bank account and provided instructions on how to use it.

Package C – Provision of tax preparation support and tax mediation services

The third package aimed to address the uncertainty and concerns that entrepreneurs had about taxes. Firms which formalized under the third group were offered help in preparing tax forms (including tax returns and supporting documentation). However, given that most businesses were subject to the TPU, and that the amount of TPU to be paid by a given business is determined by the tax administration without any form

being filled by the business, this "offer" was not technically implemented. The advisors also left their contact information in case the *entreprenant* had any complaints about future tax payments and inspections, and offered mediation services in case of a dispute between the firm and the tax administration.

Appendix 1 provides more detail on how these three packages were implemented.

1.3.2 Sample selection and study population's characteristics

A listing survey was conducted in Benin's largest city of Cotonou in March and April 2014. This survey was designed to obtain a representative sample of all businesses operating in Cotonou, including Dantokpa market.[11] All businesses with fixed location, except international and nationwide companies and liberal professions, were targeted. Overall, 19,246 businesses were listed, of which a sample of 7,945 were surveyed. We then dropped businesses which were already formal and firms which had very high or very low profits and sales to arrive at a sample of 3,596 for the study, all of which have sales below the turnover eligibility thresholds for the entreprenant.[12] Appendix 2 provides details on the sampling protocols and this selection process. Appendix 3 describes how each key outcome was measured.

Table 1 provides descriptive statistics for businesses selected in the sample, and compares them to the overall set of informal businesses and to formal businesses. Businesses selected for the study have very similar characteristics to the whole population of informal businesses surveyed, and the overall study shows good external validity for the whole city of Cotonou. Formal businesses had on average 3 employees and monthly profits of around CFAF 223,000 (USD 374), while informal businesses had 1 employees and a monthly profit of CFAF 46,000 (USD 77). 52% of businesses were involved in

[11] The largest market in Cotonou and one of the largest in West Africa.

[12] Firms with annual turnover higher CFAF 4.8 million or lower than CFAF 144,000 were excluded. As a result, all firms in the study sample are well below the entreprenant turnover eligibility threshold (30 million for traders, 20 million for craftsmen and 10 million for services).

trade activities, 28% worked in services, and 17% were craftsmen. 63% of businesses sampled for the study were owned by women. This reflects the high share of female owners in Dantokpa market. Approximately 30% of business owners never went to school, and less than 20% of the businesses were keeping some type of accounting.

In comparison to similar studies in other contexts, the businesses in this study are smaller in size, reflecting the less developed nature of the country and small size of most informal businesses. In the study in Malawi (Campos et al, 2015), businesses had on average two employees and monthly profit of USD 214, while in the study in Sri Lanka (de Mel et al. (2013)), businesses had on average three employees and monthly profit of USD 300.

1.3.3 Experimental Design

The 3,596 informal businesses[13] were randomly allocated into three treatment groups and one control group. The first group of informal businesses received package A of incentives, the second group packages A and B of incentives, and the third group packages A, B and C.

The randomization was done in the office using STATA and the following methodology was used for stratification:

1. 16 strata were created using the following variables: business owner gender, business operating in Dantokpa market, trader, and business owns a bank account.

2. Inside each stratum a Z-score was created as the average of standardized profits, turnover and number of employees. Based on this Z-score, triplets of businesses were created and inside each triplet, businesses were randomly allocated to 3 groups, each of 1,200 firms.

[13]The sample was initially composed of 3,600 businesses, but 4 businesses were in fact duplicates of other businesses in the sample and were dropped from the sample.

3. The 1,200 businesses in one group were then randomly allocated further into a first treatment group with 301 businesses, and second treatment group with 899 businesses.

As a result, 301 businesses were allocated to receive package A (treatment group 1), 899 to receive packages A and B (treatment group 2), 1,199 to receive packages A, B, and C (treatment group 3), and 1,197 to the control group. Figure A2 describes the organizational chart of the interventions. Table A2 shows the groups are balanced in terms of baseline characteristics across the different groups.

1.3.4 Data

Two main sources of data are used for this study: administrative data on formalization and program implementation and in-person quantitative surveys with business owners. In addition, we supplement this with qualitative data from study participants and implementing agencies.[14]

Our main measure of formalization is based on monthly administrative data on business registration provided by the GUFE. This database includes the complete list of all newly registered businesses for all legal statuses. Since most businesses in the control group would not have been aware of the new *entreprenant* status, this measure will capture any alternative legal status they registered under. Appendix 4 describes the matching process used to identify whether firms in the GUFE database came from our sample.

Other main outcomes on business performances (profits and turnover) and interme-

[14] 73 semi-structured qualitative interviews were conducted with program participants at different stage of the program (including 36 interviews with formal business owners conducted in June 2017 to understand the long-term impact on tax), a qualitative surveyor was also regularly sent with the CGA advisors to assess if the study design was respected (29 surveys). In addition, 61 qualitative interviews were conducted with business owners not selected for the program to monitor potential externalities of the program. Finally, focus groups were conducted with the main implementing agencies (CGA, GUFE and both commercial banks).

diate outcomes like business knowledge and practices, taxes and banking were measured through in-person interviews with business owners. The baseline survey of the selected sample of businesses was conducted in March-April 2014 prior to program implementation. Two follow-up surveys were conducted in April-June 2015, and in May-June 2016. Attrition rates at first and second follow-up surveys were 11.8 percent and 15.9 respectively and were not correlated with treatment status (Table A3). The post-attrition sample remains largely balanced in terms of baseline observables (Table A4).[15] Two years after the baseline survey, 8.6 percent of the businesses had closed their operations, and business closure was also not correlated with treatment status.

1.4 Program implementation and take-up

Table 2 summarizes key program implementation information, with further details provided in appendix 1. Panel A uses the administrative data from the CGA. Between April 2014 and January 2015, 2,344 of the scheduled 2,399 "first visits" (98%) were completed by CGA. First visits were considered as not completed successfully when CGA advisers were not able to locate the business. All businesses who received a first visit in treatment groups 2 and 3 were offered a second visit by CGA. Only 932 of these second visits were completed with success (44% of total). According to our qualitative surveys and focus groups with the CGA, the main reasons for this relatively low take-up rate were that many businesses were not interested by the second visit, or did not have time to receive it. This finding is consistent with McKenzie and Woodruff (2014) who find an average attendance rate of only 65 percent for business training programs in developing countries. During the two years following the program launch, 302 businesses registered with the CGA (13 percent of the total in treatment group 2 and 15 percent of the total in treatment group 3), and 272 businesses participated in a group training session at CGA (12 percent of the total in treatment group 2 and

[15] The one exception is that group 1 firms were paying lower taxes at baseline. Our Ancova estimation controls for this when examining the impact of formalization on tax revenues.

14 percent of the total in treatment group 3). Businesses had to first register for the *entreprenant* status with GUFE in order to be eligible to register at the CGA, and conditional on this registration, the percentage of eligible businesses that did register with CGA and obtain training is sizeable: 83 percent of the businesses in groups 2 and 3 that formalized (362 businesses in total) decided to register with the CGA, and 75 percent decided to obtain trainings. This suggests that a large majority of businesses that formalized in group 2 and 3 valued the counseling and training services provided by the CGA. After two years, 131 businesses in groups 2 and 3 opened an *entreprenant* bank account at the partner banks (6.2 percent of total).[16]

Panel B of Table 2 shows implementation information taken from our follow-up survey. It confirms that registration was much cheaper and faster under this new status. The median firm in the treatment group took 3 days to formalize, and more than 80 percent declared that they did not pay anything in the process (those who paid something in the treatment groups formalized with a different status than the *entreprenant* status). Qualitative work conducted a few days or weeks after the businesses had received a visit from the CGA suggests that the program understanding was relatively good. However, data from our endline survey suggest that one and a half to two years later, most businesses had forgotten about the program. Only 36 percent of businesses in treatment groups 2 and 3, and 32 percent of those in group 1, remembered the *entreprenant* program. Moreover, only 23 percent in groups 2 and 3, and 22 percent in group 1, were able to describe correctly what it is. In the control group, only 13 percent of the businesses declared that they had heard about the *entreprenant* program, and 5 percent were able to describe it correctly. It suggests that only marginal externalities were generated by the program on those not directly targeted. This is consistent with qualitative interviews conducted with informal businesses not targeted

[16] Bank data did not include sufficient information besides names that could be used for the matching. As a result, matching between study data and bank data was not perfect and only 70 percent of the entreprenant accounts were found in the study data. Therefore, 6.2 percent represents a lower bound of the number of entreprenant bank accounts opened by study participants.

Table 1.2: Program Implementation

	(1) Mean [SD] in Control Group	(2) Difference between […] and Control group: Group 1	(3) Group 2	(4) Group 3	(5) N	(6) P-values joint tests G1=G2=G3=0
PANEL A: Administrative data from CGAs						
Step 1: First visit done successfully	0	0.991***	0.973***	0.976***	3,596	0.000***
	[0]	(0.009)	(0.006)	(0.005)		
Step 2: Second visit done successfully	0	-0.008	0.415***	0.466***	3,596	0.000***
	[0]	(0.027)	(0.017)	(0.015)		
Step 3: Business is formal acording to the CGA$^{\beta}$	0	0.002	0.146***	0.171***	3,596	0.000***
	[0]	(0.02)	(0.013)	(0.011)		
Step 4: Additional services:						
Business registered to CGAs	0	0.009	0.129***	0.154***	3,596	0.000***
	[0]	(0.02)	(0.012)	(0.011)		
Business attended to at least one group training at CGAs	0	0.006	0.113***	0.141***	3,596	0.000***
	[0]	(0.019)	(0.012)	(0.01)		
PANEL B: Endline survey data						
Formalization process: (only formal businesses)						
Number of days it took to formalize$^{\eta}$	22.9	-14.6	-21.6**	-15.6**	329	0.11
	[27.3]	(11.4)	(8.6)	(7.5)		
Amount paid for formalization	66,931	-73,289***	-57,145***	-56,552***	332	0.001***
	[57,036]	(19,449)	(15,343)	(13,302)		
Share of business who paid something to formalize	1	-0.788***	-0.693***	-0.773***	332	0.001***
	[0]	(0.246)	(0.194)	(0.168)		
Program Knowledge:						
Ever heard of the Entreprenant status	0.131	0.187***	0.207***	0.252***	2,582	0.000***
	[0.338]	(0.041)	(0.026)	(0.023)		
Was able to explain what is the Entreprenant status	0.055	0.174***	0.148***	0.198***	2,582	0.000***
	[0.228]	(0.034)	(0.022)	(0.02)		

Notes: Column 1: Standard deviations presented in brackets. Columns 2-4: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on treatment dummies, controlling for strata dummies (dummies for each triplet). **β**: For the control group and group 1, CGA did not have any information as they are not following up with these businesses. **η**: Top-coded at the 99th percentile. ***, **, * indicate statistical significance at 1, 5 and 10%.

by the program.[17]

In practice, tax mediation services were implemented by CGA for all businesses registered with the CGA (even for those in treatment group 2). Some *entreprenants*

[17]None of the 61 business owners not in the study population that were interviewed some weeks and months after the program started had ever heard of the *entreprenant* status or of any program related formalization.

reported to the CGA that the tax administration requested tax payments that were higher than expected, or that the tax exemption offered during the first year after registration to the CGA was not implemented. The CGA advisors helped them to solve these issues as they arose. The CGA reported that 29 (2.4 percent) mediation cases happened during the two years of program implementation and that all these cases were solved in favor of the *entreprenant* (i.e. the tax exemption was respected by the tax administration). Firms in group 3 were the main consumers of these services comprising 23 out of the 29 cases of tax mediation (and the remaining 6 in group 2). The main difference between group 2 and group 3 is that the salience of the tax mediation services was increased for firms in group 3 by providing information on the existence of this service before firms had to decide to become formal or not. In comparison, firms in group 2 were only informed about the general support they could receive from the CGA and learned about the mediation services only if they first become formal and then had an issue with the tax authority and informed the CGA.

1.5 Theory and Empirical Strategy

We begin by sketching a simple organizing framework for how we should think of firms deciding on whether or not to formalize, and how the different interventions may change this decision. This is followed by a description of our empirical strategy.

1.5.1 Theory: How might the entreprenant program impact formalization and business performance?

A firm owner will formalize if the expected discounted value of the net benefits from doing so exceeds the upfront costs. That is, if:

$$\sum_{t=1}^{T} \beta\delta^t EU(\pi_{F,t} - \pi_{I,t}) > C_{Money} + C_{Time} + C_{Information} + \lambda_{liquidity} \tag{1.1}$$

Where $\pi_{F,t}$ denotes the firm's profits if it is formally registered at time t, and $\pi_{I,t}$ denotes the firm's profits if it is not formally registered at time t. C_{Money}, C_{Time}, and $C_{Information}$ denote the monetary, time, and information costs from registering. The shadow value of capital for liquidity-constrained firms is given by $\lambda_{liquidity}$.

In this framework, firms decide whether or not to become formal after weighing these costs and benefits. The basic introduction of the *entreprenant* status then influences this decision by lowering the monetary costs of registering since the registration itself becomes free (which results in both a direct reduction in C_{Money}, as well as in lowering the liquidity costs $\lambda_{liquidity}$) and by lowering the tax obligations associated with formality, especially in the first three years, therefore boosting $\pi_{F,t}$. This should induce formalization by informal firms who were at the margin of formalizing. Our three interventions can then be viewed as changing additional aspects of this decision. Package A further lowers the time and information costs of registering, package B aims to further increase the profitability benefit ($\pi_{F,t} - \pi_{I,t}$) from formalizing by linking it to training and banking services, and package C aims to increase the expected returns from formalizing by reducing uncertainty about tax payments and also lowering the chance of being overcharged taxes relative to informal status.

This framework also offers three predictions which we can test within our experiment. The first is that not all informal firms will formalize following the reform, only those which were close to the margin and for which these changes tip the balance. In particular, while the registration cost is zero, firms which lack personal identification such as a birth certificate or legal title may still face high monetary and time costs of obtaining the documentation necessary for registering, and so not register.

Second, the framework suggests that those who formalize will have been much closer

to the margin of formalizing beforehand than those who do not. We test this through examining heterogeneity of response with respect to several pre-specified characteristics of the owners and businesses which are likely to proxy for closeness to the formalization margin. The first is gender. If women are more likely to be running small businesses as a way of working while also taking care of family responsibilities, they may have fewer plans to grow their business to the size where many of the benefits of being formal attain. This would suggest they are further from the margin of formalizing and will have lower treatment effects. Second, some businesses already have access to other forms of registration that offer partial benefits and for which the added benefits of the entreprenant status will be lower. This includes two groups – those in the Dankopta market who are registered with the public company in charge of all markets ("Société de Gestion des Marchés Autonomes," or SOGEMA), and traders who have access to a "trader card". Third, we use our baseline data on formal and informal firms together with the species classification technique of de Mel et al. (2010) to identify which informal firms look similar to the formal "species", and predict that they will be closer to this formalization margin (Appendix Table TA5 shows this estimation). Fourth, we consider directly size and owner education, believing smaller, less productive firms are likely to be further from the margin where formalization can benefit them, so will respond less. Finally, if avoiding problems with tax inspections is a benefit of formalizing, we predict that firms that are less frequently inspected will see less benefit from formalizing.

1.5.2 Estimation

To analyze the impact of the program on formalization rates, our estimation is at the firm level and involves the following specification for firm i:

$$Y_{i,t=1} = \beta_0 + \beta_1 T1_i + \beta_2 T2_i + \beta_3 T3_i + X'_{(k,i)} + \varepsilon_{i,t=1} \tag{1.2}$$

Where $Y_{i,t=1}$ is the outcome variable (formalization), $T1_i$ is an indicator for being assigned to treatment group 1, $T2_i$ an indicator for being assigned to treatment group 2 and $T3_i$ an indicator for being assigned to treatment group 3. X_k is a vector of strata dummy variables (one dummy variable for each triplet of businesses) (Bruhn and McKenzie, 2009) and $\varepsilon_{i,t=1}$ is the error term. β_1, β_2 and β_3 provide the intent-to-treat effect of being assigned to treatment groups 1, 2 and 3, respectively. This is the effect of being a business assigned to treatment 1, 2 or 3 relative to being a business in the control group.

To estimate the intent-to-treat impacts of the interventions on business performances and practices, we pool data from the two follow-up surveys to run panel regressions with the following specifications:

$$Y_{i,t} = a + b_1(T1_i * F1) + b_2(T2_i * F1) + b_3(T3_i * F1) + c_1(T1_i * F2) + c_2(T1_i * F2) + c_3(T3_i * F2) + \pi Y_(i, t = 0) + \gamma M_{i,t=0} + X'_{k,i} + \varepsilon_{i,t} \quad (1.3)$$

Where $Y_{i,t}$ is the outcome variable measured post-treatment for business i in year t ($t = 1, 2$), $Y_{i,t=0}$ is its baseline value[18] and $M_{i,t=0}$ a dummy variable indicating whether or not this baseline value is missing, $(Tj_i * Fk)$ is the interaction of being assigned to treatment group j ($j = 1, 2, 3$) with a dummy for the follow-up survey k ($k = 1, 2$). X_k is a vector of strata dummy variables and $\varepsilon_{i,t}$ is the error term clustered at the business level. b_1, b_2 and b_3 give the intent-to-treat effect at the first follow-up survey of being assigned to treatment groups 1, 2 and 3 respectively. Similarly, c_1, c_2 and c_3 provide the intent-to-treat effect at the second follow-up survey of being assigned to treatment groups 1, 2 and 3 respectively. We then test whether impacts are constant over time (e.g. $b_1 = c_1$), whether they are constant across treatments ($b_1 = b_2 = b_3$),

[18] In cases where an outcome variable was not collected at baseline, these same specifications are estimated without the control for baseline outcome.

and whether all program impacts are jointly zero ($b_1 = b_2 = b_3 = c_1 = c_2 = c_3 = 0$).

In order to estimate the effect of formalization on business performances and behaviors, we use panel regressions with the following specification:

$$Y_{i,t} = \alpha_0 + \alpha_1 \widehat{FORMAL}_i + \pi Y_{i,t=0} + \gamma M_{i,t=0} + X'_{k,i} + \varepsilon_{i,t} \tag{1.4}$$

Where $\widehat{FORMAL}$ is an indicator for being formal, which is instrumented respectively by $(T1_i * F1)$, $(T2_i * F1)$, $(T3_i * F1)$, $(T1_i * F2)$, $(T2_i * F2)$, $(T3_i * F2)$.

Heterogeneous treatment effects are estimated by interacting treatment status and the lagged dependent variable in (2), (3) and (4) with the variable of interest Z.

1.6 Impact of our interventions on formalization and of formalization on firms

We first examine whether these interventions were successful in inducing firms to formalize, and then measure the impact of formalizing on firm outcomes.

1.6.1 Overall impact on formalization

As discussed in section 3.4, our main measure of formalization is registration of the business with the chamber of commerce at GUFE (i.e. the registration was found in GUFE data). We think that this definition of formalization is preferable over others that use follow-up survey data because administrative data included information on the whole study population, whereas survey data only have information on those who were surveyed. Moreover, survey data are subject to declaration bias. However, the correlation between survey data and administrative data was high (0.7), and we show

similar results using the survey data as well.

Table 3 presents the results on formalization two years after the program started. The impact of the program on the formalization rate was 9.6 percentage points in group 1, 13 percentage points in group 2, and 16.3 percentage points in group 3. All these effects are statistically significant at the one percent level. The effects in treatment groups 2 and 3 are higher than in treatment group 1 (although the difference is only statistically significant for group 3), and the effect in treatment group 3 is significantly higher than in group 2. Both sets of additional incentives included in package B (counseling, trainings and bank services) and in package C (tax mediation) seemed to be valued by informal businesses as incentives to register. The formalization rate in the control group was only 2.3 percent. Therefore, in the absence of the program, only a few businesses would have formalized. The remaining columns of Table 3 show similar results using alternative measures of formalization that use our survey data, or which combine the survey and administrative data.

Figure 1 presents trajectories of impacts in time with formalization rates by group in the months following the first visit received by the CGA.[19] It shows that most businesses that choose to formalize because of the program did it relatively quickly after the first visit. For all treatment groups, most of the impact arises during the first month following the first visit. This is also the case for groups 2 and 3, where 59% of firms those firms formalizing within a year did so in the first month after the first visit, and 37% in the month after the second visit.

[19] For the control group, the date of the first visit was set at the mode of the first visit date in the other groups (i.e. three months).

Table 1.3: Impact on Formalization

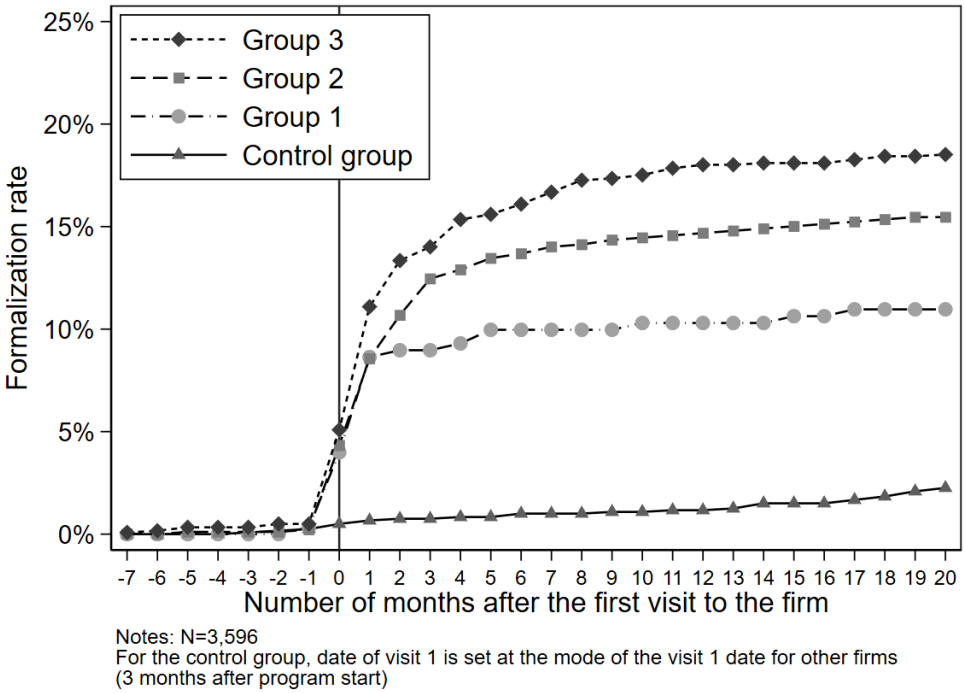
Dependent variables:	(1) Admin. Data (GUFE)	(2) Declared that the business is formal	(3) Showed a document	(4) Declared formality or found in admin. data	(5) Showed a document or found in admin. data
Group 1	0.096***	0.066**	0.069***	0.107***	0.130***
	(0.023)	(0.026)	(0.024)	(0.029)	(0.029)
Group 2	0.130***	0.108***	0.093***	0.143***	0.146***
	(0.014)	(0.017)	(0.015)	(0.018)	(0.018)
Group 3	0.163***	0.128***	0.120***	0.176***	0.181***
	(0.013)	(0.015)	(0.013)	(0.016)	(0.016)
Observations	3,596	3,061	2,929	3,061	2,929
R-squared	0.392	0.436	0.453	0.446	0.464
Adjusted R-squared	0.086	0.072	0.075	0.090	0.094
Mean dependent variable in Control	0.023	0.052	0.026	0.059	0.040
Pvalue Test Group1=Group2	0.175	0.153	0.353	0.257	0.602
Pvalue Test Group1=Group3	0.003	0.017	0.028	0.015	0.075
Pvalue Test Group2=Group3	0.022	0.211	0.066	0.068	0.057
Pvalue Test Group1=Group2=Group3	0.002	0.037	0.026	0.016	0.049
Pvalue Test Group1=Group2=Group3=0	0.000	0.000	0.000	0.000	0.000

Note: Administrative data from GUFE and survey data May 2016. OLS regression of the outcome variable on treatment dummies, controlling for strata dummies (dummies for each triplet). ***, **, * indicate statistical significance at 1, 5 and 10%.

1.6.2 A supplementary information experiment

We find that almost 10 percent of informal firms registered in treatment group 1, even without being offered the additional benefits that groups 2 and 3 were offered. This is a higher rate than obtained in "information only" interventions such as de Mel et al. (2013) and Andrade et al. (2016) in which there was no significant impact of research assistants and survey staff delivering informational leaflets. This raises the question as to whether the impact seen reflects a purely informational effect (as firms learn about the new status and that registration is now free of charge and easy), or also reflects the impact of having highly trained and qualified CGA advisors explain the program in-person, attempt to convince business owners of the benefits of formalizing, and pro-

Figure 1.1: Formalization Rates over Time



vide assistance in completing the process as needed.

To answer this question, we designed an additional experiment that was implemented during the two-year follow-up survey. Fifty percent of the control group (600 firms) was randomly selected[20] to receive two program leaflets just after the completion of the survey (so we are sure that survey answers were not affected by the "leaflets intervention"). The two program leaflets were identical to the leaflets given to group 1 firms when the program started and were introduced by the surveyor with a short script mentioning that the *entreprenant* status is now available for free and in one day to all businesses, and explaining the location of the one-stop shop for business registration. This small intervention tests whether surveyors only providing information on the new status but not in charge of convincing the business of the benefits of formalizing or

[20] With stratification on the following variables: gender, operates in Dantokpa market and trader.

assisting them with forms can have similar impact on formalization rate.

Table A6 presents the results of this "leaflets intervention". It shows that the leaflets intervention had no significant impact on formalization decision. It means that simply delivering information on the new status was not sufficient to increase formalization, and suggests that the impact measured for group 1 is also due to the fact that the information was provided by trained and qualified staff who took time to convince business owners to formalize. In the appendix 1, we provide more details on CGA advisors characteristics and qualifications that could explain this result.

1.6.3 Impact on intermediate outcomes for firms

Table 4 examines whether formalizing is leading firms to be more likely to access banks, improve accounting and other business practices, be less harassed for taxes, or access new customers. It does this through estimation of equations (3) and (4) using our two rounds of follow-up surveys. The top of the table presents the yearly intent-to-treat impacts of the different interventions, while the bottom of the table presents the impact of formalization for those who respond to treatment. Despite the facilitation of access to bank accounts in treatments 2 and 3, and the creation by banks of a special account for *entreprenants*, column 1 shows no significant impact of formalizing on whether the business has a bank account. 25 percent of the control group report having a bank account they use for the business in the two year follow-up. However, only 1.1 percent have an account in the business name. Only 1.9 percent of firms in groups 2 and 3 report having an account in the business name. So most bank account use continues to be accounts opened up in the owner's personal name that are then used for the business.[21]

Treatment group 2 is 5 percentage points more likely to have received a loan in

[21] Note that the special entreprenant bank accounts offered by banks are also issued in the owner's name, rather than in the name of the business.

Table 1.4: Impact on Intermediate Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Has a bank account^{B}	**Loan contracted in 2014-16^{B} (bank or MFI)**	**Attended business training in the past year**	**The firm does any form of account-ing^{B}**	**Share of business practises implemented (26 questions)**	**Index of tax harass-ment$^{\lambda}$**	**Has sold goods to the public administration or to a large company (last 3 months)**	**In the last month a client asked for a receipt^{B}**
1st stage: impact of treatment allocation:								
Group1 X year1 (b1)	0.028	-0.030	0.008	-0.099***	-0.046***	-0.057	0.014	-0.030
	(0.031)	(0.024)	(0.018)	(0.026)	(0.012)	(0.040)	(0.023)	(0.029)
Group2 X year1 (b2)	-0.008	-0.018	0.081***	0.007	-0.004	-0.053**	0.008	-0.027
	(0.018)	(0.014)	(0.014)	(0.017)	(0.008)	(0.024)	(0.014)	(0.018)
Group3 X year1 (b3)	0.017	-0.009	0.112***	0.023	0.004	-0.030	0.026**	0.004
	(0.016)	(0.013)	(0.012)	(0.015)	(0.008)	(0.022)	(0.013)	(0.016)
Group1 X year2 (c1)	0.054*	0.006	0.023	-0.052*	-0.018	-0.067*	-0.002	-0.026
	(0.031)	(0.025)	(0.019)	(0.028)	(0.015)	(0.039)	(0.022)	(0.031)
Group2 X year2 (c2)	0.011	0.051***	0.113***	0.020	-0.005	-0.031	-0.006	-0.017
	(0.019)	(0.016)	(0.015)	(0.018)	(0.009)	(0.025)	(0.013)	(0.019)
Group3 X year2 (c3)	0.003	0.015	0.145***	0.047***	0.007	-0.066***	0.008	-0.014
	(0.016)	(0.014)	(0.013)	(0.016)	(0.008)	(0.021)	(0.013)	(0.016)
Observations	6,211	6,215	5,949	6,166	6,169	5,217	5,361	5,394
Mean Dep. var in control year1	0.249	0.13	0.033	0.198	0.262	0.008	0.093	0.234
Mean Dep. var in control year2	0.257	0.173	0.056	0.234	0.273	0.000	0.083	0.25
Adjusted R-squared	0.147	0.191	0.140	0.155	0.099	0.133	0.089	0.252
Test for impact constant…								
...accross treatments, year1 (b1=b2=b3)	0.378	0.610	0.000	0.000	0.000	0.604	0.515	0.191
...accross treatments, year 2 (c1=c2=c3)	0.285	0.085	0.000	0.003	0.178	0.398	0.606	0.923
Coef. are jointly 0 (b1=b2=b3=c1=c2=c3=0)	0.561	0.000	0.000	0.000	0.003	0.037	0.388	0.538
(IV) impact of Formalization:								
Formalization instrumented by 1st stage	0.053	0.031	0.669***	0.152**	0.009	-0.255***	0.068	-0.059
treatment variables	(0.074)	(0.061)	(0.048)	(0.066)	(0.034)	(0.091)	(0.050)	(0.067)
P-values	0.469	0.613	0.000	0.022	0.782	0.005	0.172	0.377
Sharpened two-stage q-values$^{\mu}$	0.755	1	0.001	0.071	1	0.023	0.402	0.755

Note : Panel data from midline and endline surveys in 2015 and 2016. All regressions are controlling for strata dummies (dummies for each triplet). Standard errors (in parentheses) are clustered at the firm level. α: truncated at the 99th percentile. B: controling for baseline value. μ: Sharpened two-stage q-values as described in Anderson (2008) using P-values in table 6 and 7. λ: summary index of the following questions: "Was asked to pay a bribe by a tax inspector in the last 6 months"; "Received a sexual suggestion or other inappropriate request from a tax inspector in the last 6 months"; "Was threatened with business closure by a tax inspector in the last 6 months"; " Received more than 1 visit by a tax inspector in the last 6 months"; "Received at least one visit by a labour or hygiena inspector "; "Feel that he/she paid more taxes than he/she should have paid according to the law"; "Thinks that tax officials override their duty and ask firms to pay too much taxes". ***, **, * indicate statistical significance at 1, 5 and 10%

the second year, but there are no other significant impacts on loan usage. As a result, the overall instrumented impact of formalizing on loan receipt is positive, but not statistically significant. This does not stem from an abundance of alternative financing

options which limit demand: 77.5 percent of firms in groups 2 and 3 say they would be interested in a loan from a commercial bank like Orabank or BOA, yet only 0.3 percent currently had a loan from such a bank. It therefore does not seem that the banks are using the *entreprenant* accounts as an entry point to lending. The main formal financing that does exist comes from microfinance institutions for which the *entreprenant* status is less likely to matter.

Columns 3 and 4 do show significant impacts of formalizing on the likelihood of attending business training in the past year (67 percentage points), with this impact coming from treatments 2 and 3 who were offered this service. Formalized firms are more likely to be doing any form of accounting (15 percentage points), but this did not translate into improved overall business practices. One possible explanation is that there was some crowding out effects, and better accounting practices were offset by worst marketing and stock control practices.[22]

Formalization also reduced significantly perceived tax harassment. This result is interesting as it is also valid for businesses in group 1 and 2. It means that it was not due mainly to the tax mediation performed by the CGA but instead that all newly formalized businesses faced less tax harassment. A likely reason for this is that the tax authorities substitute in-person visits with sending tax notices to formal firms, and so these formalized firms get visited less in the first year, and then the tax exemption means they also have less tax to pay in the second year (since taxes are paid on the previous year's turnover). In contrast, we see no significant impacts on the likelihood of selling to public institutions or to clients requesting receipts. We examine further the impact on other potential channels such as advertising, business presentation, investment, the number of customers, innovation, trust in institutions, and subjective standards of living, in the appendix table A7. Formalization does not

[22]Measured using the same 26 questions on business practices as in McKenzie and Woodruff (2015).

seem to be changing significantly these other intermediate outcomes. There are a few coefficients that are significant, in particular on the total value of inventories and raw materials, but these do not survive correction for multiple hypothesis testing (Anderson, 2008 and Benjamini et al., 2006). The lack of impact on trust in institutions suggests that formalization has not yet led to a change in the culture of legality.

1.6.4 Impact on firm performance

Taken together, the evidence in the previous section shows only limited impacts of formalizing on intermediate channels that might affect firm growth and profitability. We turn to examining these outcomes directly in table 5. One important caveat to note here is that the limited impact the program had on formalization (even though this is large relative to the literature) lowers our power to find impacts of formalizing.

We do not find any significant impact of formalizing on any of our main measures of business performance: the amount of sales, level of profits, number of employees and a summary index of sales and profits. Standard errors are however quite large. This is particularly the case when we examine levels of profits or sales as an outcome, given the long tails in these variables. For example, a 95 percent confidence interval for the impact on profits is (CFAF -36,000, CFAF +16,000), relative to a control mean of CFAF 54,000, so includes halving profits or up to a thirty percent gain in profits.

We therefore include other transforms of the data which are less sensitive to outliers, considering the inverse hyperbolic sine transformations of sales and profits and binary measures of profits and sales growth (table A8), plotting the cumulative distribution functions of profits and sales in Figure 2, and quantile regressions of the business profit effect in Figure 3. These confirm a lack of impact on profits and sales across the distribution. Likewise, we see no significant impact on a summary standardized index of sales and profits, nor on employment.

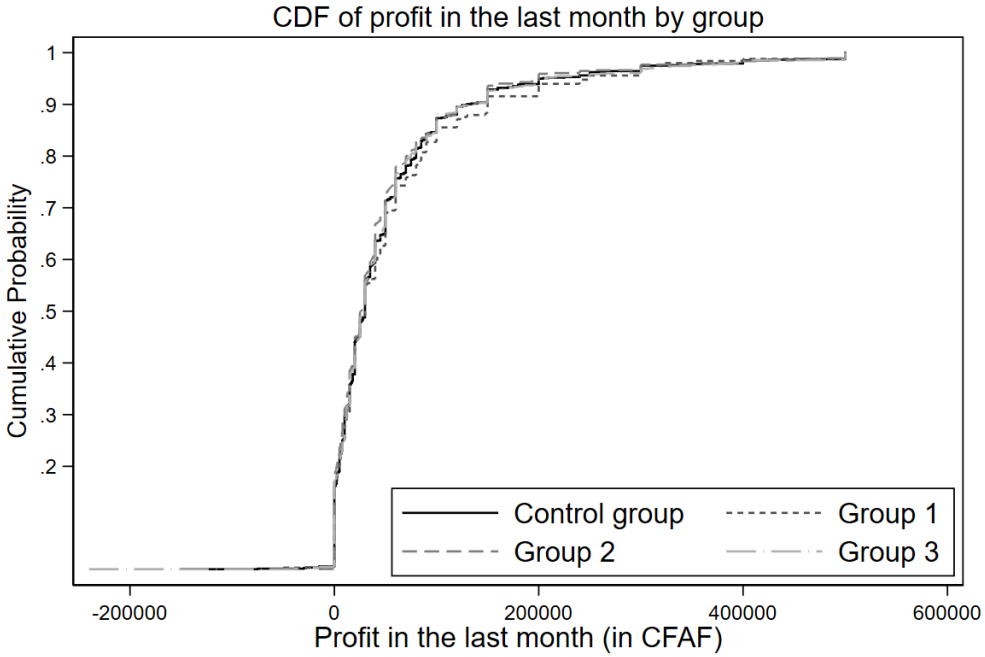
Table 1.5: Impact on Firm Performances

	(1) Total sales in the last day$^{\alpha\beta}$ (CFAF)	(2) Total sales in the last week$^{\alpha\beta}$ (CFAF)	(3) Last month profit$^{\alpha\beta}$ (CFAF)	(4) Summary index of sales and profit$^{\alpha\beta}$	(5) Total number of emplo-yees$^{\alpha}$	(6) Any tax paid for business activity in 2015^{B}	(7) Sum of all taxes paid in 2015^{B} (CFAF)
1st stage: impact of treatment allocation:							
Group1 X year1 (b1)	2,228	12,496	-8,053*	0.008	-0.22**	0.013	-19
	(2,754)	(14,029)	(4,798)	(0.057)	(0.10)	(0.030)	(1,747)
Group2 X year1 (b2)	540	-7,376	-3,016	-0.052*	-0.06	0.048***	-51
	(1,451)	(7,312)	(3,021)	(0.031)	(0.09)	(0.018)	(1,091)
Group3 X year1 (b3)	-114	-1,224	-3,106	-0.010	-0.11	0.005	-2,041**
	(1,384)	(6,399)	(2,858)	(0.030)	(0.08)	(0.016)	(949)
Group1 X year2 (c1)	602	12,192	470	0.041	-0.09	-0.066**	-3,308**
	(2,930)	(14,243)	(5,742)	(0.060)	(0.10)	(0.030)	(1,678)
Group2 X year2 (c2)	1,246	-5,235	-874	-0.007	0.05	-0.055***	-3,413***
	(1,832)	(8,010)	(3,377)	(0.036)	(0.07)	(0.018)	(1,047)
Group3 X year2 (c3)	1,847	3,998	242	0.026	0.08	-0.067***	-5,967***
	(1,669)	(7,911)	(3,233)	(0.035)	(0.07)	(0.017)	(869)
Observations	5,918	6,043	5,874	5,926	6,206	6,163	6,096
Mean Dep. var in control year1	17,373	99,984	53,313	-0.02	1.14	0.507	18,856
Mean Dep. var in control year2	17,882	106,803	54,536	-0.003	1.23	0.413	14,221
Adjusted R-squared	0.227	0.260	0.159	0.254	0.350	0.356	0.257
Test for impact constant…							
...accross treatments, year1 (b1=b2=b3)	0.684	0.401	0.593	0.406	0.457	0.085	0.168
...accross treatments, year 2 (c1=c2=c3)	0.908	0.449	0.957	0.670	0.303	0.826	0.024
Coef. are jointly 0 (b1=b2=b3=c1=c2=c3=0)	0.873	0.796	0.438	0.447	0.111	0.000	0.000
(IV) impact of Formalization:							
Formalization instrumented by 1st stage	4,718	-1,877	-10,235	-0.008	-0.12	-0.127*	-18,789***
treatment variables	(6,511)	(31,925)	(13,388)	(0.143)	(0.30)	(0.075)	(4,463)
P-values	0.469	0.953	0.445	0.957	0.687	0.091	0.000
Sharpened two-stage q-values$^{\mu}$	0.755	1	0.755	1	1	0.251	0.001

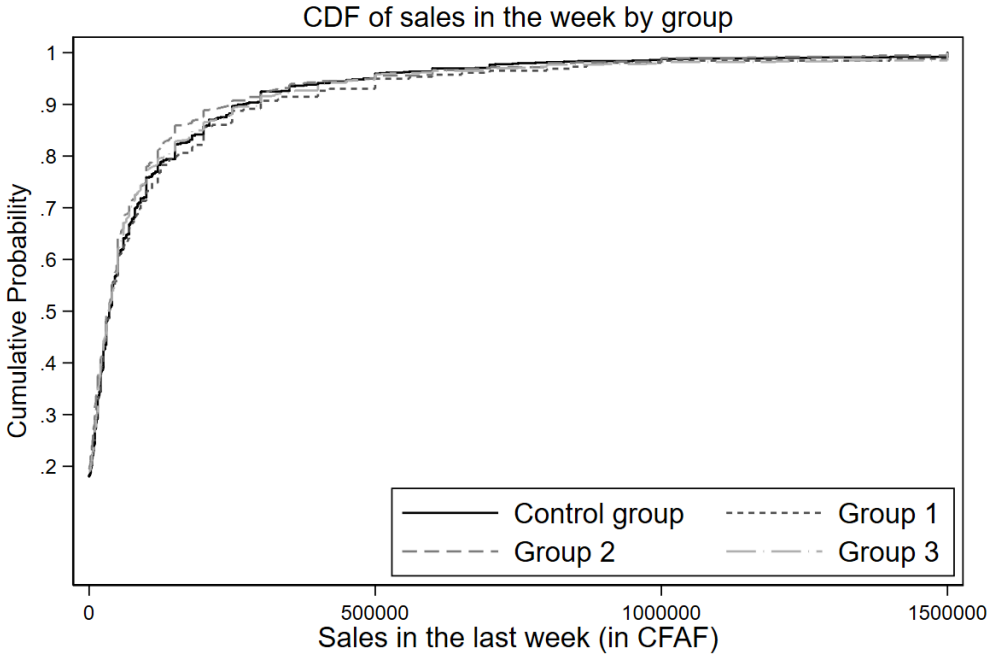
Note : Panel data from midline and endline surveys in 2015 and 2016. All regressions are controlling for strata dummies (dummies for each triplet). Standard errors (in parentheses) are clustered at the firm level. α: truncated at the 99th percentile. B: controling for baseline value. μ: Sharpened two-stage q-values as described in Anderson (2008) using P-values in table 6 and 7. ***, **, * indicate statistical significance at 1, 5 and 10%

However, formalization had a strong and significant negative impact on the likelihood of paying taxes, and on the amount of taxes paid. Newly formalized firms paid almost CFAF 19,000 (USD 32) less in taxes due to formalization. In practice, all newly formalized firms appear to have benefited from the tax exemption, not only those who

Figure 1.2: Cumulative distributions of profits and sales at endline

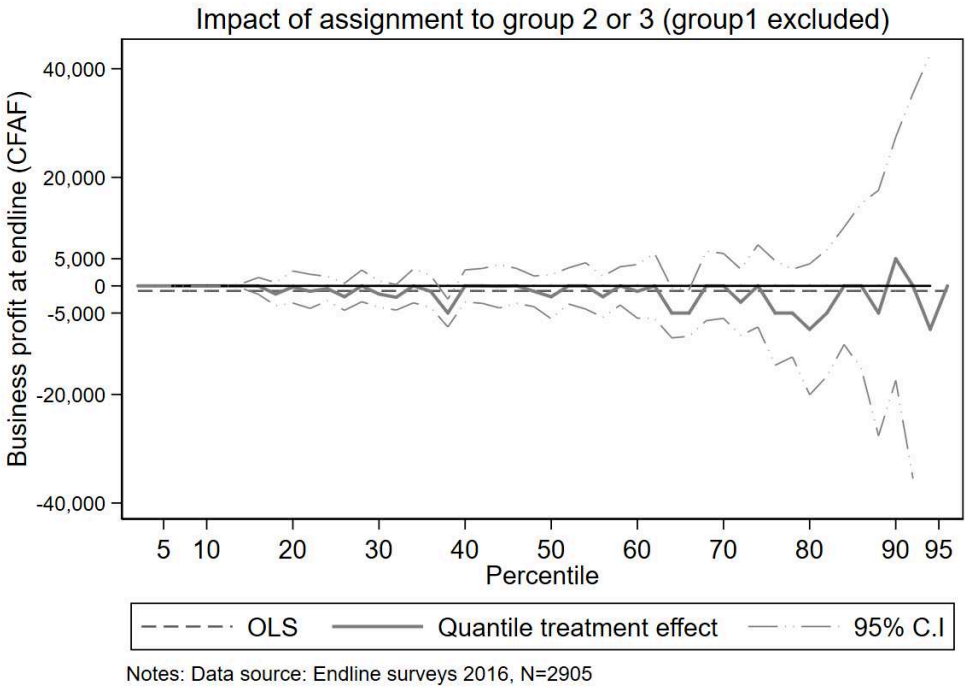


Notes: Data source: Endline surveys 2016, N=2905



Notes: Data source: Endline surveys 2016, N=2989

Figure 1.3: Quantile Regression on Business Profit



were not paying any tax before they became formal as written in the law. One likely explanation for that is that about one year after the program started, the CGA had some discussion with the tax administration to clarify this aspect of the law. Because in practice it was very complicated to know if a firm was paying any tax before or not, the tax administration agreed to apply the tax exemption to all newly formalized firms. For this reason, this result is likely to hold only in the short term, with firms likely paying more taxes in the following years (qualitative work conducted in June 2017 with 36 newly formalized firms suggest that this is the case).

Should we expect this tax exemption to show up as higher profits in the short-term? There are two ways it could have an effect. The first is a direct effect, as one less business expense. The total reduction in taxes paid is equivalent to 2.9 percent of average monthly profits. Second, if we consider the tax reduction as a windfall cash

grant for the business which they re-invest, then even at a monthly return to capital of 5 percent (c.f. de Mel et al, 2008), this would have a FCFA 950 (USD 2) impact on monthly profit, which is equivalent to only 1.7 percent of the control group profits. So the potential impact on profitability through the tax channel is of the order of 4.6 percent, which lies well within our confidence interval for the treatment effect and is too small to detect.

1.6.5 Why don't more firms formalize?

In the third treatment group, which combined all packages of incentives and in which the impact was the greatest, the formalization rate was 18.6 percent (16.3 percentage points more than in the control group). This impact is greater than for similar programs in other contexts (Bruhn and McKenzie, 2014) in which formalization is also linked to taxes. But it means that even though this type of program had a significant impact, the majority of the informal firms still remain informal.

Why do most firms remain informal? A first potential explanation is the presence of other legal barriers to formalizing. Data from our midline survey reveals that only 54 percent of informal business owners have the legal identification needed for formalization (either a passport or a Beninese ID card). In contrast, 85 percent have a birth certificate and 75 percent an electoral card, so amending the process to allow these alternative forms of identification to be used would alleviate this constraint for many firms. However, a lack of identification does not seem to be the binding constraint to formalizing for most informal firms: only 0.6 percent of the control group said this was one of the two main reasons for not formalizing (table A9).

Our endline survey asked informal business owners the two main reasons why they were still informal (table A9). The most common responses in the control group were

that firms did not see any benefits from doing so (32 percent), which concurs with our empirical analysis of the limited effects of formalizing on firms; and that they do not want to have to pay more taxes (26 percent). The other main reason was that they viewed the process as too costly, complicated, or time-consuming (31 percent). These responses are similar among those who remain informal in the treatment groups, despite the visits by CGA advisors to explain the new simpler process of registration and the potential benefits of registering. It is consistent with the idea that many of these informal firms are so far from the formalization margin that they consider this information irrelevant – and indeed, as noted before, two years after program launch, only 20-25 percent of businesses in the treatment groups could even remember what the *entreprenant* program is.

1.7 The Costs and Benefits to Government of Formalizing these firms

The above analysis suggests that the first rationale for governments to attempt to bring firms into the formal sector – that it will benefit the firms – does not appear to be occurring in practice. Such a policy may still be warranted from a public finance viewpoint if it broadens the tax base and increases tax revenue. We therefore examine the costs of implementing these interventions, and the added revenue the government can expect from this.

1.7.1 The cost of inducing firms to formalize

Data on program costs during the two years of program implementation are presented in Table 6. Total program costs were high and the program as it was implemented for the 2,399 firms in a treatment group costed around CFAF 370 million (USD 620,000). Out of this total, CFAF 50 million (USD 84,000) were used to made the *entreprenant*

status available at the one-stop shop for business registration for any firm who wants to come along and do it, and CFAF 320 million (USD 537,000) to pay for the additional interventions to encourage take-up (in-person visits, business trainings, etc.). This corresponds to a total cost per business included in the program that ranged from CFAF 71,000 (USD 119) for group 1 to CFAF 171,000 (USD 288) for group 2, which was slightly more expensive than group 3.[23]

Table 1.6: Cost Effectiveness Analysis

	In CFAF			In USD		
	Group 1	**Group 2**	**Group 3**	**Group 1**	**Group 2**	**Group 3**
Program costs:						
Total Program costs	**21,304,850**	**154,397,653**	**195,493,401**	**35,746**	**259,056**	**328,009**
Costs by intervention:						
One-stop-shop for formalization	6,325,293	18,975,879	25,301,172	10,613	31,839	42,452
Interventions to increase take up	14,979,557	135,421,774	170,192,229	25,133	227,218	285,557
Costs by types:						
Total set up costs	5,728,222	36,001,489	45,733,290	9,611	60,405	76,734
Total variable costs	15,576,628	118,396,164	149,760,111	26,135	198,651	251,275
Cost per formalization						
Number of businesses	301	899	1199	301	899	1199
Program impact:						
Impact on formalization (in pp)	9.6%	13.0%	16.3%	9.6%	13.0%	16.3%
Number of firms which formalized because of the program	29	117	195	29	117	195
Total costs…						
… per business included in treatment	70,780	171,744	163,047	119	288	274
… per formalization	737,294	1,321,106	1,000,289	1,237	2,217	1,678
Variable costs…						
… per business included in treatment	51,750	131,698	124,904	87	221	210
… per formalization	539,058	1,013,059	766,283	904	1,700	1,286
Cost effectiveness						
Expected increase in tax revenue (see appendix 5 for more details)	27,185	27,185	27,185	46	46	46
Number of years before tax revenue are greater than cost per formalization[α]	19	35	29	19	35	29

Notes: 1 USD = 596 CFAF (exchange rate on June 1st, 2016). See Table A10 for more details on program costs.
α : including one year of tax exemption following firm formalization

[23] Costs per firm included in the treatment were slightly higher for group 2 than for group 3 because each CGA advisor was allocated firms from a single treatment group only, which resulted in slightly more firms per advisor in group 3 than group 2 given the different sample sizes.

Using the program impact on formalization rates, we can then calculate the costs per formalization in each group. The costs per additional formalization were CFAF 737,000 (USD 1,237) in group 1, CFAF 1.3 million (USD 2,217) in group 2 and CFAF 1 million (USD 1,678) in group 3. Even when only considering variable costs of the program, that is the costs that a government would face once all the initial investment will be amortized, the costs per formalization were also very high. For the first group, which shows the best ratio, the variable cost per formalization was CFAF 540,000 (USD 904), which represents more than 11 times the average of baseline monthly profits (CFAF 47,000 or USD 79) and 18 times baseline median monthly profits (CFAF 30,000 or USD 50).[24]

We can also benchmark these results with results from a program in Sri Lanka offering cash as an incentive to formalization. De Mel et al. (2012) found that directly paying firms the equivalent of one month of the median firm's profits leaded to registration of one-fifth of firms. This proportion increased to one-half when payments were increased to two months of the median firm's profits. The firms in their study were larger, and so may have been closer to the margin of formalizing to begin with. Nevertheless, this comparison suggests that directly paying firms to formalize may be more cost-effective than the interventions here which instead provided services and support to firms.

1.7.2 The tax benefits to the government of bringing firms into the formal system

Formalization will result in a short-run reduction in tax revenue due to the initial tax exemption, but then should bring in increased tax revenue in future years. Since this

[24]These costs do, however, incorporate the fact that the experimental design involved some non-negligible tracking costs due to the fact that the CGA had to find and visit a sample of businesses selected by the research team and spread all over the city of Cotonou. Additional economies of scales could be attained if the CGA could target businesses located closer to one another.

future revenue will take time to materialize, and we were unable to gain access to tax administration data, in Appendix 5 we calculate the expected increase in annual tax revenue under different scenarios. Our base case assumes that formal firms have 100 percent compliance with taxation, in terms of all formal firms paying taxes, and them declaring 100 percent of the revenue they declare in our surveys. Under this assumption, they will pay CFAF 27,185 (USD 46) more in taxes per year, and it will take 19 years to recoup the costs of group 1, and 29-35 years to cover the costs of groups 2 and 3 (bottom panel of Table 6). Appendix Table A11 then considers three alternative scenarios, in which formality boosts the turnover of firms: a 20 percent level increase in turnover, a 60 percent level increase (the upper bound allowed by our confidence intervals for the formalization effect in Table 5); and a permanent 10 percent per year growth of sales. Even under these optimistic scenarios of full tax compliance and formalization boosting firm growth, it would still take at least a decade for the additional tax revenue generated to cover the costs of inducing these firms to formalize. Moreover, this assumes all firms survive. McKenzie and Paffhausen (2017) show that the half-life of a small firm in developing countries is 6 years, so the majority of firms are likely to die before their added tax revenue covers the costs of formalizing them.

1.7.3 Would better targeting help?

Our analysis shows that attempting to induce the average informal firm to formalize does not improve firm performance nor tax revenues. A potential solution then lies in attempting to better target the interventions at firms closer to the formalization margin.

Table 7 examines heterogeneity in the impact of our interventions on formalization rates according to pre-specified business characteristics. We find that male business owners were significantly more likely to formalize than female business owners: 9, 11 and 15 percent of businesses owned by women formalized in groups 1, 2 and 3 respec-

tively (1.6 percent in the control group), compared to 17 for those owned by men in group 1 and almost 25 percent for those in group 2 and 3 (3.4 percent in the control group). This result could be correlated with the fact that a large majority of businesses operating in Dantokpa market are owned by women.[25] However, column 8 of the table shows that it is also true outside Dantokpa market for women not operating in trade.

In all groups, formalization rates were 5-10 percentage points higher outside Dantokpa market than inside the market. One potential explanation is that formalization could be less attractive in the market as businesses are already registered with the public company in charge of all markets in Cotonou (SOGEMA). They also usually have representatives in the market they can address in case of problems with the administration. Businesses operating in the trade sector had lower formalization rates than in other sectors. One possible explanation which was mentioned during qualitative interviews is that before the program implementation, traders already had access to a "trader card" that provides a formal status with specific benefits (see Appendix Table 1), whereas no such specific card existed for other sectors.

The program was more effective on businesses with an owner who went to at least secondary school, but is not significantly different with firm size per se. While we would expect larger firms to be more likely to be formal in the full population of firms, our sample only contains large firms who have chosen to remain informal. Such firms are likely to face the highest tax costs of becoming formal, and may not see commensurate benefits.[26] Using species classification techniques (de Mel et al, 2010) we classified 18 percent of the businesses in the sample as "looking more like formal businesses before the program".[27] Formalization rates were 4-12 percentage points higher among infor-

[25] The correlation between female and being a trader is 0.40, and between female and operating in Dantokpa is 0.20.

[26] McKenzie and Sakho (2010) provide some evidence for this hypothesis in Bolivia, showing that larger informal firms appear to suffer a drop in profits upon formalizing.

[27] Looking like a formal business owner is based on the predicted probability of being formal from a logit of formality status on baseline characteristics, with 18.2% businesses out of the 3,596 in the study

Table 1.7: Heterogeneous Impact on Formalization by Baseline Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables:	**Formalized: GUFE data**							
Variable for heterogeneous analysis:	Female owner	Operates in Dantokpa market	Trader	Doesn't look like formal species	Index of business size below median	Does not have secondary education	One visit or fewer from tax inspectors	Female owner (sample restricted$^{\alpha}$)
Impact in group [...] for heterogeneous variable=0								
Group1	0.134***	0.105***	0.144***	0.125**	0.085***	0.140***	0.124**	0.168***
	(0.035)	(0.026)	(0.032)	(0.055)	(0.032)	(0.036)	(0.054)	(0.045)
Group2	0.192***	0.151***	0.178***	0.224***	0.139***	0.175***	0.176***	0.232***
	(0.024)	(0.016)	(0.021)	(0.035)	(0.020)	(0.024)	(0.036)	(0.031)
Group3	0.206***	0.179***	0.195***	0.231***	0.151***	0.218***	0.214***	0.216***
	(0.021)	(0.014)	(0.019)	(0.032)	(0.018)	(0.022)	(0.033)	(0.027)
Additional impact in group [...] for heterogeneous variable=1								
Group1 x Heterogenous variable (int1)	-0.063	-0.048	-0.089**	-0.036	0.022	-0.074	-0.035	-0.068
	(0.046)	(0.054)	(0.045)	(0.061)	(0.046)	(0.049)	(0.061)	(0.072)
Group2 x Heterogenous variable (int2)	-0.096***	-0.100***	-0.086***	-0.115***	-0.017	-0.073**	-0.056	-0.125***
	(0.029)	(0.034)	(0.028)	(0.039)	(0.029)	(0.033)	(0.041)	(0.047)
Group3 x Heterogenous variable (int3)	-0.070***	-0.080***	-0.058**	-0.083**	0.022	-0.096***	-0.064*	-0.052
	(0.026)	(0.031)	(0.025)	(0.036)	(0.026)	(0.031)	(0.038)	(0.042)
Observations	3,596	3,596	3,596	3,596	3,596	3,596	3,596	1,619
R-squared	0.395	0.395	0.396	0.394	0.392	0.400	0.393	0.399
Adjusted R-squared	0.090	0.089	0.090	0.088	0.085	0.097	0.086	0.088
Mean heterogenous variable	0.629	0.217	0.550	0.818	0.500	0.591	0.804	0.415
Mean dep. var. in Control heterogenous=0	0.034	0.021	0.022	0.049	0.033	0.039	0.038	0.029
Mean dep. var. in Control heterogenous=1	0.016	0.027	0.023	0.016	0.012	0.011	0.019	0.013
Pvalues of test: Heterogeneous=0								
Group1=Group2=Group3	0.112	0.006	0.239	0.160	0.115	0.040	0.196	0.449
Group1=Group2=Group3=0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pvalues of test: Heterogeneous=1								
Group1+int1=Group2+int2=Group3+int3	0.011	0.224	0.005	0.008	0.008	0.140	0.017	0.178
Group1+int1=Group2+int2=Group3+int3=0	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000

Note: Administrative data from GUFE and survey data March 2014. OLS regression of the outcome variable on treatment dummies and interaction terms (treatment dummies X variable for heterogeneous analysis), controlling for strata dummies (dummies for each triplet). α : sample restricted to non-traders outside Tokpa market.***, **, * indicate statistical significance at 1, 5 and 10%.

mal businesses that were similar to formal businesses before program implementation. Finally, businesses that received more than one visit from a tax inspector in the year prior to program implementation were more likely to formalize. This result, which is only significant for group 3, may suggest that the program was perceived as a way to

sample classified as looking more like formal. See Appendix 3 for more details.

limit tax harassment.

Appendix Table A12 then examines whether these firms that respond more to the interventions also benefit more from formalizing, by estimating the heterogeneous impact of formalization on business profits, an index of profits and sales, and employment. We do not find any significant heterogeneity in the impact of formalizing, although standard errors are large.

If the cheapest intervention (group 1) could be targeted to these sub-populations that respond most strongly, then appendix table A11 shows the cost per formalization would drop to USD 695 if targeted at firm owners which look more like formal businesses before the intervention, or USD 620 for those with secondary education. Coupled with the fact that these firms also earn higher turnovers and therefore would have higher assessed taxes, this reduces the time taken to recoup the cost of formalization in our base scenario to 13 to 14 years, as opposed to 19 years under un-targeted assistance. Under our alternative scenarios in which formalization also increases firm revenues, this drops to between 6 to 12 years. Only with formalization yielding 60 percent growth in turnover and 100 percent tax compliance would we then see the cost of formalizing be recouped in tax revenue within the average lifespan of a small firm.

1.8 Conclusions

Informality is the most common form of business operation in Benin. The new *entreprenant* status was introduced with the goal of offering a faster, cheaper, and easier way for small firms to become formal for tax purposes, and to enable them to access many of the potential benefits of being formal. When this status was introduced, there was a question as to whether the legal change was enough, by itself, to get informal firms to formalize, or whether the government needed to also offer additional efforts

and assistance to bring firms into the formal sector.

Our randomized experiment tested three such approaches to encourage informal firms to take up the new *entreprenant* status. While few informal firms registered for this new status after the legal status was launched, our interventions were successful in getting more informal firms to become formal.

However, such efforts are costly, and we find that firms which formalize do not appear to benefit much from this status in the first two years afterwards. They access more business training and pay lower taxes due to a tax exemption, but are not more likely to have business bank accounts, gain new customers, have higher profits or sales, or hire additional workers. Moreover, our calculations suggest that the additional tax revenue the government will collect from these firms over their lifetime is unlikely to cover the cost of inducing them to formalize. As such, these results cast doubt on the two most common reasons for governments attempting to bring informal firms into the formal sector. Justification for such efforts must then rely on other rationale, such as a desire to generate a culture of respect for the law (Bruhn and McKenzie, 2014).

Our analysis also highlights the potential importance of targeting. The rate of formalization can be doubled by focusing interventions on firms with characteristics which place them closer to the margin of formalizing on their own. In Benin, we find these to be male-operated firms, run by more educated owners, operating outside of the main market and not in retail, as well as firms which we would ex ante classify as looking more similar to formal businesses. However, even with our suggested targeting, we do not find significant impacts of formalizing on firm performance, and the cost per firm formalized will still take many years to be recouped in additional tax revenue. The key to cost-effectiveness therefore requires large reductions in the cost of getting firms to formalize. Rather than offering additional benefits and expensive personal assistance,

it may be more cost effective to set in place the new, easy-to-register system, but then to directly pay firms to formalize, as suggested by de Mel et al. (2012), or to rely on enforcement efforts to get targeted firms to become formal (Andrade et al., 2016).

Chapter 2

Firm Formalization, Individual Property Rights and Intra-household Relationships

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Abstract

I use a randomized experiment to study the causal impact of micro-business formalization on intra-household relationships in Benin. In this context, formalization changes effective property rights by clarifying who in the household is the legal owner of the business (today and in case of divorce). I find first that formalization increases entrepreneurs' (both male and female) control over household revenue. They contribute proportionally less to household expenditures and to the personal expenses of their partner. Second, I find strong gender differential effects of formalization on the probability that entrepreneurs pay to hide a windfall transfer from their spouse. Female entrepreneurs are 50 percentage points more likely to pay to hide, while male entrepreneurs are 27 percentage points less likely to do so. This result is consistent with a bargaining model in which formalization, by enhancing property rights, raises the value of the entrepreneur's outside option in case of divorce. It then translates into increased control over household revenue and increased private returns to investment (to further improve the outside option). For women, who lack control on investment, the effect on investment dominates. They are more willing to hide the transfer because they want to invest more in their business. For men who have more control on investment to start with, the effect on household revenue dominates. They are less willing to hide because their bargaining power is higher, and they will share less with their spouse. These results show that individual formal property rights have complex effects on intra-household dynamics.

Keywords: Individual Property Rights, Intra-Household Bargaining, Micro-entrepreneurs, Informality.

JEL Codes: D13, L26, O17

2.1 Introduction

In developing countries an overwhelming share of the economy is informal (La Porta and Shleifer, 2014). As a country experiences economic development, institutions are built and the share of the informal sector decreases (Acemoglu and Robinson, 2013). This transformation is likely to have deep socio-economic implications, especially on tax revenue, firm performances, economic distortions and total factor productivity (see Levy, 2008, McKenzie and Sakho, 2010, de Mel et al., 2013, Ulyssea, 2018, and Benhassine et al., 2018 among others). In this paper, I study another important aspect: how firm formalization, by clarifying who in the household is the legal owner of the firm, can change intra-household allocation, investment decisions and female empowerment.

I shed light on this question using an experiment on firm formalization implemented in Cotonou, the economic capital of Benin. This experiment provides an ideal setting because informality is widespread in Cotonou (88 percent of firms are unregistered according to national firm census data, INSAE, 2009) and because formalization in this context clearly identifies one sole individual as the legal business owner. 2,000 informal entrepreneurs (with a spouse or partner) were randomly allocated to a control group and a treatment group receiving information and incentives to register with a new legal regime called the *Entreprenant* status[2]. Being assigned to the treatment group increased the formalization rate by 14 percentage points for female entrepreneurs and by 22 percentage points for males, relative to the control group. I use these differences to study the causal impact of firm registration on entrepreneurs' relationships within the household. Importantly, we find in Benhassine et al. (2018) that formalization in this context has no or limited effects on firm performances, taxes paid and access to credit[3]. It means that this experiment on formalization provides a shock on individual

[2]The *Entreprenant* status is a simplified regime adopted in 2014 in Benin and 16 other African countries to make registration easier for small informal firms. Incentives received by the treatment group included in-person visits providing information on the new status and its benefits, registration assistance, access to business training, and bank and tax mediation services.

[3]With the caveat that estimates of the impact of formalization on firm profits and sales are imprecise

property rights in a context where it has limited effect on other firm outcomes. I measure intra-household outcomes using survey data and incentivized questions based on Jakiela and Ozier (2016) measuring the willingness to pay to hide a windfall transfer from the spouse. This question provides a measure of the intra-household constraints faced by entrepreneurs. Specifically, how much they are willing to pay to get more control on the transfer and reduce the constraints.

I find two main results. First, I find that formalization increases entrepreneurs' (both male and female) control on household revenue. They contribute less to household expenditure and to the personal expenses of their partner. Second, I find strong gender differential effects of formalization on the probability that entrepreneurs pay to hide a windfall transfer from their spouse. Female entrepreneurs who became formal because of the treatment are 50 percentage points more likely to hide, while male entrepreneurs are 27 percentage points less likely to do so.

These results are consistent with an extended version of the standard collective model of the household (Chiappori, 1988). In this model, a wife and her husband, who are both entrepreneurs, decide how to invest a windfall transfer in various household activities. Ex-post, investment decisions determine the value of each spouse's outside option in case of divorce, which in turns determines revenue allocation through a bargaining process. An entrepreneur who receives a transfer can hide it (at a cost) if he or she is not satisfied with either the investment decisions or with the revenue allocation made by her household. Hiding allows entrepreneurs to decide unilaterally on investment and revenue allocation. In this framework, formalization increases the share of the business that the entrepreneur would keep in case of divorce. This has two implications: first, it raises the value of the entrepreneur's outside option, his or her bargaining power, and the share of household revenue received. The entrepreneur

and thus that meaningful effects cannot be completely ruled out.

who gets a larger share of total revenue should be less willing to pay to hide. This is consistent with the impact I find on revenue allocation for both male and female entrepreneurs and with the reduction in males' willingness to pay. Second, formalization makes additional investment in the business more attractive for the entrepreneur because it increases the effect it has on his/her future outside option and bargaining power. An entrepreneur who does not have sufficient control on investment decisions within his/her household (as is the case for the women in the model) should be more willing to pay to hide the transfer (to invest it in his/her business). This is consistent with my result for female entrepreneurs who are more willing to pay to hide the transfer when they become formal. Consistently, I also find that formalization significantly increased investment for female entrepreneurs who substituted away from their personal savings and from transfers made outside the household. Reassuringly, it suggests that even if women are constrained in their investment decisions (and willing to pay to get more control on capital), they find ways to increase it following formalization.

This paper is to my knowledge the first to study the causal impact of micro-entrepreneurs' formalization within the household. My results show that individual property rights on firms provided by formalization have important but complex implications on intra-household relationships. While formalization increases control over household revenue for both female and male entrepreneurs, my results suggest that women are also constrained in their investment decisions which can limit the potential benefits of formalization.

This paper makes three additional contributions. First, it contributes to the empirical literature studying how formal institutions affect family systems, women's empowerment and the gender gap (World Bank, 2011, Duflo, 2012, Aldashev et al. 2012, Platteau and Wahhaj, 2014, Guirkinger and Platteau, 2016, O'Sullivan, 2017). This literature focuses on the impact of family law and inheritance or property rights reforms

and finds positive impacts on women's empowerment in different contexts (Stevenson and Wolfers, 2006 and Voena, 2015 in the United States, Hallward-Driemeier and Gajigo, 2015 in Ethiopia, Deininger et al., 2013 and Roy, 2015 in India, Goldstein et al., 2018 in Benin and Harari, 2019 in Kenya). While this paper shows that formalization has some positive impact on female empowerment, it emphasizes that additional rights might not be sufficient if husbands are able to limit investments in their wives' businesses when they become formal. This result resonates with recent findings from Bernhardt et al. (2019) showing that cash grants given to women entrepreneurs are often invested in their husband's activity, offering an explanation for the large gender gap in returns to capital found in several cash drop experiments (de Mel et al., 2008, de Mel et al., 2009, Fafchamps et al., 2014). However, Bernhardt et al. (2019) cannot assess whether it is a voluntary decision or not. This paper pushes this literature a step further by showing that many female entrepreneurs, especially when they have formal rights on their business, are willing to pay to get more control on this type of cash grant. It suggests that these women are constrained in their investment decisions and that when they invest cash grants in their husband's activity, it is not a personal choice. This finding could help in the design of programs targeting women entrepreneurs.

Second, this paper contributes to the family economics literature that studies intra-household bargaining processes. In many economic models, individual property rights are a key parameter for bargaining powers because they determine outside options of household members (Chiappori, 1988, Browning et al., 2014). This paper contributes to the literature that provides empirical tests of these models and highlights the role of individual income and asset ownership on bargaining power and revenue allocation (Lundberg et al., 1997, Fafchamps and Quisumbing, 2002, Duflo, 2003, Doss, 2006, Anderson and Mukesh, 2009, Wang, 2014, Almas et al., 2018). My result that formalization increases entrepreneurs' control over household revenue is consistent with this literature and in particular with Wang (2014) who in a related paper finds that increasing individual property rights on housing assets in China increases individual bar-

gaining power measured by household consumption of male or female preferred goods. However, these models do not explain my second result that women entrepreneurs who became formal have both more bargaining power on revenue and higher willingness to pay to hide income. I'm able to reconcile this finding using an extended version of the collective household model in which men have more agency regarding investment decisions. Formalization makes hiding more attractive for women because it strengthens individual property rights and makes investment more attractive.

Finally, this paper adds to a large body of work that studies intra-household inefficiencies. This work identifies reasons why household decisions can be inefficient (Browning et al., 2014, Baland and Ziparo, 2018). A first reason is described in theoretical work such as Lundberg and Pollak (2003), Chen and Woolley (2001) and Basu (2006) who show that non-cooperative behaviors and endogenous bargaining powers can generate inefficiencies when spouses cannot coordinate (for example because they cannot commit to staying together). Walther (2018) provides some empirical support for these theories by showing, using variation in land rights in Malawi, that individuals allocate more time to agricultural work when household land is their own, even if it lowers overall household consumption. This is consistent with the positive impact of formalization on investment that I find for female entrepreneurs. A second type of inefficiency can arise from social norms such as norms that prevent women from earning higher revenue than their husband (Bertrand et al., 2015), norms that determine gender specific activities (Udry, 1996) and norms that "*force*" people to redistribute more income than they would like (Platteau, 2000, 2014, Grimm et al., 2016). Norms of redistribution are especially important in developing contexts and a recent literature shows that many individuals and entrepreneurs are willing to undertake costly strategies to escape it. This includes pretending to be poor by contracting unnecessary loans (Baland et al., 2011), investing in non-sharable assets (Falco and Bulte, 2011) or hiding income (Ashraf, 2009, Jakiela and Ozier, 2016, Boltz et al., 2019, Beekman et al., 2015, Squires, 2018, Almas et al., 2018). Consistent with this literature, I find that

many entrepreneurs in Benin (a quarter in my sample in the control group) are willing to pay to hide resources from their household, suggesting important inefficiencies. An important contribution of this paper is to show that formal property rights institutions such as firms' legal status have a large impact on income hiding and intra-household inefficiencies. This paper is among the first to study what can (causally) determine income hiding (to my knowledge, Almas et al. (2018) which studies the effect of targeting women with a cash transfer program on their willingness to pay to hide is the only exception[4]).

The rest of this paper proceeds as follows. Section 2 provides background on intra-household relationships, entrepreneurship and firm formalization in Benin. Section 3 outlines a model describing how formalization can affect investment decisions and bargaining power within the household. Section 4 provides details on the experiment design and program implementation while Section 5 describes the data and empirical specification. Section 6 presents the empirical findings and robustness checks. Section 7 concludes and outlines avenues for future research.

2.2 Context

2.2.1 Gender Norms and Intra-Household Relationships in Benin

This study takes place in Cotonou the economic capital of Benin[5]. The existing anthropological and economic literature in Benin suggests that the unitary model of the

[4]Other papers using the willingness to pay to hide income as a measure of intra-household inefficiencies take different approaches. Jakiela and Ozier (2016) and Beekman et al., 2015 analyze the correlates of intra-household inefficiencies, Boltz et al. (2019) study how individuals use their revenue when they are able to hide it, and Squires (2018) looks at the effect of intra-household inefficiencies on firm productivity.

[5]Benin is a low income country in West Africa with a per capita GDP of USD 1,979 in 2011 (UNDP, 2014). Benin ranks 166th out of 187 countries in the Human Development Index (UNDP, 2014) and 155th out of 199 countries on the World Bank Doing Business ranking in 2017. In 2013, Cotonou, had a total population of 680,000 inhabitants (2013 national population census, INSAE). According to Demographic and Health survey data, in 2013, 48.5 percent of the population was Christian, 27.7 percent Muslim, 11.6 percent Vodun and 12.2 percent had another or no religion. 20 percent of Beninese couples were also living in polygamous unions.

household is not likely to be adapted to this context. Falen (2011), who studies family relationships among the Fon, the dominant ethnic group in Cotonou, describes an important competition between spouses: "while men invoke their customary rights as authorities, women skillfully manipulate cultural norms, kin networks, and supernatural resources to win arguments". Lemay-Boucher and Dagnelie (2014) also find evidence of non-cooperative behaviors among couples living in Cotonou. They show that husband and wife's financial spheres are largely disconnected and that spouses are secretive about their personal resources. This evidence applies to a large extend to other African countries. In a closely related context, Friedson-Ridenour and Pierotti (2019) provide qualitative evidence that women entrepreneurs in urban Ghana hide income and savings in order to reinforce their husband responsibility as a primary provider of household needs.

Traditional and informal norms define roles and duties of husbands and wives in Benin. Husbands have more agency with respect to household economic decisions, but they also have to provide for the family and should contribute more to household expenses. Women are expected to bring a secondary source of income and to pay for some specific expenses like water or food. Falen (2011) also describes in details how "people are generally wiling to take, borrow, beg or in any way extract money from one another".

Another important characteristics of Benin (and most Sub-Saharan countries) is that the threat of divorce or separation is important in this context. Clark and Braumer-Otto (2015) use Demographic and Heath Survey data to estimate trends in divorce rates in sub-Saharan Africa (for both formal and traditional marriages). They estimate the probability of divorce for a couple within 15 years of the wedding to be 14.3 percent in Benin in 2012[6].

Formal legal norms in Benin are considered as been more favorable to women than in

[6]This rate is lower than the sub-Saharan average (24.8 percent), but comparable to other countries in West-Africa such as Nigeria (12 percent), Burkina Faso (11 percent), and Ivory Coast (22 percent) (Clark and Braumer-Otto, 2015)

other countries in West-Africa (Hallward-Driemeier, 2013). The Family Code adopted in 2004 significantly improved the legal situation of women by defining equal rights for men and women relative to parental authority and inheritance, by suppressing polygamy and levirat (obligation for a widow to marry her brother-in-law) and by increasing women legal age for marriage to 18 years old. The default marital property regime is the separation of property: all property acquired during and prior to the marriage are individually owned by one spouse. In case of divorce, spouses keep individually all assets if she can prove her ownership. However, these formal norms are difficult to enforce due to the lack of formal property title, in particular on businesses, land or other important assets. Formalization could be useful in case of divorce because it gives to entrepreneurs a way to formally prove their ownership of the business.

2.2.2 Entrepreneurship and Firm Formalization in Benin

In Benin, a large majority of micro, small and medium firms operate in the informal sector which represented up to 70 percent of GDP and 95 percent of employment in 2009 (INSAE, 2009). In Cotonou, 59 percent of women between 15 and 49 years old are working. This is relatively high compared to similar countries but still lower than men labor force participation at 70 percent. Self-employment is a dominant form of employment and 90 percent of the labor force is self-employed in Cotonou (DHS, 2013).

This study is based around the introduction of the *entreprenant* status in Cotonou. This status was adopted in 2011 and made available to entrepreneurs in April 2014 when this study started. Formalization with the *entreprenant* status can be done in one business day at no direct cost and is available to all business with a limited turnover[7]. Businesses can also use other formal status with no limitation on turnover such as *individual enterprise* or *limited liability company*. These status are also available in one business day but at some cost (CFAF 5,000 to 17,000 or USD 8 to 29). Firm registration is done at the *GUFE* ("*Guichet Unique de Formalisation des Entreprises*"),

[7]CFAF 30 million for traders. CFAF 20 million for craftmen, CFAF 10 million for services.

the one-stop-shop office in Cotonou that gathers services of the tax administration and of the chamber of commerce. When a business becomes formal a card with the name of the owner (with the *entreprenant* status it is limited to one person), her picture, her tax unique identifier and the address of the business is issued. This card is a legal document equivalent to a property title and constitutes the ID card of the business. Figure 2.1 shows an example of an *entreprenant* card.

Figure 2.1: The *Entreprenant* Card Identifying a (Unique) Business Owner

As described extensively in Benhassine et al. (2018), the relationship between tax and formalization in Benin is complex but for most firms, formalization implies paying higher taxes once the two-years tax exemption is over. This is mainly due to the fact that it is easier for the tax administration to collect taxes on formal firms because they can use additional information on business location that are not available for informal firms. In practices most formal firms receive tax notifications and go to the tax office by themselves to pay tax while informal firms only pay taxes if they are visited by a tax inspector and are open during this visit. Conditional on paying any tax, tax rate are also higher for formal firms.

Another important implication of formalization in Benin is that firms are expected to do some basic accounting. Firms are informed of that obligation when they register with the administration. A reason for that is that the tax system applicable to small business (including *entreprenant*) is based on firm turnover which requires some basic accounting to be calculated. In practices, this obligation is not enforced and doing some accounting is more an individual decision of the entrepreneur. Indeed, the likelihood of being fined for not doing accounting is very low for small firms and tax inspectors can approximate turnovers when accounting records are not available. But a reason why doing some accounting might be advantageous for formal firms is that it is a way to make sure the amount of tax paid corresponds to the law an not to an approximation.

2.2.3 Formalization has Limited Effects on Business Outcomes in this Context

The main hypothesized advantages of formalization in Benin are related to access to the banking system (formal credit and possibility to open a bank account for the business), access to new markets (large formal firms and government contracts), access to export license and access (usually at some cost) to government programs providing business training and services. However, we show in Benhassine et al. (2018) that in this context, formalization had no or limited impact on access to credit, access to new markets, business practices, firm profits and sales and number of employees. In the appendix table A1, I show that it is also the case in my sample restricted to entrepreneurs who have a partner, and for both female and male entrepreneurs.[8]

These results allow me to interpret formalization as a shock on individual property rights in a context where other business outcomes are not affected.

[8]There is however a negative impact on tax paid (significant only for men). This is due to the two-years tax exemption that newly formalized firms can get.

2.3 Theoretical Framework

In this section, I use a model to describe investment decisions and bargaining within the household. This model extends the standard collective model of the household (Chiappori, 1988) in two directions. First, it allows investment decisions to affect future bargaining power by changing the value of outside options (this is similar to the model described by Walther (2018)). Second, it allows each spouse to hide a windfall transfer from their partner, mimicking the incentivized questions implemented in the survey.[9]

2.3.1 General Setup

Consider a female entrepreneur A and her husband B also entrepreneur. Each spouse maximizes (non-cooperatively) her own utility derived from a unique private good x_A for A and x_B for B. The female entrepreneur uses capital K_A as input to produce an output valued at $f(K_A)$. Her husband produces $g(K_B)$ using K_B. f and g are increasing and concave functions of K_A and K_B respectively.

This model has five steps:

- ***Step 1 - Windfall transfers:*** each entrepreneur receive a windfall transfer. The female entrepreneur receives the amount G_A, and her husband G_B.

- ***Step 2 - Hiding decisions:*** each entrepreneur can choose between informing her partner about her transfer or hiding that information. I define π as a binary variable equal to 1 if the female chooses to hide the transfer and to 0 if she doesn't. Similarly, δ is equal to 1 if the husband hides and to 0 otherwise. Hiding the transfer is costly and implies receiving a smaller amount: $G_A(1-p)$ for the wife and $G_B(1-p)$ for the husband. p, which lies between 0 and 1, is the share of the transfer that they have to forgo in order to hide it from their spouse. Hiding is not observed by the other spouse.

[9] Note that the goal of this section is to provide a conceptual framework compatible with my main empirical results rather than to develop a new theory.

- ***Step 3 - Investment decisions:*** I assume that the husband decides completely how the total household available capital $((1-\delta)G_B + (1-\pi)G_A)$ is allocated between K_A and K_B.[10] This assumption is based on the idea that in this context (as in many contexts), men are more likely to take productive decisions while women have more responsibility within the household.[11] A female entrepreneur who chose to hide can invest secretly a share ϕ of the transfer in her own business. For the husband, investing secretly makes no sense because he can already decide investment levels unilaterally.

- ***Step 4 - Production and income allocation:*** each entrepreneur produces an output using the capital received at step 3. Production levels are perfectly observable. Total household revenue $Y = f(K_A) + g(K_B)$ is then allocated through an efficient bargaining process.[12] The husband receives a share $\sigma(z)$ of total revenue and the wife a share $(1-\sigma(z))$, with $d\sigma/dz > 0$. z, the distribution factor, depends on intra-household bargaining power. It is determined by the outside option of each spouse in case of separation which depends on existing formal and informal rules governing divorce. Let α and λ be the shares of $f(K_A)$ and $g(K_B)$ that the husband would keep in case of divorce. I assume that $z = [\alpha f(K_A) + \lambda g(K_A)]/Y$, so that intra-household bargaining power depends on relative income in case of separation. A similar assumption is made in Browning et al. (1994), Hoddinott and Haddad (1995) and Walther (2018).

- ***Step 5 - Consumption:*** each entrepreneur consumes her respective share of household revenue. If they chose to hide the transfer, they can also consume the

[10] While in the interest of simplicity I take here an "extreme" case in which the husband decides alone investments, I get similar results when I take a less extreme assumption and only assume that he has more agency than his wife regarding investment decisions. This would be the case for example if investment decisions were also determined through a bargaining process depending on initial endowments (assuming that men have on average larger endowments).

[11] This idea is empirically supported by the anthropological literature on Benin described previously which suggests that men have more responsibility in productive decisions (or at least more than women). It is also consistent with Bernhardt et al. (2019) who find evidence that cash grants given to female entrepreneurs are often invested in their husband's activity.

[12] In this case, efficient means that there is no "waste" of resource during the bargaining process. See Browning et al., 2014 for a review of the literature on efficient bargaining and non-cooperative models.

share of the transfer that was not invested (the full transfer for the husband and a share $(1-\phi)$ for the wife).

The female entrepreneur maximizes her utility by choosing first weather to hide the transfer or not (π), and second, by choosing how to use the hidden transfer (ϕ for investment and (1-ϕ) for consumption). Her problem consists of:

$$\max_{\pi=0,1,\phi} U_A(x_A)$$

$$s.t.$$

$$x_A = \big(1-\sigma(z_A)\big)\Big(f\big(K_A+\phi\pi G_A(1-p)\big)+g\big(K_B\big)\Big)+(1-\phi)\pi G_A(1-p) \tag{2.1}$$

$$z_A = \frac{\alpha f\big(K_A+\phi\pi G_A(1-p)\big)+\lambda g\big(K_B\big)}{f\big(K_A+\phi\pi G_A(1-p)\big)+g\big(K_B\big)} \tag{2.2}$$

The husband maximizes his utility by allocating available capital in the two businesses (K_A and K_B) and by choosing weather to hide his transfer or not (δ). His problem is:

$$\max_{K_A,K_B,\delta=0,1} U_B(x_B)$$

$$s.t.$$

$$x_B = \sigma(z_B)\Big(f(K_A)+g(K_B)\Big)+\delta G_B(1-p) \tag{2.3}$$

$$K_A+K_B = (1-\delta)\theta_B G_B+(1-\pi)G_A \tag{2.4}$$

$$z_B = \frac{\alpha f\big(K_A\big)+\lambda g\big(K_B\big)}{f\big(K_A\big)+g\big(K_B\big)} \tag{2.5}$$

Importantly, both spouses take into account the effects of their decisions on investment levels and on their future outside option and bargaining power. As a result, z can be different from z_A and z_B depending on each spouse's hiding strategy. This adjustment is done ex-post when the entrepreneurs observe realized production levels. Since the model is static, there is no effect of hiding on the future relationship. This assumption is made to keep the model simple, but the results are very similar when I

introduce some uncertainty about the windfall transfer (each spouse receives a transfer with a certain probability) and when I allow the husband to form expectations about weather his wife is hiding or not based on observed capital.[13]

2.3.2 Direct Effect of Formalization

As seen in section (2.2.3), formalization in this context has no or limited impact on business economic outcomes such as profits, sales or number of employees. In this model, I therefore consider that the business production functions f and g are not impacted by formalization and I only focus on the impact within the household. I assume that the main effect of firm formalization is to provide formal individual property rights on the business. This should increase the share of the business that the entrepreneur would keep in case of divorce.[14] In the model, formalization impacts the parameters α and λ:

- When the **wife becomes formal, α decreases**
- When the **husband becomes formal, λ increases.**

This model can be solved by backward induction. I first derive the husband's optimal choices and discuss how these choices are impacted by formalization. I then do the same for the wife.

2.3.3 Impact of Formalization on Husband's Optimal Decisions

The husband chooses investment levels K_A^* and K_B^* that satisfy the following first order conditions:

$$f'(K_A) = g'(K_B) + \left(\frac{dz_B}{dK_B} - \frac{dz_B}{dK_A}\right) Y \frac{\sigma'(z_B)}{\sigma(z_B)}$$

[13]The husband expected value of z would be $E(z) = E(z/hiding).Proba(hiding) + E(z/not.hiding).Proba(not.hiding)$ which would be higher than z_B is the simple case. This would imply that ex-post the difference between z_A and z_B would be smaller.

[14]Note that even if divorce laws are not perfectly enforced in practice, formalization could still impact effective property rights on business capital and profits through behavioral mechanisms like labeling or mental accounting (Thaler, 1992, Duflo and Udry, 2004).

$$\Leftrightarrow f'(K_A) = g'(K_B) + (\lambda - \alpha)\Big(g'(K_B)f(K_A) + f'(K_A)g(K_B)\Big)\frac{\sigma'(z_B)}{Y\sigma(z_B)} \tag{2.6}$$

A first key result of this model is that when λ is different from α, there is a wedge that keeps us away from the optimal investment levels in which household revenue is maximized and $f'(K_A^*) = g'(K_B^*)$.[15] When $\lambda > \alpha$ (ie. the husband has more property rights on his business than on the business of his wife), $f'(K_A^*) > g'(K_B^*)$ and the husband over-invests in his own business.

Taking into account the impact of his decisions on future bargaining power, the male entrepreneur chooses δ by comparing his consumption levels if he hides (x_B^H) and if he does not (x_B^N):

- If he chooses to hide: $K_A + K_B = G_A$ and he invests K_A^H and K_B^H that satisfy the first order conditions. $z = z^H$ and $x_B^H = \sigma(z^H)Y^H + G_B(1-p)$.
- If he doesn't hide: $K_A + K_B = G_A + G_B$ and investment are equal to $K_A^N > K_A^H$ and $K_B^N > K_B^H$. $z = z^N > z^H$ and $x_B^N = \sigma(z^N)Y^N$.

Hiding is more attractive if:

$$x_B^H > x_B^N \Leftrightarrow \sigma(z^H)Y^H + G_B(1-p) > \sigma(z^N)Y^N$$

$$\Leftrightarrow p < 1 + \frac{\sigma(z^H)Y^H - \sigma(z^N)Y^N}{G_B} \tag{2.7}$$

The husband chooses to hide when the direct cost of hiding is smaller than the direct benefits in term of consumption adjusted by the potential loss of total household revenue due to lower investment levels when the husband is hiding.

If the male entrepreneur becomes formal, his property rights becomes more effective and λ is higher. I derive formally the relationship between λ and the decision of

[15] $f'(K_A^*) = g'(K_B^*)$ is the outcome of a cooperative model in which the household maximizes total profits (Chiappori, 1988, 1997).

hiding by looking at $d\bar{p}/d\lambda$. With $\bar{p}$ defined as the maximum value of p such that the male entrepreneur prefers to hide (equation (2.7) holds). In other words, $\bar{p}$ is the maximum willingness to pay to hide a windfall transfer to the spouse. It is similar to the incentivized questions I use in my empirical survey. From equation (2.7), I can derive:

$$\frac{d\bar{p}}{d\lambda} = \frac{\sigma'(z^H)g(K_B^H) - \sigma'(z^N)g(K_B^N)}{G_B} \tag{2.8}$$

$d\bar{p}/d\lambda$ is **negative** if $\sigma'(z^N)g(K_B^N) > \sigma'(z^H)g(K_B^H)$. Since $g(K_B^N) > g(K_B^H)$ and $z^N > z^H$, it is the case if $\sigma(z)$ is convex (and so $\sigma'(z^H) > \sigma'(z^N)$) or if it is concave but not sufficiently to overcome the difference between $g(K_B^N)$ and $f(K_B^H)$. Intuitively, formalization increases the value of the husband's outside option and his bargaining power. The share of total revenue that the husband gets if he invests the transfer increases which makes hiding less attractive.

2.3.4 Impact of Formalization on Wife's Optimal Decisions

Optimal Decisions when Hiding is for Investment Purposes Only

In order to better isolate the main mechanisms, I first assume that $\phi = 1$ and that the women can only hide for investment purposes. Later, I will relax this assumption and detail the more general case in which ϕ can be lower than 1.

Taking into account her husband's optimal strategy, the female entrepreneur chooses π by comparing her consumption levels if she hides (x_A^h) and if she does not (x_A^n):

- If she is hiding ($\pi = 1$), she invests secretly her transfer $G_A(1-p)$ in her business. She assumes that her husband will allocate his capital G_B in the two businesses, and that he will choose K_A^* and K_B^* such that the first order conditions seen previously are satisfied. Total household production is given by $Y^h = f(K_A^h) + g(K_B^*)$ with $K_A^h = K_A^* + G_A(1-p)$. The distribution factor z is equal to $z^h = [\alpha f(K_A^h) + \lambda g(K_B^*)]/Y^h$ and $x_A^h = (1 - \sigma(z^h))Y^h$.

– If the female entrepreneur is not hiding ($\pi = 0$), $K_A + K_B = G_B + G_A$ and she assumes that her husband will choose K_A^{**} and K_B^{**} that satisfy his first order conditions. Total production is equal to $Y^n = f(K_A^{**}) + g(K_B^{**})$, the distribution factor z to $z^n = [\alpha f(K_A^{**}) + \lambda g(K_B^{**})]/Y^n$ and $x_A^n = (1 - \sigma(z^n))Y^n$.

The female entrepreneur chooses to hide if $x_A^h > x_A^n$ or if:

$$(1 - \sigma(z^h))Y^h > (1 - \sigma(z^n))Y^n \tag{2.9}$$

Note that when p and G_A are small (and G_B sufficiently large), hiding is always better. Indeed, we know from the first order conditions that the husband "over-invests" capital in his own business ($f'(K_A^*) > g'(K_B^*)$), and therefore that at the margin, total production is higher when the wife hides and invests in her own business ($Y^h > Y^n$).

For women entrepreneurs, the impact of formalization is to decrease α. From the husband's first order conditions (equation 2.6), we see that when α decreases, husband's incentive to over-invest in his own business also increases. Intuitively, it suggests that women should also be more willing to pay to hide (to invest) to compensate for the increased inefficiency.

I derive formally the relationship between α and the decision of hiding (for investment purposes) by looking at $d\bar{p}/d\alpha$. When $p = \bar{p}$, I have:

$$D(\bar{p}, \alpha) = (1 - \sigma(z^h))Y^h - (1 - \sigma(z^n))Y^n = 0$$

Differentiating $D(\bar{p}, \alpha)$, I get :

$$\frac{d\bar{p}}{d\alpha} = \frac{D'(\alpha)}{D'(\bar{p})} = \frac{\left[\sigma'(z^n)f(K_A^*) - \sigma'(z^h)f(K_A^h)\right]Y^h}{(\lambda - \alpha)G(1-p)f'(K_A^h)g(K_B^{**})\sigma'(z^h)} \tag{2.10}$$

$d\bar{p}/d\alpha$ is **negative** if $\sigma'(z^*)f(K_A^*) - \sigma'(z^h)f(K_A^h) < 0$. Since $f(K_A^h) > f(K_A^*)$ and $\sigma'(z) > 0$ and $z^h > z^n$, it is the case under reasonable assumptions regarding the functional form of $\sigma(z)$. Specifically, $d\bar{p}/d\alpha < 0$ if $\sigma(z)$ is convex (and so $\sigma'(z^h) >$

$\sigma'(z^n)$) or if it is concave, but not sufficiently to overcome the difference between $f(K_A^h)$ and $f(K_A^*)$.

General Case

I now allow the female entrepreneur to also hide for consumption purposes. If she chooses to hide ($\pi = 1$), she can invest a share ϕ in her business and consume a share $(1-\phi)$ without having to share with her partner. Using the same notations, the female entrepreneur chooses to hide if $x_A^h > x_A^n$ or if:

$$(1-\sigma(z^h))Y^h + (1-\phi)G_A(1-p) > (1-\sigma(z^n))Y^n \tag{2.11}$$

When $p = \bar{p}$, I have :

$$D(\bar{p}, \alpha) = (1-\sigma(z^h))Y^h + (1-\phi)G_A(1-p) - (1-\sigma(z^n))Y^n = 0$$

Differentiating $D(\bar{p}, \alpha)$, I get :

$$\frac{d\bar{p}}{d\alpha} = \frac{D'(\alpha)}{D'(\bar{p})} = \frac{\left[\sigma'(z^n)f(K_A^*) - \sigma'(z^h)f(K_A^h)\right]Y^h}{(\lambda-\alpha)G(1-p)f'(K_A^h)g(K_B^{**})\sigma'(z^h) - (1-\phi)G_A} \tag{2.12}$$

The sign of $d\bar{p}/d\alpha$ also depends on the sign of the denominator of equation (2.12). There are now two effects going in opposite directions. On the one hand, formalization by reducing α makes investment in the business more attractive and has a positive effect on $\bar{p}$. On the other hand, formalization also increases bargaining power by raising the value of the outside option. This second effect makes hiding less attractive because the wife gets a larger share of total household revenue (which drives $\bar{p}$ toward zero).

2.3.5 Summary of Model Results

I use a bargaining model in which investment decisions determine the outside option of each spouse and their future bargaining power in the allocation of household revenue. In this model, the husband has more control on household investment which leads to

over-investment in his own activity. Indirectly, it also creates incentives for his wife to hide capital and invest secretly in her own business. In this framework, formalization increases property rights and the share of the business that the entrepreneur would keep in case of separation. It has the following predicted effects:

- Formalization raises the value of the entrepreneur's outside option and increases his or her share of household's revenue ($\sigma(z)$ for the husband and $(1 - \sigma(z))$ for the wife).

- Formalization raises individual incentives to invest in the business newly formalized to further increase the value of future outside option.

- For male entrepreneurs who control investment decisions in their household, formalization should reduce the willingness to pay to hide the windfall transfer ($\bar{p}$). They hide less because they have more control on revenue.

- For female entrepreneurs, the overall effect of formalization on the willingness to pay to hide ($\bar{p}$) depends on which effect dominates. If the effect on household revenue share dominates, then formalization should reduce $\bar{p}$. If the effect on investment dominates, formalization should increase $\bar{p}$. Importantly, this would imply that female entrepreneurs are constrained in their investment decisions. If they are able to hide capital in the "real life" (or to find alternative strategies to overcome this constraint), investment in the business should increase.

While the main purpose of this model is to better interpret empirical findings from the incentivized windfall transfer game described below, it is important to note that hiding in the model is conceptually not very far from typical decisions that many entrepreneurs regularly take. Indeed, there is strong empirical evidence, especially in Africa, that entrepreneurs undertake costly behaviors (like hiding in the model) to get more control on their decision and reduce taxation from relatives (Baland et al., 2011, Falco and Bulte, 2011, Ashraf, 2009, Jakiela and Ozier, 2016, Boltz et al., 2019, Beekman et al., 2015, Squires, 2018 Almas et al., 2018).

2.4 Experimental Design and Data

In this section, I start by describing the *entreprenant* study which provides experimental variation in firm formalization. Second, I outline the sample selection process and the characteristics of the study population. Finally, I detail how the key parameters of the model are measured ($\sigma(z)$ and $\bar{p}$) as well as potential intermediary outcomes (investment, separation of business and personal resources).

2.4.1 The *Entreprenant* Study

The *entreprenant* status was introduced in Cotonou in April 2014. While this status was made available to any firm operating in Cotonou, very few firms were aware of its creation at that time. Instead of informing the general public of the creation of this new status, the Government of Benin decided instead to implement a randomized experiment in order to learn how to best incentivized firms to become formal[16]. Different combinations of the following three packages of incentives were tested[17].

Package A of incentives included information on the new *entreprenant* status and help in the registration process. This information and assistance was provided in-person and in the firm premise by trained program officers working for the CGA ("*Centre de Gestion Agréés*"), a semi-public organization specialized in micro-business counseling. Entrepreneurs received detailed information about the benefits of formalization and program leaflets on the *entreprenant* status, the tax regime applicable to *entreprenants* and the registration process.

Package B of incentives included additional business and bank services. Firms who choose to become formal also benefited from free business training and counseling services also provided by the CGA. This included a one-hour in-person personalized training provided in the firm premise (and not conditional on formalization) and addi-

[16]Indeed, at that time, existing evidence from Latin America and Asia suggested that introducing this type of status had only limited impact on formalization and that additional incentives might be necessary (Bruhn and McKenzie, 2014).

[17]Benhassine et al. (2018) describe in more details how the program was designed and implemented.

tional in-class business training designed for *entreprenants*. In-class trainings included four 1.5 days workshops on basic accounting, initiation to tax obligations, financial education and micro-business management. In addition, firms who decided to become formal were also offered support to open a bank account at better conditions than the market in two commercial banks participating in the project (Bank of Africa and Orabank)[18].

Finally, Package C of incentives included tax mediation services. This package was designed to address the potential concerns related to taxes. It included information on the tax system applicable to *entreprenants*, assistance in filing tax forms if needed and mediation services in case of problem with the tax administration.

3,596 informal businesses (I describe in details the sample selection below) were randomly allocated into a control group and three treatment groups receiving different combinations of the three packages[19]. In order to get more statistical power, and because this paper focuses on the impact of formalization on other outcomes (rather than on the impact of the different types of incentives), I'm pooling all treatment groups together for most of the analysis (I look at the impact separately by initial treatment groups as a robustness check). The randomization was conducted in office using STATA and was stratified on key firm characteristics: business owner gender, business operating in Dantokpa market (the largest market of Cotonou), trader, business owns a bank account, and a Z-score averaging standardized profits, turnover and number of employees. In total, 2,399 informal firms were allocated to one of the treatment groups and 1,197 to the control group.

Between April 2014 and January 2015, CGA advisers conducted in-person visits to

[18]The *entreprenant* bank accounts designed by the two banks were cheaper than usual business bank accounts (CFAF 1,000 per month, or USD 1.7, against CFAF 2,000, or USD 3.4) and did not require initial deposit.

[19]The group 1 (300 entrepreneurs) received package A of incentives, the group 2 (800 entrepreneurs) packages A and B, and the group 3 (1200 entrepreneurs) packages A, B and C.

all the firms in the treatment group to inform them about the program, to describe the benefits of the *Entreprenant* status and explain the additional incentives. They were able to reach out successfully with 98 percent of the targeted firms. Firm owners had then to decide whether or not to become formal. Firms who became formal were next eligible to additional benefits (packages B and C). Additional benefits were provided between September 2014 and May 2016. 62 percent of firm owners who registered in the treatment group also participated to at least one group training session with the CGA (14 percent of the total sample). In addition, 30 percent of them (6.2 percent of total) also opened an *Entreprenant* bank account at the partner banks. However, we show in Benhassine et al. (2018) that these bank accounts simply replaced other types of bank account already available to entrepreneurs and that there was on average no impact of the program on bank account ownership.

These results on the take-up rates on different component of the program are important for the interpretation of the results as it means that formalization in this context comes with some additional benefits (mainly in-class group business training on accounting). I discuss in the robustness section to what extend this is important and show that my results are not driven by these additional incentives.

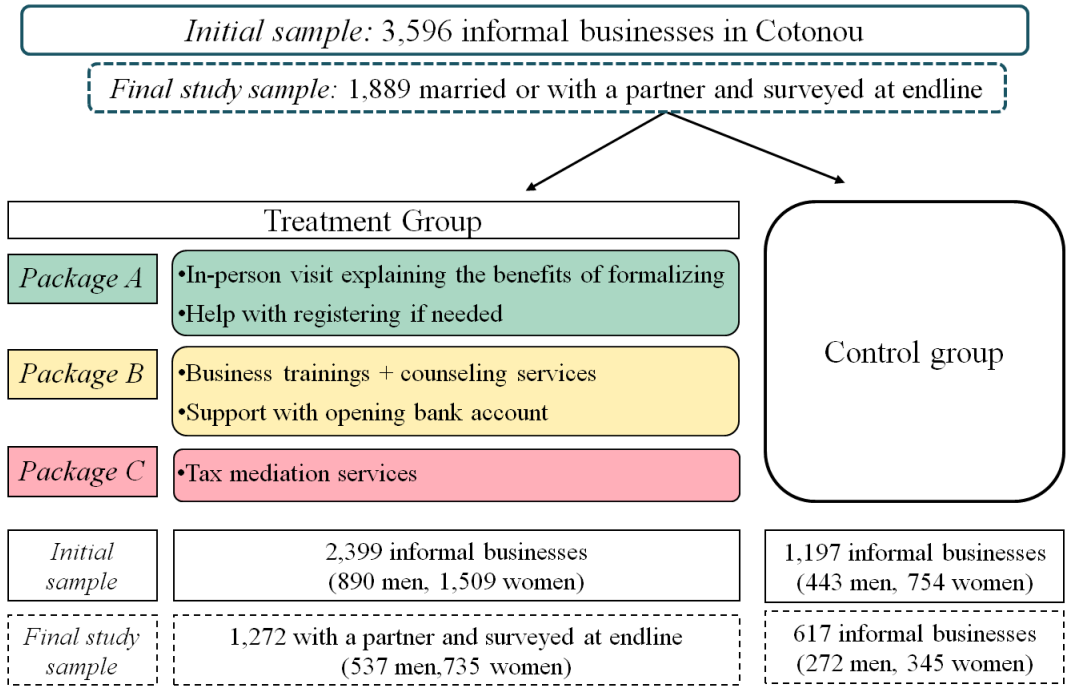
2.4.2 Sample Characteristics and External Validity

The *entreprenant* study population was identified through a listing survey conducted in March and April 2014. This survey is representative of all informal entrepreneurs operating in Cotonou with a fixed location (except liberal professions and international and nationwide companies). During this survey, 19,246 businesses were listed and 7,945 surveyed with a short baseline survey. Then, firms with very high or low level of profits and sales and firms already formal (608 firms or 7.6 percent of total) were dropped in order to get the original *entreprenant* study sample of 3,596 firms. Because this paper focuses on intra-household relationships, I further restrained the original *entreprenant* sample to entrepreneurs who are married or have a partner (73 percent of the initial

sample), and were successfully surveyed and still operating at the endline survey.[20] I end up with a final study sample of 1,889 informal firms, 1,272 in a treatment group and 617 in the control group.

Figure 2.2 summarizes the study design and the sample sizes.

Figure 2.2: Experimental Design



Notes: The initial sample corresponds to the sample used for the randomization in the initial *entreprenant* study. The final study sample corresponds to the sample used in this paper (entrepreneurs married or with a partner who were surveyed at endline)

The first and fourth columns of Table 2.1 show baseline characteristics of female and male business owners for the final sample used for this paper (informal entrepreneurs with a fixed location who have a partner and where surveyed at endline). Business owners are on average 40 years old, have monthly profits close to 50,000 CFAF (USD 84) and some level of formal education (67 percent of women and 80 percent of men). The main difference between female and male entrepreneurs is the sector of activity. Women are much more likely to do trade (68 percent against 24 percent) while men

[20] Since information on the marital status of respondents was only available at endline, I can only restrain the sample ex-post using post-attrition endline survey data

are more likely to operate in craft (37 percent against 8 percent).

Female business owners are also slightly less likely to do some form of accounting (15 percent against 21 percent for men) and to pay any tax (50 percent against 64 percent for men).

To get a sense of the external validity of this sample, Table 2.1 also shows characteristics of all informal (columns 2 and 5) and formal businesses (columns 3 and 6) in Cotonou. Overall, both female and male entrepreneurs in the study population have characteristics that are very similar to those of the whole population of informal firms. It suggests a good external validity of the study sample relative to the whole informal sector. As expected, informal firms are much larger than informal ones in term of number of employees and amount of profits and sales. They are also much more likely to pay taxes and to do accounting.

Since the baseline survey did not include any information on entrepreneur's household characteristics, I use endline survey data to describe household composition and intra-household relationships in the sample. I restrain the sample to the control group to avoid potential issues of endogeneity. These characteristics are presented in Appendix Table A2. On average, entrepreneurs have 3.5 children and live in households with slightly less than 6 members. 12 percent of male entrepreneurs are polygamous while 24 percent of female entrepreneurs have a partner who is polygamous. There are important differences between male and female entrepreneurs. Men entrepreneurs declare contributing to around 90 percent of the household expenditures and to 45 percent of the personal expenditure of their wife. Women entrepreneur declare contributing to a smaller but significant part of household expenditure (between 23 percent for housing expenditure to 46 percent for food), and to a small part of their husband's expenditure (8 percent).

Differences between male and female entrepreneurs are however difficult to interpret because they could reflects different things besides gender norms in Benin. Indeed, because our study sample is only representative of self-employed entrepreneurs, these

Table 2.1: Sample Characteristics and External Validity

	(1) **SELECTED Sample**		(2) **All informal businesses**		(3) **Formal businesses**	
	Mean [SD]	N	Mean [SD]	N	Mean [SD]	N
Firm owner characteristics						
Female owner	0.629	3,596	0.632	7,089	0.419	608
	[0.483]		[0.482]		[0.494]	
Age of the owner	39.5	3,557	39.4	6,955	43.6	589
	[10.4]		[11.2]		[10.5]	
Business owner has some formal education	0.712	3,591	0.708	7,081	0.884	606
	[0.453]		[0.455]		[0.32]	
Business owner has some secondary education	0.409	3,596	0.38	7,090	0.74	608
	[0.492]		[0.486]		[0.439]	
Firm characteristics						
Trade	0.55	3,596	0.518	7,090	0.584	608
	[0.498]		[0.5]		[0.493]	
Services	0.262	3,596	0.277	7,090	0.26	608
	[0.44]		[0.447]		[0.439]	
Craft	0.16	3,596	0.17	7,090	0.09	608
	[0.366]		[0.375]		[0.287]	
Firm area in m²	18.7	3,590	18.3	7,078	52.5	606
	[43.5]		[50.8]		[106.5]	
Business connected to electricity network	0.619	3,594	0.605	7,085	0.898	608
	[0.486]		[0.489]		[0.303]	
Number of employee	1.175	3,596	1.03	7,090	2.961	608
	[1.687]		[1.603]		[4.59]	
The firm does any form of accounting	0.179	3,594	0.156	7,089	0.642	604
	[0.383]		[0.363]		[0.48]	
Amount of sales in an average week	60,561	3,596	82,630	6,639	542,167	528
	[56,508]		[298,695]		[4,434,990]	
Amount of profit in the last month	46,698	3,596	46,434	6,358	223,041	490
	[46,578]		[141,423]		[726,068]	
Firm owner owns a bank account	0.222	3,514	0.194	6,928	0.789	582
	[0.416]		[0.395]		[0.409]	
Firm pays taxes	0.547	3,560	0.466	7,005	0.836	597
	[0.498]		[0.499]		[0.371]	
Amount of taxes paid in the previous year	18,732	3,482	16,649	6,827	316,636	533
	[27,265]		[30,727]		[2,591,065]	
Thinks that it's difficult to know in advance how much taxes she will have to pay	0.744	2,665	0.764	4,921	0.725	520
	[0.437]		[0.424]		[0.447]	
Ratio tax/ annual profit for all businesses	0.051	3,482	0.072	6,174	0.128	445
	[0.089]		[0.174]		[0.221]	
Ratio tax/ annual profit for businesses paying taxes	0.094	1,870	0.165	2,859	0.169	372
	[0.104]		[0.286]		[0.313]	

Notes: sources: listing-baseline survey March 2014

difference could rather reflect a different selection process into entrepreneurship between man and women. In addition, gender differences could also come from differences in declaration bias. If declaration bias follow the overall gender norms (that men should be the main provider of their household), then men would over-declare their contributions while it would be the opposite for women. For these reasons, I look at men and women separately and don't interpret too much gender differences in this paper. In the robustness check section, I discuss to what extend my results can be explained by other differences between male and female entrepreneurs.

2.4.3 Data and Outcomes

I use two main sources of quantitative data: administrative data on firm registration and surveys with business owners.

Administrative Data on Firm Formalization

To measure formalization, I follow Benhassine et al. (2018) and use monthly administrative data on firm registrations provided by the GUFE and matched with survey data.[21] I construct a variable equal to one if the firm became formal during the study period (April 2014 to June 2016) according the the GUFE and using any type of formal status. I include all types of formal status because firms in the control group were less likely to use the *entreprenant* status to register (most of them were not aware of its introduction). A key advantage of this measure of formalization is that it is not subject to declaration bias (firms in the treatment group being more willing to say that they are formal even if it is not true).

Survey Data

Baseline survey data were collected during the listing survey in March-April 2014 before the program started. The baseline questionnaire was relatively small and focuses

[21] GUFE and survey data were matched using names, addresses and phone numbers of entrepreneurs. This matching process is describe in details in the appendix 4 of Benhassine et al. (2018)

on few key firm characteristics. Endline survey data were collected in May-June 2016. Attrition rate (entrepreneurs not found or refusing to do be surveyed) at this survey was 15.5 percent. In addition, 24 percent of women and 12 percent of male were excluded because they don't have a partner[22], 8.5 percent (7.4 for men) because their business shut down and 1.3 percent because the business owner deceased (1 percent for men). Attrition rates as well as rates of inclusion in the final study sample are not correlated with treatment status. Appendix Table A3 provides details on survey completion rates, reasons for attrition and tests for differential attrition. Importantly, baseline firm characteristics of the final post-attrition study sample are well balanced across treatment and control groups. None of the 15 baseline variables presented in Table 2.1 presents any statistically significant difference by treatment status. This is true for both female and male samples. Results from these regressions are presented in the appendix Table A4.

The endline survey data was designed to measure business performances as well as relationships between entrepreneurs and their household. To measure intra-household bargaining power and the relative share of household revenue received by the entrepreneur ($\sigma(z)$), I use the relative contributions made to partner's personal expenses and to household food expenditure. I use incentivized games described in the next subsection to elicit the entrepreneur's willingness to pay to hide income ($\bar{p}$). Investment in the business (K_A) is measured using questions on investment in inventories and raw materials and total values of firm assets. In addition, I also use questions on access (and willingness to access) to credit and other form of capital (direct investment made by another person). Finally, I also measure other intermediaries outcomes such as alternative utilization of available capital (personal savings and transfers made outside the household) and the degree of separation between the business and the household.

To reduce potential issues with multiple hypothesis testing and in order to draw

[22]The difference between female and male business owner comes from a larger share of women who are widows, divorced or separated (see Appendix Table A2).

more general conclusion on the program impact, I construct summary indexes by averaging standardized z-scores (using control means and standard deviations) of multiple questions in a particular dimension.

The appendix A provides the exact definition of all the outcomes used in this paper.

Incentivized Questions to Elicit the Willingness to Pay to Hide a Windfall Transfer

At the end of the endline survey, each respondent received two lottery tickets to thank him or her for participating into the study and responding to the surveys. Each lottery ticket was giving a chance to win a cash prize of CFAF 40,000 (USD 80) with a probability equal to approximately one percent[23].

The first lottery question was designed to elicit respondent's maximum willingness to pay to hide income. Respondents were explained that if they win this lottery, the cash prize will (only) be paid in front of their spouse (or partner). Then, there were asked whether they would prefer to receive the money anonymously instead of receiving it in front of their spouse. Respondents who answered positively were subsequently asked to choose between receiving smaller amounts of money anonymously or the full amount (CFAF 40,000) in front of their spouse. The maximum willingness to pay is elicited by progressively increasing the amount that the respondent could "pay" to hide, from 5 percent to 50 percent of the cash prize[24].

It is important to note that in practice only two options were potentially implemented: receiving the full amount in front of the spouse, or receiving 50% of the amount privately. If we assume that respondents understood and anticipated that feature, it means that the comparison between these two options is the only question that is really incentivized.[25]

[23] 25 prizes distributed among 2,585 respondents for each lottery, so overall around a 2 percent change of winning a prize.

[24] Respondents were ask if they would prefer CFAF 38,000 anonymously or 40,000 in front of their spouse. The amount that could be received privately was then decreased to CFAF 35,000, 30,000, and 20,000.

[25] A strategy to ensure that all options are incentivized would have been to first ask the respondent

The second lottery was designed to elicit the maximum willingness to pay to keep full control over the money. Respondents were explained that if they win this lottery, the cash prize would be shared between their partner and themselves (FCFA 20,000 each). Next, they were asked whether they would prefer to receive all the money themselves (anonymously) instead of receiving it in front of their partner. Like in the first lottery, the maximum willingness to pay is elicited by progressively increasing the amount that the respondent could "pay" to keep the money for themselves from 5 percent to 45 percent of the cash prize[26].

Both lotteries were carefully explained to the respondents, and it was made clear that the answers provided will have an impact on how the money will be disbursed and on the amount received. To make it credible, respondents were told that if the non-private option was chosen, the prize would be only given in the presence of their partner. The name and phone number of the partner were also collected.

The cash prize amount used for these questions is quite large and represents 87 percent of baseline average monthly profits of firm in my sample (the median is CFAF 30,000). This is much larger than typical amounts offered in other studies measuring the willingness to pay to hide income. This amount was equal to USD 2.35 In Jakiela and Ozier (2016), to USD 15 in Boltz et al. (2017), to USD 5 in Squires (2017) and to USD 17 in Almas et al. (2018). However, this amount is comparable to amounts given to firms in cash-drop experiments such as de Mel et al. (2008 and 2009) in Sri Lanka (grants of USD 100 and USD 200) and Fafchamps et al. (2014) in Ghana (grants of USD 120)[27].

to answer to all the questions and second to randomly select the answer that will be implemented. Unfortunately, survey piloting revealed that this strategy was too complex and too time consuming to implement in this context.

[26]Respondents were ask if they would prefer CFAF 38,000 anonymously or 20,000 for them and 20,000 for their spouse. This amount was then decreased to CFAF 35,000, 30,000, and 22,000

[27]In the Sri Lanka experiment, the USD 100 grants represented 87 percent of firms' average monthly

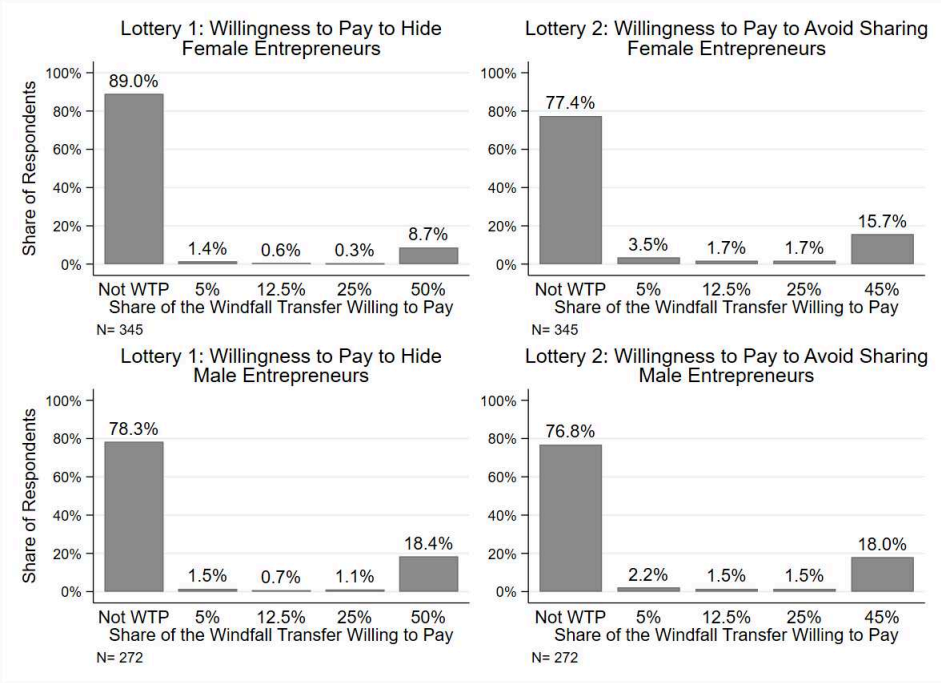
My main measure of willingness to pay to hide a windfall transfer ($\bar{p}$) is a variable equal to 1 if the respondent is willing to pay a positive price to at least one lottery question. This is the case for 24 percent of women entrepreneurs and 28 percent of male entrepreneurs in the control group. I chose to combine the two lottery questions instead of using only the first one (which is maybe closer to the definition of $\bar{p}$ in the model), because I did not pre-specified this decision. Since I only implemented two incentivized questions in my survey, it seems natural to combine them. I also show the results of each lottery question separately, which gives very similar results.

Answers to each lottery question for the control group are presented in the figure 2.3. For the first lottery question, 11 percent of women and 22 percents of male entrepreneurs in the control group are willing to pay to hide the windfall transfer to their partner. Answers to the second lottery question are very similar for male entrepreneurs (23 percent are willing to pay a positive price). Women entrepreneurs are however more willing to pay to the second lottery and catch-up with male entrepreneurs (22 percent of women are willing to pay to the second lottery). Conditional on being willing to pay a positive price, both female and male entrepreneurs are willing to forgo a large share of the windfall transfer in order to receive it privately. This is also consistent with the fact that in practice, only the two extreme answers were truly incentivized (receiving the full transfer in front of the spouse or receiving 50% privately).

Overall, these results for the control group suggest that many entrepreneurs in the sample (about a quarter) are constrained by their household and are willing to pay a high price to get more agency.

profits. In the Ghana experiment, the USD 120 grants represented 117 percent of firms' average monthly profits

Figure 2.3: Answers to Incentivized Lottery Questions (Control Group)



2.5 Empirical Specification

I first estimate the impact of treatment assignment on firm formalization (my "*first-stage*") and the intend-to-treat impacts on other outcomes. I use the following entrepreneur-level empirical specification:

$$Y_i = \alpha_0 + \alpha_1 T_i + X'_k, i + \epsilon_i \tag{2.13}$$

Where Y_i is the outcome variable for entrepreneur i, T_i is an indicator for being assigned to the treatment group, X'_k, i is a vector of strata dummy variables and ϵ_i is the error term. α_1 is the coefficient of interest and provides the effect of being assigned to the treatment group relative to the control group.

Second, I estimate the impact of firm formalization on other outcomes by instru-

menting firm formalization with treatment assignment. I rely on the following specification:

$$Y_i = \beta_0 + \beta_1 \widehat{Formal}_i + X'_k, i + \epsilon_i \tag{2.14}$$

Where $\widehat{Formal}$ is an indicator equal to 1 if the entrepreneur became formal, instrumented by treatment assignment (T_i). β_1, the coefficient of interest, provides the local average treatment effect (LATE) of firm formalization on the outcome Y. It measures the impact of formalization on entrepreneurs who registered because they were assigned to the treatment group.

As discussed previously, I estimate separately equations (2.13) and (2.14) for female and male entrepreneurs.

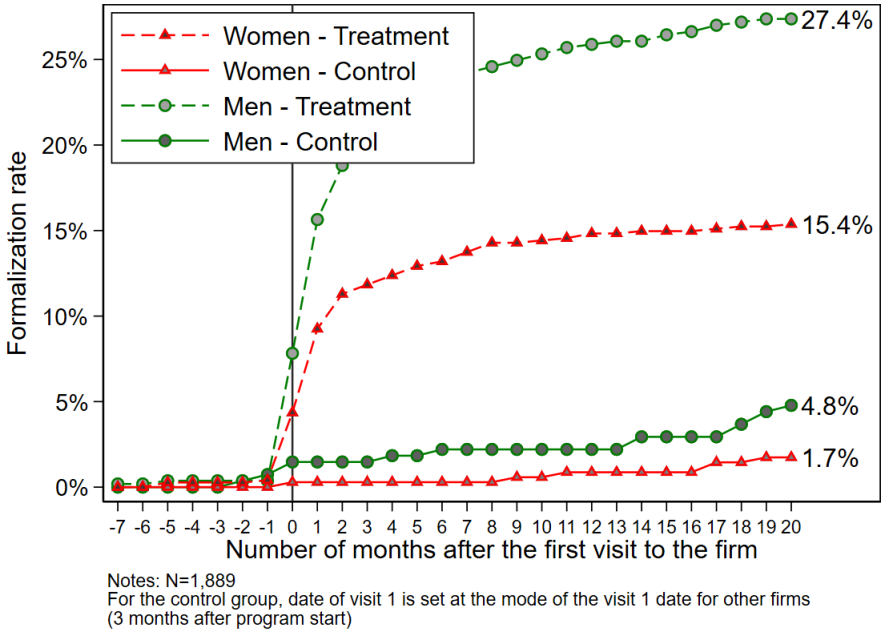
2.6 Results

2.6.1 First Stage: Impact on Firm Formalization

Using administrative data on firm registration, I find that firms in the treatment group were more likely to become formal. The Figure 2.4 shows the evolution of formalization rates in time in treatment and control groups by gender of the owner. 20 months after the program started, 15.4 percent of female entrepreneurs and 27.4 percent of male entrepreneurs were registered in the treatment group. In the control group, only 1.7 percent of female and 4.8 percent of male were registered. It shows that the program had a large impact on both female and male entrepreneurs and that in the absence of any intervention, very few entrepreneurs in this sample become formal. Figure 2.4 also shows that most entrepreneurs who registered did it in the few weeks that followed the first visit they received from a program officer.

Entrepreneurs who became formal because of the program are not very different

Figure 2.4: Answers to Incentivized Lottery Questions (Control Group)



from those who remained informal. They have the same number of employees, similar amounts of profits and sales (sales are slightly lower for female entrepreneurs who formalized), and the same household size. The main differences is that those who became formal are more educated (around 10 percentage points more likely to have some secondary education), were paying higher taxes at baseline and were more likely to do some accounting, to have a bank account and to be connected to electricity network to begin with. In addition, female entrepreneurs who became formal are less likely to be in a polygamous union (15 percent versus 22 percent, P-value=0.108). Appendix Table A5 provides more details on the correlates of formalization in the treatment group.

In the first row of Table 2.2, I estimate the program impact on firm registration using equations (2.13). Being assigned to the treatment group increases the likelihood that a firm becomes formal by 14 percentage points for female business owners and 22 percentage points for male. I use this result as a "*first stage*" and instrument firm

formalization by assignment to treatment group.

2.6.2 Impact of Firm Formalization on Revenue Allocation and Willingness to Pay to Hide a Windfall Transfer

Table 2.2 presents the main results of the paper: the impact of formalization on contributions to partner's and household's expenses ($\sigma(z)$) and on entrepreneur's willingness to pay to get more control over a windfall transfer ($\bar{p}$).

The first key result is that firm formalization reduces contributions to partner's and household's expenses for both men and women entrepreneurs. Female entrepreneurs in the treatment group are contributing 2.1 percentage points less to their husband's expenditure (P-value = 0.089) and 2.9 percentage points less to household's food expenditure (P-value = 0.117). Similarly, male entrepreneurs contribute 5.8 percentage points less to their wives' expenses (P-value = 0.032) and 2.9 percentage points less to household's food expenditure (P-value = 0.06). It suggests that formalization increases bargaining power and gives more control on household revenue.

The second key results from Table 2.2 is that formalization has a large impact on respondents willingness to pay to get more control on a windfall transfer. Importantly, this impact is going in opposite direction for male and female entrepreneurs. Female entrepreneurs in the treatment group are 6.9 percentage points more likely to be willing to pay a positive price to at least one lottery question (P-value = 0.019). The local average treatment effect of formalization is close to 50 percentage points. Hiding the transfer represents an important loss for women entrepreneurs as conditional on positive willingness to pay, they are willing to forgo on average 35 percent of the windfall transfer to get it privately. For male entrepreneurs, being assigned to treatment group reduces the likelihood of being willing to pay a positive price to at least one lottery question by 6.3 percentage points (P-value = 0.047) and the local average treatment effect of formalization is equal to -28 percentage points.

Table 2.2: Impact of Formalization on Primary Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Female Business owners			**Male Business owners**		
Dependent variables:	Mean in Control group [SD]	Diff. with Treatment group (ITT)	Impact of formali-zation (LATE)	Mean in Control group [SD]	Diff. with Treatment group (ITT)	Impact of formali-zation (LATE)
First stage: treatment impact on firm formalization:						
Formalized (Gufe administrative data)	0.017	0.141***		0.048	0.224***	
	[0.131]	(0.02)		[0.214]	(0.028)	
Impact on contributions to partner's and household's expenses:						
Share of partner's personal expenditures paid by the respondent (in %)	7.529	-2.145*	-15.41*	45.515	-5.83**	-26.111**
	[21.811]	(1.26)	(9.252)	[36.989]	(2.721)	(12.448)
Share of household's food expenditures paid by the respondent (in %)	46.299	-2.924	-20.798	83.739	-2.915*	-13.042*
	[28.066]	(1.862)	(13.651)	[19.018]	(1.546)	(7.073)
Impact on willingness to pay to hide a windfall transfer:						
Positive willingness to pay to get more control on a windfall transfer (at least to one lottery)	0.241	0.07**	0.495**	0.279	-0.063**	-0.282*
	[0.428]	(0.03)	(0.221)	[0.45]	(0.032)	(0.146)
Positive willingness to pay to hide a cash transfer to partner (lottery 1)	0.11	0.071***	0.505***	0.217	-0.047	-0.21
	[0.314]	(0.024)	(0.184)	[0.413]	(0.029)	(0.132)
Positive willingness to pay to avoid sharing a cash transfer with partner (lottery 2)	0.226	0.068**	0.483**	0.232	-0.07**	-0.315**
	[0.419]	(0.029)	(0.217)	[0.423]	(0.029)	(0.135)
Observations		1,080			809	

Notes: Administrative data on formalization and Endline survey data (May 2016). Column 1 and 4: Standard deviations presented in brackets. Columns 2 and 5: coefficient and robust standard error (in parentheses) from an OLS regression of the firm owner characteristic on a treatment dummy, controlling for strata dummies. Columns 3 and 6: coefficient and robust standard error (in parentheses) from a 2SLS regression controling for strata dummies with formalization instrumented by treatment dummy. ***, **, * indicate statistical significance at 1, 5 and 10%.

I interpret these empirical findings in the light of the model described in Section 3. For female business owners, the results are consistent with formalization increasing incentives to invest in the business (to increase future outside option), making hiding more attractive. Female entrepreneurs are better off with formalization (they keep a larger share of household revenue) but they are also constrained in their investment decisions (at least for this type of windfall transfer). This constraint on investment

potentially limit the benefits of formalization, especially if hiding or the other strategies used by women to get more control on investments are costly.

For male business owners, the results are consistent with formalization increasing bargaining power on household revenue which reduce the benefits of hiding. Male entrepreneurs hide less because they are happier with the way revenue are allocated within their household.

2.6.3 Mechanisms

I study mechanisms using summary indexes on investment in the business (K_A) and on other (alternative) uses of capital such as savings and transfers to relatives outside the household. The idea here is to investigate weather female entrepreneurs are able to invest more in their business even if their investment decisions are potentially constrained by their husband (as suggested by a positive willingness to pay to hide the windfall transfer). I look at the impact of formalization on private savings and on transfers made outside the household as it could be a way for women to reallocate some capital (on which they may have more control) to their business.

In addition, I also look at a index of separation of business and household resources as it could provide additional evidence of greater control on household revenue. These results are presented in Table 2.3.

For female business owners, I find significant positive impacts of formalization on an index of investment in the business (K_A) and negative impacts on an index of savings and transfers made outside the household. The index of investment increased by 16 percent of the control group standard deviation (P-value = 0.014) while the likelihood of regularly saving money and regularly transferring money to relatives decrease by 12 percent (15 percent of the control group standard deviation for the index, P-value = 0.019). These results are consistent with the idea that formalization makes investments in the business more desirable for women entrepreneurs, who are able to use their own

Table 2.3: Impact of Formalization on Secondary Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Female Business owners			**Male Business owners**		
Dependent variables:	Mean in Control group [SD]	Diff. with Treatment group (ITT)	Impact of formali-zation (LATE)	Mean in Control group [SD]	Diff. with Treatment group (ITT)	Impact of formali-zation (LATE)
Index of investment and willingness to invest in the business:	0 [1]	0.161** (0.065)	1.142** (0.475)	0 [1]	-0.01 (0.068)	-0.045 (0.307)
Variables included in the index:						
Value of inventories and raw materials$^{\alpha}$	796,719 [1,914,578]	238,083* (125,708)	1,697,113* (909,255)	631,442 [1,908,373]	-53,866 (119,997)	-239,956 (536,909)
Amount spent on inventories and raw materials in the previous month$^{\alpha}$	450,107 [883,369]	46,593 (58,026)	328,650 (411,091)	307,310 [703,274]	-17,374 (49,762)	-78,823 (226,441)
Value of all investments in the firm$^{\alpha}$	1,881,067 [2,979,760]	222,500 (202,835)	1,626,670 (1,480,279)	2,102,272 [3,282,341]	-66,156 (243,458)	-281,032 (1,038,649)
Contracted a loan in 2014-16 (any type)	0.449 [0.498]	0.034 (0.032)	0.241 (0.231)	0.283 [0.451]	-0.037 (0.032)	-0.167 (0.146)
Interested in a bank loan	0.735 [0.442]	0.043 (0.028)	0.306 (0.198)	0.801 [0.4]	0.03 (0.028)	0.133 (0.127)
Would want someone to invest in the business in exchange of some	0.264 [0.441]	0.052* (0.029)	0.376* (0.216)	0.471 [0.5]	0.027 (0.037)	0.12 (0.167)
Index of savings and transfers	0 [1]	-0.146** (0.062)	-1.041** (0.468)	0 [1]	-0.064 (0.074)	-0.288 (0.336)
Variables included in the index:						
Often saving money in case of an unanticipated event	0.453 [0.499]	-0.055* (0.032)	-0.388* (0.234)	0.439 [0.497]	-0.019 (0.037)	-0.087 (0.168)
Often sends money outside household	0.4 [0.491]	-0.055* (0.031)	-0.391* (0.229)	0.537 [0.5]	-0.03 (0.037)	-0.133 (0.168)
Often receives money from outside household *[Not in the index]*	0.125 [0.331]	-0.015 (0.021)	-0.106 (0.147)	0.077 [0.267]	0.005 (0.02)	0.025 (0.092)
Index of separation of business and household	0 [1]	-0.065 (0.064)	-0.459 (0.466)	0 [1]	0.171** (0.076)	0.763** (0.333)
Variables included in the index:						
Owner separates business and personal resources	0.302 [0.46]	-0.03 (0.029)	-0.215 (0.208)	0.203 [0.403]	0.058* (0.032)	0.261* (0.142)
The firm does any form of accounting	0.246 [0.432]	-0.014 (0.027)	-0.097 (0.196)	0.279 [0.45]	0.056* (0.034)	0.252* (0.147)
Observations		1,080			809	

Notes: Administrative data on formalization and Endline survey data (May 2016). Column 1 and 4: Standard deviations presented in brackets. Columns 2 and 5: coefficient and robust standard error (in parentheses) from an OLS regression of the firm owner/firm characteristic on a treatment dummy, controlling for strata dummies. Columns 3 and 6: coefficient and robust standard error (in parentheses) from a 2SLS regression controling for strata dummies with formalization instrumented by treatment dummy. α: top-coded at the 99th percentile. ***, **, * indicate statistical significance at 1, 5 and 10%.

resources (private savings, and money used for transfers) to invest more. It also suggests that women entrepreneurs are able to hide some investments to their husband in the "real life". Indeed, it is perfectly possible that in this context, husbands don't have perfect information on their wives' savings. The fact that I find positive effects on investment in the business but not on business profits or sales (see appendix table A1) suggests that this behavior is costly (although, our estimates of the impact of formalization on profits and sales are imprecise).

For male entrepreneurs, I also find that formalization increases the separation between the firm and the household. Male entrepreneurs are 6 percentage points more likely to do some form of accounting and to separate business from personal resources. It could be an additional mechanism explaining why they have more control on household revenue when they become formal.

2.6.4 Robustness Checks and Alternative Interpretations

Are the Results driven by Other Differences Between Male and Female Business Owners?

As discussed previously, the gender of the business owner is correlated with important characteristics like education, sector of activity and number of employees (see Table 2.1). It could be an issue for the interpretation of my result if the impacts of formalization are heterogeneous across these characteristics. For example, suppose that formalization has a greater impact on entrepreneurs operating in the trade sector and results in those entrepreneurs being more likely to hide the cash transfer in the lottery questions. The fact that female entrepreneurs are more likely to operate in the trade sector could then drive the heterogeneous results I find by gender. To check whether it is the case, I allow the effect of formalization to vary with other characteristics of entrepreneurs. I do that by estimating the following equation for a set of H entrepreneur's

characteristics E_h:[28]

$$Y_i = \gamma_0 + \gamma_1 \widehat{Formal * Female} + \gamma_2 \widehat{Formal * Male} + \sum_{h=1}^{H} \eta_h \widehat{Formal * Female} * E_{h,i} + \sum_{h=1}^{H} \mu_h \widehat{Formal * Male} * E_{h,i} + \sum_{h=1}^{H} \varphi_h E_{h,i} + \rho Female + X'_k, + \epsilon_i \tag{2.15}$$

$\widehat{Formal * Female}$ is instrumented by treatment assignment interacted with $Female$ (and similarly for the other interaction terms). For the variables E_h, I use variables measured at baseline that are highly correlated with gender and across which the effects of formalization could plausibly be heterogeneous. I use the following variables: "*at least secondary education*", "*Operates in trade*", "*Connected to electricity*", "*Does any form of accounting*", "*At least one employee*", and "*Firm area greater than 10m2*". All variables E_h are demeaned so γ_1 and γ_2 can be interpreted as the impact of formalization on female and male entrepreneurs respectively, measured at the mean of the other variables.

Results of these estimations are presented in the Table 2.4 and show that γ_1 and γ_2 coefficients have similar magnitude and statistical significance as in Table 2.2. My main results are therefore robust to the introduction of these additional controls.

Are the Results Driven by the Incentives Provided to Firms for Formalization?

Another potential concern in the interpretation of my results is the extend to which the effects can be attributed to formalization itself rather than to the additional incentives provided to firms. Indeed, 62% of firm that registered in the treatment group also participated in at least one group training (mainly to study basic accounting). If the main driver of the impact was the participation in this training, then the "exclusion restriction" would be violated and the interpretation of the results would change.

[28] This strategy is similar to the one presented in De Mel et al. (2009).

Table 2.4: Heterogeneous Impact by Gender Including Additional Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: Willing to pay to get more control over a windfall transfer (at least to one lottery)						
Formalization impact (IV) for **female** entrepreneurs	0.495**	0.522**	0.539***	0.544**	0.496**	0.460**	0.591**
	(0.210)	(0.218)	(0.209)	(0.228)	(0.216)	(0.214)	(0.235)
Formalization impact (IV) for **male** entrepreneurs	-0.282*	-0.285*	-0.200	-0.311*	-0.269*	-0.329**	-0.230
	(0.147)	(0.165)	(0.178)	(0.173)	(0.152)	(0.154)	(0.210)
P-val difference (female / male):	0.002	0.003	0.007	0.002	0.004	0.003	0.008
Controling for heterogeneity of formalization impact with variable:	At least secondary education	Operates in Trade	Connected to electricity network	Does any form of accounting	At least one employee	Firm area > 10m2	All variables together
Observations	1,889	1,889	1,889	1,888	1,888	1,889	1,889

Note: 2SLS regressions measuring the heterogeneous impact of formalization adoption (instrumented by assignment to treatment) by gender of the business owner. Robust standard errors in parentheses. All regressions include control dummies for strata. ***, **, * indicate significance at 1, 5 and 10%.

In order to test the "exclusion restriction", I use the fact that I know which individual entrepreneur in the treatment group received additional incentives. I use that information to check that my results hold when I drop entrepreneurs who benefited from the additional incentives (participated to at least one business training) from my sample. In Table A6, I reproduce my main results from Tables 2.2 and 2.3, and compare it to the same analysis on those who did not participated in the CGA business trainings. Of course, an important issue here is that entrepreneurs who received additional benefits are self-selected and excluding them could re-introduce some bias. **This evidence can therefore only be considered as suggestive at best**. Table A6 shows that the main results hold when entrepreneurs who participated to at least one business training are dropped.

Another way to test the exclusion restriction is to use the fact that there are some (random) variations within the treatment group in the type of incentives received.

Indeed, the treatment group is divided into three subgroups: group 1 received only the package A of incentives (information and assistance to registration only), group 2 received packages A and B (information, registration assistance, business trainings and bank services) and group 3 received packages A, B and C (Tax mediation services). Appendix Table A7 shows the results of regressions on the main outcomes with a separate dummy for each treatment group. Unfortunately, the group that only received Package A of incentives is too small (76 women and 81 men in total) to be compared to the other groups (only few firms registered in that group in total). While overall, the results look similar for all the group (and we cannot reject that all groups have similar results), standard errors are large for the group 1 and it is difficult to conclude anything for that group. Reassuringly, group 2 and group 3 have similar results.

2.7 Conclusion

This paper presents novel experimental evidence on the impact of firm formalization on intra-household dynamics in Benin. In this context, firm formalization provides individual formal property rights on the business and clarifies who in the household is the legal owner (today and in case of divorce). I find that formalization increases control over household resources (measured by contribution to household's and partner's expenses) for both male and female entrepreneurs. However, I also find that formalization has large gender differential effects on entrepreneurs' willingness to pay to hide a windfall transfer to their spouse ; female entrepreneurs being much more likely to pay while it is the opposite for male entrepreneurs. These results are consistent with a bargaining model in which men have more control on household investment decisions but women can implement costly strategies to get more agency. Formalization raises the value of the entrepreneur's outside option which increases control over household revenue and incentives to invest in the business. For women entrepreneurs who lack control on investment, the effect on investment dominates. They hide more because they want to invest more in their business. For male entrepreneurs who have more

control on investment to begin with, the effect on household revenue dominates. They hide less because they will have to share less with their spouse.

Overall, my results show that formalization has some benefits for both female and male entrepreneurs who get a larger share of household revenue. However, they also suggest that women who become formal face additional constraints on investment. They are willing to pay a high price to get more control on their investment decision, suggesting that this lack of agency is costly.

This study prompts several avenues for future research. First, measuring the overall effect of formalization on other household members and not only on the entrepreneur as I do would be interesting. Indeed, my results suggest that formalization can change bargaining powers within the household which could impact intra-household inequality. If male entrepreneurs benefit more than female entrepreneurs, public policies promoting formalization might exacerbate gender inequalities (this is especially true as male business owners are also more likely to take up on formalization). Second, understanding whether my results hold beyond the two years of this study looks like an important question. Formalization might indeed have long term consequences on intra-household bargaining power and gender norms. It might also take some time for women entrepreneurs to adapt to their new status and to overcome potential constraints on investment. Finally, more work is needed to better understand how and under which circumstances, women entrepreneurs are constrained by their household. This is key for the design of effective policies that could help women entrepreneurs to overcome these constraints.

Chapter 3

Technology, Taxation, and Corruption: Evidence from the Introduction of Electronic Tax Filing

This chapter is based on a joint work with Oyebola Okunogbe (World Bank Development Research Group)[1]

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Abstract

Many e-government initiatives introduce technology to improve efficiency and avoid potential human bias. Electronic tax filing (e-filing) is an important example, as developing countries increasingly adopt online submission of tax declarations to replace in-person submission to tax officials. This paper examines the impact of e-filing on compliance costs, tax payments, and bribe payments using experimental variation and data from Tajikistan firms. Firms that e-file have lower compliance costs, spending five fewer hours each month on fulfilling tax obligations. There are no significant average effects of e-filing on tax or bribe payments, but significant heterogeneity exists across firms by their baseline likelihood of tax evasion. Among firms previously more likely to evade, e-filing doubles tax payments, likely by disrupting collusion with officials. Conversely, among firms less likely to have been evading, e-filing reduces tax payments, suggesting that officials had previously required them to pay more. These firms also pay fewer bribes, as e-filing reduces opportunity for extortion. In all, the results indicate that e-filing reduces compliance costs and makes the distribution of tax payments across firms arguably more equitable.

Keywords: Technology, taxation, corruption, e-government, electronic tax filing (e-filing)

JEL codes: D73, H26, O33.

3.1 Introduction

Technology is transforming the ways governments deliver services to and interact with citizens across various sectors, from public financial management to social programs to elections and many others (World Development Report 2016). These e-government initiatives typically seek to improve service delivery and efficiency. Often, they also aim to combat corruption by automating systems and reducing officials' discretion.

Tax administration is an important application of e-government in developing countries. Tax systems in these countries are often characterized by frequent interactions between tax officials and taxpayers because, given limited data sources to monitor compliance, tax officials are often responsible for direct, in-person monitoring of taxpayers. This makes the system more vulnerable to corruption, both in terms of collusion between tax collectors and taxpayers to evade taxes, as well as extortion of taxpayers by tax officials. These manual systems also typically result in high compliance costs which may further discourage compliance. These features of the tax system may contribute to the observed low fiscal capacity in many developing countries (Gordon and Li, 2009, Besley and Persson, 2014) that limits their ability to provide services and growth-promoting public goods.

A number of governments have responded by adopting electronic filing (henceforth e-filing) of taxes. E-filing refers broadly to online submission of tax declarations, typically replacing in-person submission to tax officials.[2] As of 2015, 32 percent of developing countries had introduced e-filing and its prevalence continues to grow rapidly (World Development Report 2016).[3] The most common feature of tax reforms reported in the 2015 World Bank Doing Business Indicators was the introduction or enhancement of electronic systems for filing and paying taxes, with 26 economies implementing such changes (World Bank, 2016). Given the rising prevalence of e-filing, it is increasingly

[2]Mail submission is also possible but less common in low income countries with unreliable postal systems.

[3]E-filing use increases with national income. It is present in 85 percent of high-income countries and in 65 percent of middle-income countries (World Development Report 2016).

important to understand its impact.

In this paper, we examine the impact of e-filing adoption using data from small and medium sized businesses in Dushanbe, the capital city of Tajikistan. Since e-filing was available to all firms, we implement an encouragement design whereby we provide a randomly selected group of firms in-depth training on e-filing as well as logistical help in completing the different steps involved in the e-filing registration process. Ninety-three percent of firms in this group adopt e-filing, compared with 60 percent in the comparison group. We use this difference to estimate the impact of e-filing adoption on firms.[4]

E-filing may improve tax administration in multiple ways. First, online submission may reduce tax compliance costs by removing the need for time-consuming, anxiety-inducing visits to the tax office, freeing up resources for productive activities. Second, by reducing the frequency of in-person interactions between taxpayers and tax officials, e-filing may reduce collusion between the two parties to reduce tax payments. Third, by removing the need for a tax official to verify submission of tax declarations, e-filing may also protect taxpayers from tax officials holding them up and extorting them. In addition, e-filing may produce system-wide efficiency gains by removing the need for physical collection of forms and data entry. Lastly, by making tax information submitted by taxpayers immediately available electronically, e-filing may increase the ease of data analysis for monitoring.

On the other hand, it is possible that e-filing may not deliver these expected benefits or may even lead to worse outcomes, especially in low income settings with limited information technology coverage and low capacity in other aspects of tax administration. For example, certain taxpayers may experience significant costs of adoption rendering e-filing inaccessible to them (Yilmaz and Coolidge, 2013). For small businesses with limited third-party reporting or other means of verifying income, tax officials may have important private information gathered from field visits and frequent interactions with

[4]Given the firm-level design, we are unable to examine system-wide efficiency impacts of e-filing.

firms which they use in verifying filing submissions. Since e-filing removes this *ex-ante* check, it may lead to lower tax revenues.

While e-filing may benefit taxpayers by decreasing compliance costs and reducing exposure to extortion, it may also constrain them by reducing opportunities for collusion and tax evasion. As such, the adoption decision will depend on the relative expected costs and benefits to each firm. This suggests that there may be important selection effects in the adoption of e-filing, as well as heterogeneous effects of e-filing on firms by their tax compliance at baseline. Since tax evasion is not directly observable, we use a risk profile score developed by the tax authority as an indicator of likelihood of evasion. Supporting the use of this proxy, we observe that conditional on observable firm characteristics including industry, number of employees and turnover, higher risk scores are correlated with lower tax payments and with higher audit adjustments and penalties. For ease of exposition, we consider firms above the median risk score to be "high-risk firms" and those below the median to be "low-risk firms."

We find evidence of selection effects in e-filing adoption: one standard deviation increase in a firm's risk score is associated with a 7 percentage point decrease in its likelihood of e-filing. Further, among the treatment group for whom adoption was almost universal, high-risk firms are 13 percentage points more likely to stop using e-filing within six months. This pattern is consistent with these high-risk firms deriving more benefit from dealing directly with tax inspectors under paper filing, presumably to reduce their tax liabilities.

Next, we examine the impact on our main outcomes (compliance costs, tax payments, and unofficial payments). Firms that e-file because of our intervention save almost five hours on average every month, about 15 percent of the total amount of time spent on tax-related activities. Overall, we find no significant effects on unofficial payments or on the amount of taxes paid, but this result masks substantial heterogeneity across firms. Among high-risk firms, e-filing leads to a significant increase in taxes paid. This result is consistent with high-risk firms losing opportunities to collude

with officials to reduce their taxes, an interpretation further supported by evidence of changes in tax preparation procedures of high-risk firms. Over time, this impact on tax payment fades as more high-risk firms revert to paper filing. In line with this, there is no significant impact of e-filing on unofficial payments measured one year after the intervention.

Among low-risk firms, e-filing adoption leads to a decrease in the amount of taxes paid and in the likelihood of paying bribes. The coexistence of these two effects suggests that at baseline, tax officials played a role in increasing the amount of tax paid by these firms while also extracting bribes from them. Importantly, these opposing effects on tax payments by high-risk and low-risk firms lead to closing the revenue gap otherwise observable between these two groups. This result holds when controlling for observable differences between high- and low-risk firms and for other sources of impact heterogeneity. As such, while the intervention does not change the amount of taxes paid, it changes the distribution of tax payments across firms in a way that is arguably more equitable, given the evidence of higher evasion among high-risk firms and reduction of unofficial payments among low-risk firms.

To examine the robustness of our results, we also use machine learning methods to confirm that the risk score is an important variable in explaining the heterogeneity of impact of e-filing. Following Chernozhukov et al. (2018b), we use Random Forest to, first, establish the presence of impact heterogeneity. Next, we use the predicted impact from Random Forest to divide the sample into the 50 percent most and least affected firms and observe significant differences in the risk score across these two groups reflecting the heterogeneous impacts.

This paper contributes to different areas of the literature: First, it adds to a growing body of work on the role of technology in enhancing state capacity. Recent studies have examined the impact of e-government initiatives in increasing transparency, reducing leakages and monitoring compliance in different government functions ranging from procurement (Lewis-Faupel et al., 2016) to elections (Fujiwara, 2015) to social

programs (Banerjee et al., 2017, Muralidharan et al., 2016) and many others (Olken and Pande, 2012, World Development Report 2016). In the field of taxation, Ali et al. (2015) and Eissa et al. (2015) examine the impact of electronic billing machines on tax compliance in Ethiopia and Rwanda respectively. While much of the existing literature across sectors indicates positive effects, this paper highlights the fact that technology may have heterogenous effects on users based on their compliance behavior prior to the introduction of the technology. Further, when adoption is voluntary, firms and individuals on whom the technology may have the greatest monitoring impact may be the least likely to adopt.

Second, this paper contributes to the rapidly growing literature on taxation in developing countries. To date, this literature has focused largely on taxpayer responses to different types of messaging, third-party reporting and tax policy changes (See Slemrod, 2017 for a review), devoting less attention to interactions between tax officials and taxpayers. Notable exceptions are Khan et al. (2016) and Amodio et al. (2017), who study the impact of performance pay for tax collectors on revenue and bribe payments. Whereas those interventions sought to change the incentives of tax collectors, this paper focuses on changing the opportunities for collusion and extortion between tax officials and taxpayers. Third, and more broadly, this paper contributes to our understanding of corruption and of the effectiveness of strategies to reduce it (see Olken and Pande, 2012 for a review). Similar to Sequeira and Djankov (2014), it differentiates between collusive and coercive corruption and the differential response of firms to both.

Lastly, this study provides some of the first evidence on the causal impact of e-filing. The only other study we are aware of is Kochanova et al. (2016) which uses variation in when different countries introduced e-filing and firm-level outcome data from different waves of the World Bank Enterprise Surveys to determine that, on average, e-filing reduces compliance costs and bribe solicitation, but provides no results on the impact on tax revenue. By using firm-level variation in e-filing adoption that arises from a randomized experiment, this paper avoids endogeneity bias that may be otherwise

present.

The rest of this paper proceeds as follows. Section 2 provides background on the tax administration system and the introduction of electronic tax filing in Tajikistan while Section 3 provides details on the experiment design and program implementation. Section 4 outlines a simple conceptual framework for the impact of e-filing and the adoption decision of firms. Section 5 describes the data and Section 6 outlines the empirical specification. Section 7 provides results on e-filing adoption, as well as results on the impact of e-filing on firms. Section 8 concludes and outlines policy implications.

3.2 Context: Tax Administration and Electronic Tax Filing in Tajikistan

Like many developing countries, Tajikistan[5] faces significant challenges with improving tax administration and reducing corruption, making it an interesting setting to study the introduction of e-filing. Firms face high tax compliance costs: In addition to the turnover tax (filed quarterly),[6] small and medium firms must also file monthly declarations for income tax withholdings on employee salaries and social insurance tax for employees.[7] In addition, they are obliged to conduct a quarterly reconciliation of their tax accounts.

In the absence of e-filing, firms submit their tax declarations in person at local tax offices, spending otherwise productive time waiting in line for multiple checks and signatures from tax officials. On average, firms in the study sample report spending six hours each month fulfilling tax obligations (excluding accounting), with about three hours going towards visits to the tax office. Furthermore, corruption is a major concern in Tajikistan. At the time this project commenced, the World Bank Enterprise Survey

[5] With a 2015 GDP per capita (current USD) of $919, Tajikistan is classified as a low-income country in Central Asia (World Development Indicators, 2015).

[6] Firms in the study sample are drawn from the simplified tax regime and as such are subject to a turnover tax rather than a corporate income tax.

[7] The tax rates are 6 percent of turnover, 25 percent of salaries for the social tax, and 13 percent of salaries for the income tax.

(2013) indicated that 32 percent of firms expect to give gifts in meetings with tax officials and 37 percent expect to give gifts to any public officials to "get things done." Opportunities for corruption in this context may be reinforced by the fact that tax officials are responsible for a portfolio of taxpayers, which means that they interact with the same taxpayers frequently.

These two concerns—improving service delivery for taxpayers by eliminating long wait times for submission of declarations and curtailing corruption by reducing the frequency of interactions with tax officials—were among the primary reasons the tax authority in Tajikistan introduced e-filing. By making it easier for people to file and pay taxes, and by closing off opportunities for corruption, the government expected e-filing would ultimately lead to increased voluntary compliance and thus increased tax revenues. Other motives for introducing e-filing are to improve the quality of tax records by reducing arithmetic mistakes by firms[8] and data entry mistakes by clerks and to improve the efficiency of tax administration by releasing officials from routine work to focus on higher-value activities.

In order to file taxes online, firms must first register for e-filing by submitting application documents to the tax authority. After processing and approval of the application, the firm receives an e-token containing its digital signature which it must use to verify its online declarations. Once a firm registers for e-filing, it can file all taxes online using the e-filing software either on its own computer or at public e-filing terminals located in tax offices.[9] However, firms are still required to visit the tax office quarterly to reconcile their accounts.

Adoption of e-filing by firms was slower than expected following its introduction in 2012. Initially, firms had to purchase e-tokens for $40 plus an additional $40 registration fee. Even after the elimination of these fees, only about 30 percent of firms

[8]The online system has in-built formulas to perform calculations automatically based on inputted entries.

[9]Online payment of taxes through e-banking is also available to firms but is separate from the e-filing system: firms that e-file do not have to pay online and vice versa. Although this paper does not study the impact of electronic tax payment, we observe that 66 percent of firms that e-file also pay online.

registered for e-filing. The low take-up was puzzling given the anticipated benefits from adoption, prompting significant interest in understanding the constraints to adoption and potential ways to address them. Focus group meetings and interviews with both business owners and tax officials indicated firms were not using e-filing for a variety of reasons, including: lack of awareness; lack of trust in the system's reliability and in the security of information submitted online; difficulties navigating the registration process; and lack of access to computers and internet.[10] In addition, some firms indicated that they did not file online because they preferred to deal directly with the same tax official on a regular basis when submitting their tax declarations (perhaps for benign reasons such as having someone trusted crosscheck their submissions, or perhaps intending to evade tax obligations).

3.3 Experiment Design

The experimental treatment arms of this study aimed to address those barriers to e-filing identified by firms. Firms were randomly assigned into two treatment groups (and one control group). In the intensive treatment arm (Group A), firms received training and information about e-filing intended to increase awareness and trust in the system. In the training session, they learned about e-filing availability, its benefits, and registration procedures, and participated in an interactive demonstration of the e-filing system. In addition, these firms received logistical support in registering for e-filing to mitigate the hindrances firms willing to use e-filing face in accessing the system: a representative of the implementing partner helped firms complete all the steps required for registration.

Firms in the second treatment arm (Group B) received an identical e-filing training session but they did not receive the logistical help for registration. In the control group (Group C), firms did not receive any e-filing training. However, to hold the delivery

[10] From the baseline survey, 50 percent of firms in our study sample were unaware of the possibility of e-filing and 37 percent did not have high-speed internet on their premises.

format of the treatments constant, these firms received general training on taxation not specific to e-filing.[11] Rather, the training included a review of different tax laws and procedures. Due to a requirement by the Tax Committee, this general tax training included one statement about the availability of e-filing on a slide listing the three modes of filing taxes: "by paper, by mail and electronically." In addition, firms in this group would have been aware of the existence of e-filing from a reference to it in the invitation materials and from some questions in the baseline survey. This observation is important for interpreting our results since it means Group C is not a pure control group but rather a group with a light information treatment.

This design allows us to answer two broad sets of questions. The first set examines firms' decisions to adopt e-filing: What is the impact of providing information and training about e-filing? What is the additional impact of helping firms to register? What other firm characteristics predict e-filing adoption? The second set of questions focuses on the impact of using electronic filing on firm outcomes, in particular, compliance costs, tax payments and unofficial payments.

3.3.1 Sampling and Randomization

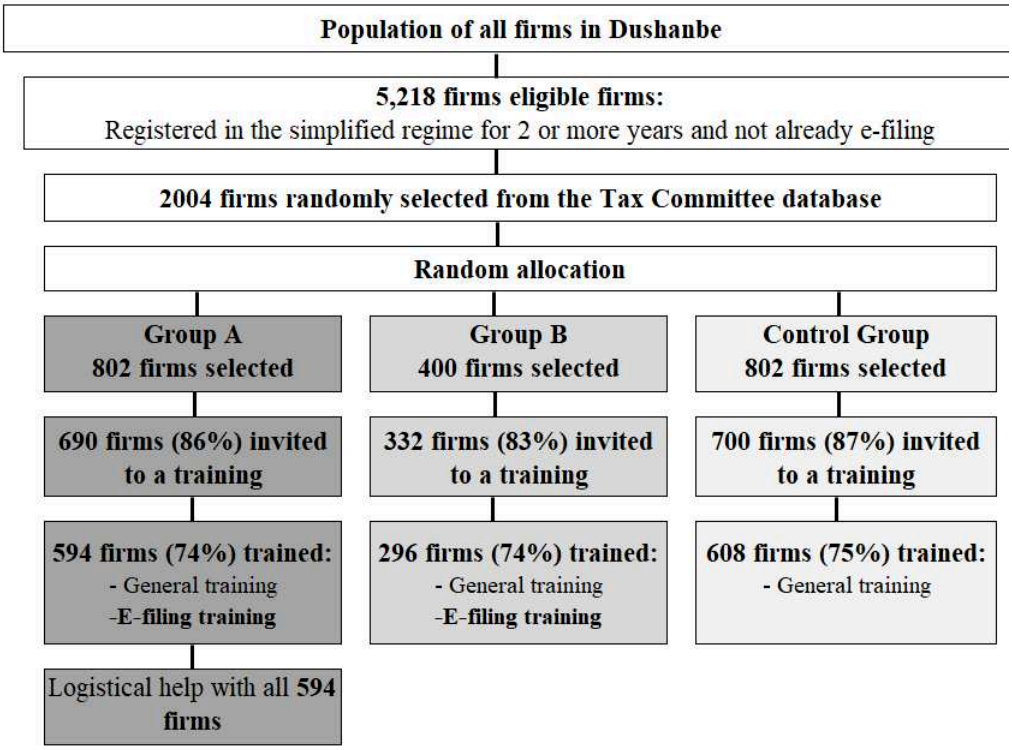
The study draws from the universe of firms in Dushanbe that are registered in the tax authority database. All legal entities and individual entrepreneurs that are (i) simplified tax regime payers, (ii) have been active in the system for at least two years (i.e. not new enterprises or liquidated ones), and (iii) not currently e-filing, were eligible for the study. There were 5,218 firms in the tax database meeting these three criteria.

We randomly selected a list of 2,004 firms from this overall population with stratification on status of the firm (legal entities or individual enterprises) and rayon (tax district). Based on discussions with the tax authority and the implementing partner on expected response rates, we estimated that we needed to contact 2,000 firms to have 1,500 firms attend the training sessions. Since we expected the intervention to be more

[11] Groups A and B also received this general tax training during their sessions.

effective on legal entities which are usually bigger firms than individual enterprises, we over-sampled legal entities to achieve a relative proportion of 75 percent of legal entities to 25 percent of individual enterprises in the study population. We randomly allocated the 2,004 firms into three groups: 802 into Group A, 400 into Group B and 802 into Group C.[12] We conducted the randomization by computer using STATA and stratified using legal status, sector of activity and rayon (tax district). Figure 1 illustrates the experimental design and the sampling strategy.

Figure 3.1: Study Design and Program Implementation (Control Group)



3.3.2 Program Implementation

The training programs and logistical support were delivered by a Dushanbe-based firm with the support of the tax authority from October to December 2014. Firms were

[12]More firms were allocated to Groups A and C than to Group B in order to increase our statistical power to measure the impact of e-filing on firms adopting it since we expected the Group A treatment to have the greatest impact on e-filing adoption.

invited to attend a general training on taxation through telephone calls by trained operators.[13] Although we assigned firms randomly into the treatment and control groups before the trainings (to facilitate scheduling into the different training sessions), all firms received invitations following exactly the same script (see Appendix A for the text of the script). Out of the 2,004 firms in the study database, 1,722 (86 percent) received telephone calls and 1,498 (75 percent of the full sample and 87 percent of those invited) attended training. These response rates were balanced across the three treatment groups.

Since the invitations to all firms followed the same protocol, each firm had to decide whether to attend the training before learning its treatment group. Therefore, we are confident that the decision to attend training is orthogonal to treatment status and did not introduce selection bias into the study design. As such, we use the sample of the 1,498 firms that attended training in studying the program's impact, with the caveat that this could slightly limit the external validity of our findings.

The training sessions took place either on the tax authority's premises or in the implementing partner's office. At the beginning of training (before revealing treatment status), the baseline survey was self-administered (completed on paper forms by firm representatives) with detailed instructions and examples provided by implementing partner trainers.

Groups A and B received identical training which included both a general tax presentation and an e-filing presentation and demonstration, with a question-and-answer session at the end. The training for Group C (control group) differed in that it did not include the e-filing presentation and demonstration. On average, training lasted for two hours in Groups A and B and for one hour in Group C. A few days after each training, the implementing partner called back all firms in Group A and assisted interested firms in registering for e-filing. This logistical assistance involved visiting each firm, collecting all necessary documentation, submitting it to the tax authority on the

[13] The tax authority periodically organizes events and trainings for firms, so this program was not unusual.

firm's behalf, obtaining the e-token, and installing the software.

3.4 Conceptual Framework

In this section, we outline a simple framework for thinking about a firm's decision to adopt e-filing. A firm will switch from paper filing to e-filing if the expected discounted value of the benefits associated with e-filing adoption is greater than the cost of adoption. That is, if:

$$\sum_{t=1}^{T} \beta\delta^t E((CC_{p,t} - CC_{e,t}) + (UP_{p,t} - UP_{e,t}) + (Tax_{p,t} - Tax_{e,t})) > AC_e \tag{3.1}$$

where $CC_{p,t}$ and $CC_{e,t}$ are compliance costs a firm would face at time t under paper filing and e-filing respectively. Similarly, $UP_{p,t}$ and $UP_{e,t}$ are unofficial payments a firm would make to tax officials at time t under paper filing and e-filing and $Tax_{p,t}$ and $Tax_{e,t}$ are taxes a firm would pay at time t under paper filing and e-filing. AC_e is the one-time adoption cost associated with switching to e-filing. β and δ are the parameters for present-bias and discount factor respectively.

We expect that $CC_{p,t} - CC_{e,t} > 0$, that is, we expect that compliance costs will be lower for firms under e-filing since there is no longer any need to spend time traveling to the tax office (except for those using public terminals) and obtaining approval.[14] Further, we expect that the larger the difference, that is, the greater the potential savings in compliance costs from e-filing, the more likely a firm will be to adopt e-filing (for example, firms with high paper filing compliance costs).

Under paper filing, each firm is assigned to a tax official who reviews the firms' declarations and signs before the declaration is considered accepted. After the decla-

[14] E-filing does not necessarily reduce compliance costs for firms in all contexts. For example, if firms submit both electronic and paper documents due to legal requirements or lack of trust in the system (Yilmaz and Coolidge, 2013), they may indeed face higher compliance costs. However, we do not think this should be the case in our context given that it is not technically possible to submit a paper and an electronic declaration simultaneously.

ration is submitted to the official, the firm then makes the taxpayment at the bank or through electronic transfer (not directly to the official.) Each tax official is responsible for a group of firms and faces a monthly tax revenue target that is expected from those firms.[15] Importantly, tax officials that receive declarations are different from tax officials that conduct audits (which are centrally determined).

We hypothesize that the change in firms' unofficial payments to tax officials, $UP_{p,t} - UP_{e,t}$, will be positive or null because the reduced frequency of interactions between taxpayers and tax officials under e-filing provides fewer opportunities for unofficial behaviors.[16] Qualitative evidence from focus group discussions and interviews indicate that at least two different types of unofficial payments may occur during interactions between taxpayers and tax officials: (i) coercion (tax officials demanding unofficial payments or creating administrative hurdles to put firms in a position such that they would voluntarily offer a gift), and (ii) collusion (tax officials and taxpayers working together to help taxpayers evade taxes, usually with an unofficial payment for tax officials).

Bribe coercion will be more difficult under e-filing since officials will be less able to hold up taxpayers, causing them to submit their declarations late and incur fines. The greater the savings from fewer coerced unofficial payments, the more likely firms are to e-file. In addition, collusion may be more difficult to coordinate if submissions are now done electronically. For firms that voluntarily make unofficial payments to reduce their tax liability, their likelihood of e-filing will depend on the combination of savings from both unofficial payments and tax payments. Since e-filing reduces but does not eliminate interactions with tax officials, these impacts may be muted if tax officials and/or taxpayers adjust their behavior to compensate for fewer opportunities to interact.

[15] Due to data limitations, we do not observe which firms are assigned to the same official.

[16] Sequeira and Djankov (2014) find significantly higher levels of customs corruption in Maputo ports relative to Durban ports. Online processing of clearance documentation in Durban results in minimal interactions between clearing agents and customs agents compared to higher levels of interaction with in-person submissions in Maputo.

The impact on tax payments as a result of e-filing, $Tax_{p,t} - Tax_{e,t}$, is ambiguous as it depends on firms' experiences prior to e-filing. Eliminating the interaction between taxpayers and tax officials at the point of sbmission of returns through e-filing can affect the amount of tax a firm pays in at least two ways.[17] First, tax payments may decrease for firms whom tax officials had previously constrained regarding the minimum amount they could declare. The review during in-person submission may serve as a mini-audit and help to limit evasion as the tax official may have private information about firms which may be useful in estimating how much taxes the firms should pay. Alternatively, this check could be an opportunity for tax officials to force firms to declare more than their actual tax liability. In interviews and focus group discussions, some firms mentioned that a major consequence of e-filing was the ability to avoid officials forcing these increases in tax payment.[18] In either case, for firms in this category, the introduction of e-filing may lead to lower taxes paid, $Tax_{p,t} - Tax_{e,t} > 0$, since tax officials will no longer be able to influence the amount of taxes firms can declare at the time of submission. The greater the reduction in tax paid under e-filing, the more likely the firm will be to adopt e-filing.

The second channel by which in-person meetings may affect taxes paid is that rather than monitoring the taxes declared by firms, tax officials may actively collude with firms and assist them in completing their declarations to minimize their tax liability. This type of collusion typically involves an unofficial payment to the tax official. The introduction of e-filing increases the transaction costs for this collusion because forms submitted online are not easily changeable (unlike paper declarations that can be easily redone). For firms in this category, e-filing may lead to higher taxes paid, $Tax_{p,t} -$

[17] It is also possible for lower compliance costs to increase voluntary compliance (by increasing tax morale) or to increase profits (by reducing business costs), which could both lead to higher taxes paid. However, we find no evidence for improved attitudes on taxation issues and the lower compliance costs are small relative to the tax amounts; hence, we do not emphasize these channels.

[18] Some examples of comments are: "[Tax inspectors] do not care whether we make a profit or how much was our turnover during the reporting period, they insist on an amount [they want us to pay] to fulfill their targets. So when filing in person, sometimes they reject a declaration if the amount is too small. Now, by filing online, you don't depend on tax inspectors." "After moving to e-filing, we're more certain of the amount we need to pay. Before, during paper-filing, each time we didn't know what figures the tax inspector will want us to pay for that filing period."

$Tax_{e,t} < 0$, and so these firms will be less likely to adopt e-filing. These two channels may be self-reinforcing because tax officials face incentives to meet revenue targets. If a tax official is colluding with some taxpayers to reduce their tax payments, he may need to compensate by collecting higher tax revenue from others.

Since we are unable to directly observe tax evasion and unofficial payments, it is difficult to know which firms fall into each of the two categories described above. In subsequent analyses of the heterogeneous impact of e-filing, we distinguish firms in the two categories using a risk index developed by the tax authority to identify firms by their likelihood of tax evasion. Section 5 (Data) provides a description of this index. As such, we expect that firms in the first category (non-collusive firms) will have lower risk scores as they will be less likely to be evading taxes whereas firms in the second category (collusive firms) will have higher risk scores. Figure 2 outlines the expected impact for each of the outcomes for these two categories.

Figure 3.2: Conceptual Framework

	Expected Impact of E-filing on:		
	Compliance Costs	**Unofficial payments**	**Tax payments**
Collusive firms	Decrease	Decrease (collusion)	Increase
Proxy: Higher risk scores	*Taxpayer spends less time on travel and on queues*	*Official and taxpayer have less opportunity to collude*	*Official and taxpayer have less opportunity to collude*
Non-collusive firms	Decrease	Decrease (coercion)	Decrease
Proxy: Lower risk scores	*Taxpayer spends less time on travel and on queues*	*Official has less opportunity to hold up taxpayer*	*Official is less able to require taxpayer to increase tax paid*

Using this framework, we can also discuss the expected impact of the experimental interventions. The two treatments aim to reduce the adoption costs, AC_e of e-filing: the lower the adoption costs, the more likely a firm will switch to e-filing. Although firms may register for e-filing free of charge, they would nonetheless face additional costs in accessing the system, such as learning how to use the technology and the

time and uncertainty costs associated with registration. The information and training component (Group B) helps firms overcome the hurdle of understanding how to use the system while the additional logistical help with registration (Group A) reduces the time and uncertainty costs of adoption.

The impact of the interventions will depend on firm type. First, firms for which expected benefits of e-filing are greater than the cost of adoption (for which inequality (3.1) holds) will register when they learn e-filing is available. Given that e-filing was mentioned during the general training provided to all firms (including the control group), all firms of this type in the study sample should register.

Second, firms for which expected returns from e-filing adoption are positive but smaller than the adoption cost (the left-hand term of equation (3.1) is positive but smaller than AC_e) will be impacted by the two treatments designed to reduce adoption cost. As such, we expect that the treatments will increase e-filing adoption for these firms and that the combination of training and logistical help will be more effective.

Finally, the intervention should not have any impact on firms with negative expected returns from e-filing adoption (i.e. firms for which the left-hand term of equation (3.1) is negative) as they should not be willing to register regardless of the reduction in adoption costs.[19] One exception would be if the treatment promoted the perception that e-filing was mandatory (We discuss this possibility in the section on mechanisms). Note that since $Tax_{p,t} - Tax_{e,t}$ is negative for these firms (since we expect that $CC_{p,t} - CC_{e,t} > 0$ and $UP_{p,t} - UP_{e,t} > 0$), they are likely to be evading tax in the paper system. As a result, we expect firms in this third category to have higher risk scores and thus to be less likely to e-file than firms in the first two categories.

[19] Note that as $AC_e \to 0$ (and $t \to \infty$), inequality (3.1) simplifies to: $E(CC_p + UP_p + Tax_p) > E(CC_e + UP_e + Tax_e)$, which is never true for these firms.

3.5 Data

We rely on three main sources of quantitative data. First, we use administrative data from the tax authority on firm characteristics (such as number of employees, legal status, industry and district), e-filing use, and tax behavior (such as monthly tax declarations and payments). These data include all 1,498 firms in the study sample as well as the additional 506 firms originally selected but that did not participate in the training.

The other two sources are the baseline survey of firms conducted prior to the trainings and the endline survey conducted about one year later. The surveys include information on firm characteristics and economic behavior, as well as experiences of firms with the tax administration process (such as compliance costs). All 1,498 firms in the study sample completed the baseline survey.

The endline survey differed from the baseline by including more questions and in that enumerators administered it in person at the firm's premises (as opposed to the brief, self-administered baseline survey at the beginning of the training sessions). Eighty-four percent of the study sample (1,263 firms) completed the endline survey. Twelve percent of the sample did not complete the survey because the firm was liquidated, while the remaining four percent proved untraceable or had moved outside Dushanbe. There were no significant differences in attrition across treatment groups at the endline survey (Appendix Table A1). In addition to these data, the study relies on extensive interviews and focus groups with tax officials and firms at different stages of the project to design the intervention, understand potential channels of impact and interpret findings.

Table 1 shows summary statistics for some variables from the administrative data and the baseline survey. Firms have a median of two employees (including the entrepreneur) and an average of three. In 40 percent of firms, the entrepreneur is the only employee. About 42 percent each are in the trade and services sector. Women own

eight percent of firms. Table 1 also shows that randomization achieved balance across the different treatment groups for most variables.[20] P-values of joint orthogonality tests obtained from regressing the treatment variable against different firm characteristics also indicate that the variables are not systematically correlated with the treatment. Since the analysis will emphasize heterogeneous results by firms' baseline risk score, Table 1 also includes randomization checks for the two subgroups (firms above and below the median risk score). As Section 7 will describe, the information and training only treatment has no significant impact on e-filing adoption; therefore Table 1 combines Groups B and C as the control and compares with Group A. Appendix Table A2 provides randomization balance tables for the original three groups. Analogous to Table 1, Appendix Table A3 shows that randomization balance persists in the sample surveyed at endline consistent with the non-differential attrition across groups.

At baseline, we measure firms' tax compliance costs using the number of visits to the tax office in the last six months, the amount of time spent on different activities during visits to the tax office,[21] and the amount of time spent calculating taxes and completing tax forms. Compliance cost measurement at endline is similar to at baseline, except that the endline survey also includes time spent on tax accounting.

In both baseline and endline surveys, we measure unofficial payments using a survey question asking how often it is true that firms "in their line of business" typically have to make unofficial payments to tax officials and create a dummy variable for firms saying it is "always true" or "often true."[22]

Our main measure of unofficial payments in the endline survey is a list experiment (Kuklinski et al., 1997). In response to the same question about *how many* actions

[20] Firms' compliance costs are a notable exception. Firms in Group A visited the tax office 6.53 times compared to 6.4 times in the control group. Results from the endline survey show a reduction in the number of visits in Group A so, if anything, the results may underestimate the reduction in compliance costs due to e-filing.

[21] We ask firms separately about each of the following: Time to travel (both directions); Staying in line; Attendance at tax inspector office for checking reports and submission; Staying in line to sign tax reports by a head of tax office; Obtaining tax payments reconciliation act; Calculation of tax due and filling in tax reports at tax office; and Other.

[22] The question is worded in this manner to avoid asking firms about their own behavior as corruption is a sensitive topic.

Table 3.1: Descriptive Statistics and Balance Checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All sample			**Below median of 2014 risk profile score (low risk)**			**Above median of 2014 risk profile score (high risk)**		
	Mean [SD] Control group (B&C)	Diff. in Group A	N	Mean [SD] Control group (B&C)	Diff. in Group A	N	Mean [SD] Control group (B&C)	Diff. in Group A	N
PANEL A: Administrative data from Tax Committee (2014)									
Legal entities$^{\beta}$	0.729	-	1,498	1	-	547	1	-	520
	[0.445]			[0]			[0]		
Sector of activity is Trade$^{\beta}$	0.415	-	1,498	0.374	-	547	0.248	-	520
	[0.493]			[0.485]			[0.432]		
Sector of activity is Services$^{\beta}$	0.42	-	1,498	0.495	-	547	0.582	-	520
	[0.494]			[0.501]			[0.494]		
Sector of activity is Manufacturing	0.116	0.012	1,498	0.1	-0.003	547	0.113	0.012	520
	[0.321]	(0.011)		[0.301]	(0.017)		[0.317]	(0.021)	
Female owner	0.076	0.023	1,498	0.07	0.007	547	0.048	0.032	520
	[0.266]	(0.015)		[0.255]	(0.023)		[0.215]	(0.024)	
No employee	0.406	-0.01	1,498	0.195	0.003	547	0.469	-0.025	520
	[0.491]	(0.025)		[0.396]	(0.035)		[0.5]	(0.045)	
Number of employees	3.287	-0.127	1,498	4.271	-0.57*	547	3.257	0.108	520
	[3.443]	(0.171)		[3.71]	(0.306)		[3.781]	(0.331)	
The firms was audited in 2014	0.037	-0.006	1,498	0.067	-0.023	547	0.016	0.014	520
	[0.188]	(0.009)		[0.25]	(0.019)		[0.126]	(0.014)	
Risk profile score in 2014$^{\lambda}$	62.6	0.1	1,067	41.3	1.6*	547	85.1	-0.3	520
	[28.9]	(1.7)		[10.5]	(0.9)		[24.7]	(2.1)	
Risk profile score in 2014 above	0.486	-0.015	1,067	0	0.000	547	1	0.000	520
	[0.5]	(0.031)		[0]	(0.000)		[0]	(0.000)	
PANEL B: Baseline Survey Data (2014)									
Firm has an accountant	0.73	0.028	1,498	0.799	-0.032	547	0.762	0.041	520
	[0.444]	(0.023)		[0.401]	(0.037)		[0.427]	(0.036)	
Share of technological practices implemented	0.538	0.024	1,498	0.639	-0.011	547	0.665	0.074**	520
	[0.437]	(0.021)		[0.422]	(0.038)		[0.402]	(0.036)	
Number of visits to tax authority office in Jan-Jun 2014	6.382	0.13**	1,498	6.514	0.109	547	6.444	0.158	520
	[0.948]	(0.056)		[1.027]	(0.101)		[1.111]	(0.106)	
Time spent on tax related activities during a typical month (hours)	6.185	0.131	1,483	6.26	-0.005	544	6.657	0.188	513
	[2.926]	(0.162)		[2.852]	(0.241)		[3.195]	(0.359)	
Number of times tax inspectors visited the company in Jan-Jun 2014	1.324	-0.027	1,498	1.271	-0.044	547	1.199	0.022	520
	[0.948]	(0.054)		[0.871]	(0.107)		[0.879]	(0.08)	
Ever used e-filing (with another company)	0.14	-0.013	1,498	0.198	-0.037	547	0.177	0.000	520
	[0.348]	(0.018)		[0.399]	(0.034)		[0.382]	(0.035)	
Think that it is common for firms to make informal payments	0.18	0.004	1,498	0.255	-0.046	547	0.174	0.019	520
	[0.385]	(0.02)		[0.437]	(0.035)		[0.379]	(0.035)	
P-values of joint orthogonality tests$^{\alpha}$	0.658			0.526			0.553		

Notes: Columns 1, 4, 7: Standard deviations presented in brackets. Columns 2, 5, 8: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on a treatment variable (group A), controlling for strata dummies. β: variables used for stratification. λ: Risk profile scores are only calculated for legal entities. α: P-values of joint orthogonality tests obtained from regressions of the treatment dummy on all the variables in the right-hand column (not used for stratification) and testing for all coefficients are jointly equal to zero. ***, **, * indicate significance at 1, 5 and 10%.

on a given list a company had taken in the last year to "solve or prevent problems with the Tax Administration," half of the respondents receive a list of four options that are neutral and legal.[23] The other half receive a list of five options that includes "making unofficial payments" as an additional option. The difference between the average numbers selected by firms presented with the longer list and by those presented with the shorter list gives a measure of how common it is for firms to make unofficial payments.

To measure tax payments, we aggregate monthly payments from administrative records from the tax authority to obtain the total amount of tax paid over the course of the year. Given the large number of zeros in the distribution of taxes paid, we also use the inverse hyperbolic sine function of total taxes paid as well as the median tax amount paid in that year. As an alternative measure, we use firms' self-reports of their tax payments in two focal months of the year (June and December).

3.5.1 Risk Score

We use the firm's risk score at baseline as a proxy for its likelihood of evading taxes. Like many tax administrations, Tajikistan's Tax Committee uses a risk-scoring system to assess firm risk as part of its audit strategy.[24] Risk-based audits help administrators allocate limited resources to cases likely to yield significant revenue while reducing the monitoring burden on compliant firms (less likely targets for an audit). A firm's risk score is the product of a proprietary algorithm incorporating observed firm characteristics and results of prior audits on other firms. Similar to those of most countries (both developed and developing), Tajikistan's tax authority keeps confidential the details of the risk-scoring process to prevent taxpayers engaging in strategic behavior in order to avoid an audit. That said, risk criteria incorporated into basic models for small firms in different countries include, *inter alia*, the sector(s) of activity and business struc-

[23] The four items on the short list are: 1. Received help from trade associations, 2. Had detailed discussions with tax officials, 3. Provided additional documents, 4. Pursued court action.

[24] Khwaja et al, (2011) provide examples from dozens of countries' experiences with risk-based audits.

ture, quality of record keeping, past compliance behavior, cost ratios and deductions from gross revenue, and comparisons with industry and sector averages (Loeprick and Engelschalk, 2011).

To investigate empirically this variable's correlates in our setting, we regress firms' risk scores at baseline against different firm characteristics from administrative and survey data. Table 2 indicates that risk score is negatively correlated with operating in the trade sector and with having had a recent audit, whereas it is positively correlated with claiming to have no other employees besides the entrepreneur and with the amount of tax adjustments and penalties from the prior audit. In addition, we find two pieces of evidence suggesting that the risk score is predictive of non-compliance. First, we find that, controlling for observable firm characteristics such as industry, gender of owner, number of employees and (survey data report of) turnover, firms with higher risk scores at baseline (2014) paid lower taxes in 2015 (Table A4, Columns 3 and 4). Second, we find that, controlling for firm characteristics, risk score at baseline is positively correlated with the total amount of audit adjustments and penalties in the following year, conditional on an audit occurring (Table A4, Column 6). These effects are statistically significant for the inverse hyperbolic sine function of total taxes and audit penalties, suggesting that the large number of zeros are of particular importance.

The tax authority only calculates risk scores for legal entities (75 percent of the sample), so it is unavailable for individual entities.[25] Unfortunately, the risk score variable was not available to us at the time of randomization; hence we were unable to stratify upon it. Nevertheless, from Table 1 we find that, within the two subgroups, most variables are balanced, with a few exceptions: Among the low-risk group, firms in group A are smaller and have slightly higher risk scores (both at 10-percent level).[26] As with the full sample, p-values of the joint F-test indicate that the variables are not jointly correlated with the treatment group.

[25] Since randomization was stratified on legal status, this characteristic is perfectly balanced among the different treatment groups.

[26] We control for these variables in robustness checks and find no significant difference on our main results.

Table 3.2: Baseline Correlates of Risk Profile Score

	(1)	(2)	(3)	(4)
Dependent variables:	**Risk Profile Score in 2014**		**Above median of Risk Profile Score in 2014**	
Administrative data				
Sector of activity : omitted = manufacturing				
Trade	-6.161**	-6.598**	-0.115**	-0.120**
	(2.783)	(2.748)	(0.048)	(0.047)
Services	-0.607	-0.826	-0.016	-0.019
	(2.565)	(2.536)	(0.044)	(0.044)
Female owner	-1.924	-2.389	-0.078	-0.085
	(3.396)	(3.392)	(0.061)	(0.061)
No employee	20.330***	20.399***	0.299***	0.300***
	(2.147)	(2.138)	(0.036)	(0.036)
Number of employees	0.120	0.240	0.006	0.007
	(0.240)	(0.238)	(0.005)	(0.005)
The firm was audited in 2014		-20.187***		-0.264***
		(3.231)		(0.069)
Amount of fine following an audit in 2014 (in TJS/1000)		0.150***		0.002***
		(0.034)		(0.000)
Baseline survey data				
Firm has an accountant	3.353	3.038	0.041	0.037
	(2.089)	(2.068)	(0.037)	(0.037)
Share of technological practices implemented	3.144	3.229	0.029	0.030
	(2.030)	(2.011)	(0.038)	(0.038)
Number of visits to tax authority office in Jan-Jun 2014	-1.029*	-0.921	-0.011	-0.010
	(0.586)	(0.596)	(0.013)	(0.013)
Time spent on tax related activities during a typical month (hours)	0.288	0.303	0.008*	0.008*
	(0.271)	(0.269)	(0.004)	(0.004)
Number of times tax inspectors visited the company in Jan-Jun 2014	0.514	0.398	0.003	0.002
	(0.739)	(0.741)	(0.015)	(0.014)
Ever used e-filing (with another company)	2.063	2.075	-0.000	-0.000
	(2.270)	(2.261)	(0.041)	(0.041)
Think that it is common for firms to make informal payments	-2.594	-2.411	-0.083**	-0.080**
	(2.052)	(2.033)	(0.036)	(0.036)
Observations	1,057	1,057	1,057	1,057
R-squared	0.203	0.221	0.141	0.151
Mean Dependent Variable	63.864	63.864	0.494	0.494

Notes: OLS regresions with standard errors presented in parentheses controling for dummies for the tax Rayon. ***, **, * indicate significance at 1, 5 and 10%.

3.6 Empirical Specification

We use Equation (2) below to examine the relative impact of the two treatments in promoting e-filing adoption as well as the firm characteristics associated with adoption:

$$D_i = \beta_0 + \beta_1 T_{A,i} + \beta_2 T_{B,i} + \alpha X_i + \lambda S_i + \epsilon_i \tag{3.2}$$

where D_i is an indicator variable for whether a firm registers for and uses e-filing, $T_{A,i}$ and $T_{B,i}$ are indicators for the training with logistical help and the training alone treatments respectively. β_1 and β_2 estimate the causal effects of receiving the two treatments respectively on adoption and the difference between them, $\beta_1 - \beta_2$, estimates the differential impact of the provision of logistical support in addition to the training. S_i is a vector of strata dummies (one dummy for each triplet of the following business characteristics): legal status (individual entrepreneur or legal entity), sector of activity (manufacturing, trade or services), and rayon (four tax districts in Dushanbe) (Bruhn and McKenzie, 2009). To examine firm characteristics associated with adoption, we include in Equation (2) a range of firm-level variables X_i, in particular, the measures of firms' compliance costs, unofficial payments, and the proxy for their likelihood of evading taxes (as discussed above).

To assess the impact of e-filing, we can use a variant of Equation (2) above in which we replace D_i with Y_i, the outcome variables of interest, to estimate the effect of assignment into either of the two treatment groups (the intent-to-treat estimate). We control for baseline measures of outcome variables when available. In addition, we use Equation (3) below to estimate the effect of e-filing on firms that adopted it as a result of the program by using assignment to Group A (the intensive treatment arm) only as an instrumental variable (IV) for adopting e-filing (Local Average Treatment Effect estimate), since assignment to Group B has no effect on e-filing adoption. As such, in the IV estimates, the effective control group consists of Groups B and C (and not Group C alone).

$$Y_i = \beta_0 + \gamma \widehat{Efile} + \pi Y_{i,t=0} + \lambda S_i + \epsilon_i \tag{3.3}$$

where Y_i are outcome measures such as compliance costs, unofficial payments, and tax payments. $Y_{i,t=0}$ are baseline measures of the outcome variable.

We assess the differential impact of e-filing by firms' risk profiles (above and below the median of the tax authority risk score) using Equation (4) below which includes an interaction of e-filing and an indicator for a firm having below-median risk score (*LowRisk* and an interaction of e-filing and an indicator for a firm having above-median risk score (*HighRisk*).

$$Y_i = \beta_0 + \gamma Efile \widehat{*LowRisk} + \alpha Efile \widehat{*HighRisk} + \rho HighRisk + \pi Y_{i,t=0} + \lambda S_i + \epsilon_i \tag{3.4}$$

γ and α are the coefficients of interest and give the impact of adopting e-filing among low-risk firms and high-risk firms respectively. For assignment to Group A to be a valid instrument in Equations (3) and (4), it must affect outcomes only by inducing firms to e-file and not have a direct effect. For example, it must not be the case that receiving a visit by the implementing firm (as part of the logistical help) caused firms to think that their tax declarations were under greater scrutiny. While we are unable to explicitly rule out a direct effect, we think this is unlikely because firms were accustomed to receiving visits from the tax authority (over two times a year on average). Further, given the opposite pattern of results observed for high-risk and low-risk firms, the logistical help would need to have affected these firms in opposite ways.

3.7 Results and Discussion

3.7.1 Adoption of Electronic Tax Filing

By December 2015, about one year after program implementation, 93 percent of firms in Group A had registered for e-filing and used it at least once, relative to 63 percent in Group B and 59 percent in the control group. The combination of training and logistical support for registration was successful in increasing e-filing adoption by 34 percentage points relative to the control group (Table 3, Panel A). On the other hand, there was no significant difference between the adoption rates for firms in Groups B and C, indicating that e-filing training and demonstration did not promote e-filing adoption compared to the brief mentions of e-filing the firms in the control group encountered.

Table 3.3: Impact on E-filing Adoption

	Mean [SD] Control group	Difference between control group and […] Group A	Group B	N	P-values of the test Group A= Group B
PANEL A: Administrative data from TC (Aug 2014-Dec 2015)					
Used E-filing	0.59	0.337***	0.038	1498	0.000***
	[0.492]	(0.023)	(0.033)		
Used E-filing conditional on survival	0.641	0.34***	0.042	1275	0.000***
	[0.48]	(0.022)	(0.035)		
Still using e-filing in Dec 2015	0.548	0.238***	0.046	1498	0.000***
	[0.498]	(0.027)	(0.034)		
PANEL B: Endline survey data (Feb 2016)					
Firm used electronic filing to submit tax reports in 2015	0.564	0.439***	0.038	1263	0.000***
	[0.496]	(0.022)	(0.037)		
Found out about e-filing during intervention training	0.796	0.202***	0.054*	1263	0.000***
	[0.403]	(0.018)	(0.029)		
Found out about e-filing from business network	0.17	-0.169***	-0.047*	1263	0.000***
	[0.376]	(0.017)	(0.027)		
Found out from another source (other training, tax Committee publication...)	0.033	-0.033***	-0.007	1263	0.011**
	[0.18]	(0.008)	(0.013)		

Notes: Column 1: Standard deviations presented in brackets. Columns 2-3: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on treatment dummies, controlling for strata dummies. ***, **, * indicate significance at 1, 5 and 10%.

The large (30 percentage point) difference between the impacts of the treatments

in Groups A and B indicates that the logistical help with registration addressed an important constraint to e-filing. This may be due to a number of reasons including reducing the hassle costs of navigating a complex registration process (Currie, 2004) or helping firms overcome procrastination. One additional possibility is that firms in Group A may have felt coerced to register for e-filing due to the follow-up support the implementing firm offered.

The lack of a significant difference between Group B and the control group could be because neither of the two interventions had any impact on firms or because control group firms' limited exposure to information on e-filing had effects as strong as the e-filing training. While there are currently no data available about a randomly selected pure control group to investigate these two possibilities, we can compare the study treatment groups to two groups of firms not included in the study: first, those firms not contacted at all after reaching the required number of firms,[27] and second, contacted firms that declined to participate in the training.[28] In both groups, the e-filing adoption rate is about two-thirds of that of the control group at 39 percent and 44 percent respectively, suggesting that the brief mentions of the availability of e-filing in the control group had a significant effect not dissimilar to the effect of detailed training on e-filing procedures and demonstration. Indeed, 80 percent of firms in the control group indicated that they had found out about e-filing from the general tax training session they attended, only five percentage points lower than the share of Group B firms that found out about e-filing through the detailed training sessions (Table 3, Panel B).[29]

We examine whether firms' compliance costs, experiences with unofficial payments, and their propensity to evade taxes affect their likelihood of adopting e-filing as outlined in the conceptual framework. Since almost all firms in the treatment group adopt e-

[27] This group is not necessarily random because the implementing firm may have selected certain types of firms to call before others.

[28] This group is also not necessarily random as firms with particular characteristics may have declined to participate.

[29] The other main source of information about e-filing for the control group was business networks (17 percent). In contrast, almost all firms in Group A learned about e-filing from the intervention trainings.

filing, we run Equation 2 using only Groups B and C and present the results in Table 4 to show which firm characteristics are associated with e-filing adoption. The first two columns of Table 4 provide results for all firms while the third column covers only legal entities.[30] We find a positive association between e-filing adoption and number of hours spent on tax preparation, supporting the hypothesis that firms with higher compliance burdens under paper filing would be more willing to switch.

In addition, we find that firm size is strongly associated with e-filing adoption: one-(wo)man businesses are significantly less likely to e-file and, among firms with employees, e-filing increases with the number of employees, suggesting that firms with more complex taxes are more likely to adopt.

Unlike our priors, we find no significant correlation between e-filing adoption and firms stating that bribe payment is common (our baseline proxy for firms that pay bribes) in Table 4. Since this measure does not distinguish between voluntary and involuntary bribes, we interact it with the risk score, as firms with higher risk scores are more likely to be voluntarily paying bribes in exchange for tax evasion support from tax officials, but find no significant effects (regressions not shown). This could be because this measure of bribes is too noisy (given the potential bias in responding directly to a sensitive question) or because no relationship between e-filing use and bribe payments exists once you control for risk score and other firm characteristics.

Importantly, Table 4 shows that firms with higher risk scores are significantly less likely to adopt e-filing. One standard deviation increase in the risk score is associated with a 7.2 percentage point decrease in a firm's likelihood of e-filing. This result is consistent with more risky firms preferring to deal directly with tax inspectors with whom they have ongoing relationships and are able to collude to pay less in taxes. Among Group A firms, this relationship does not exist (almost all firms in this group registered for e-filing). We analyze the differential selection into e-filing use by firm risk by assessing complier characteristics and calculating the relative likelihood that

[30] Since risk score is only available for legal entities, column 2 assigns the mean value for legal entities to individual enterprises.

Table 3.4: Determinants of E-filing Adoption in Groups B and C

	(1)	(2)	(3)
Dependent variable:	***Firm used E-Filing***		
	Group B & C All Sample		***Group B & C Only Legal entities***
Treatment variables			
Group B (Training alone)	0.026	0.033	0.015
	(0.033)	(0.033)	(0.040)
Administrative data (baseline)			
Female owner	-0.009	-0.009	0.010
	(0.063)	(0.063)	(0.081)
No employee	-0.133***	-0.092**	-0.147***
	(0.040)	(0.041)	(0.052)
Number of employees	0.018***	0.018***	0.017***
	(0.005)	(0.005)	(0.005)
The firms was audited in 2014	-0.034	-0.068	0.001
	(0.084)	(0.085)	(0.085)
Standardized risk profile score in 2014$^{\lambda}$		-0.072***	-0.060***
		(0.019)	(0.019)
Survey data (baseline)			
Firm has an accountant	0.059	0.062	0.039
	(0.038)	(0.038)	(0.048)
Share of technological practices implemented	0.023	0.031	0.013
	(0.043)	(0.043)	(0.049)
Number of visits to tax authority office in Jan-Jun 2014	0.012	0.008	0.005
	(0.017)	(0.017)	(0.016)
Time spent on tax related activities during a typical month (hours)	0.010**	0.011**	0.011*
	(0.005)	(0.005)	(0.006)
Number of times tax inspectors visited the company in Jan-Jun 2014	-0.016	-0.018	-0.039*
	(0.017)	(0.017)	(0.022)
Ever used e-filing (with another company)	-0.018	-0.016	-0.029
	(0.050)	(0.050)	(0.052)
Think that it is common for firms to make informal payments	-0.006	-0.010	0.036
	(0.043)	(0.043)	(0.047)
Observations	894	894	634
R-squared	0.173	0.188	0.161
Mean Dep Var in control	0.590	0.590	0.563

Notes: Robust standard errors in parentheses. Omitted group are firms in the control group that received a general tax training. Regressions include fixed effects for strata. λ: for individual entities there are no risk profile scores so missing values were replaced by the mean of the variable. ***, **, * indicate significance at 1, 5 and 10%.

compliers are high-risk firms (Angrist and Jörn-Steffen, 2008). This statistic, given

by the ratio of the "first stage"[31] among high-risk firms to the overall "first stage," (0.381/0.349=1.09) shows that compliers are 9 percent more likely to be high-risk firms. This pattern is consistent with the possibility that firms in Group A may have perceived the treatment as meaning e-filing was mandatory, thereby bringing in almost all firms, including those that would otherwise not have registered voluntarily.

Lastly, we find that other firm characteristics, such as having a female owner, prior exposure to e-filing, a firm's level of comfort with technology (measured by an index of whether a firm has high-speed internet, uses email for business communications, and maintains accounting records electronically), and having an accountant do not predict e-filing adoption.

3.7.2 Impact of Electronic Tax Filing

This section examines the impact of e-filing on compliance costs, unofficial payments, and tax payments as outlined in the conceptual framework. Table 5 presents estimates of the impact of e-filing using assignment to Group A as an instrumental variable for e-filing use.[32] The top panel shows results for the overall sample, the middle panel shows results for legal entities alone, while the bottom panel shows heterogeneous results for firms above and below the median risk score.

We find a significant impact of e-filing on compliance costs as shown in Table 5 (columns 1 and 2). Firms that e-file as a result of the program visit the tax authority 1.4 times fewer each month. In all, e-filing reduces the time firms spend on tax-related activities by 4.7 hours a month. As shown in Table 7 (column 6), this effect is concentrated in activities that involve visiting the tax authority office (submitting tax returns and obtaining the reconciliation act). As such, e-filing does fulfill the intended goal of reducing tax compliance costs of firms. The time savings corresponds to 15 percent of the overall 33 hours firms report spending on tax-related activities. A

[31] The "first stage" is the share of compliers and is given by the adoption rate in Group A minus the adoption rate in the control group

[32] For simplicity, we only present the instrumental variables results. ITT results are qualitatively similar (scaled down by a factor of about 3) and available upon request.

Table 3.5: Impact of E-filing Adoption on Main Outcomes

Dependent variables:	(1) # visits per month to tax authority office in 2015	(2) Total time spent on tax-related activities by month in 2015 (hours)	(3) Think that it is common for firms to make informal payments	(4) Tax paid in 2015$^{\alpha}$ (Admin. data) (in TJS)	(5) Inverse hyperbolic of tax paid in 2015 (Admin. data)	(6) Median of Tax paid in 2015$^{\alpha}$ (Admin. data)	(7) Tax paid in 2015$^{\alpha}$ (Survey data) (in TJS)
Overall Sample:							
(ITT) Impact of Assignment to Group A	-0.47***	-1.59***	0.023	1,904	0.028	-50	-1,480
	(0.03)	(0.36)	(0.028)	(2,860)	(0.206)	(153)	(7,497)
(IV) E-filing Impact (all firms)	-1.39***	-4.75***	0.07	5,857	0.087	-155	-4,395
	(0.06)	(1.07)	(0.084)	(8,735)	(0.631)	(474)	(22,286)
Observations	1,263	1,252	1,263	1,498	1,498	1,498	1,263
Mean outcome control group (B&C)	0.79	33.48	0.613	28,062	8.827	1,605	32,786
Mean outcome group A	0.33	31.87	0.632	29,996	8.83	1,551	30,806
E-filing Impact, Legal Entities Sample:							
(IV) E-filing Impact (Legal Entities)	-1.47***	-4.78***	-0.025	7,217	-0.049	-216	-6,980
	(0.08)	(1.2)	(0.093)	(10,937)	(0.771)	(591)	(28,230)
Observations	934	925	934	1,096	1,096	1,096	934
Mean outcome control group (B&C)	0.84	34.05	0.617	30,971	8.404	1,660	38,192
Mean outcome group A	0.32	32.37	0.608	33,533	8.41	1,586	35,082
Impact by Baseline Risk Profile Score:							
(IV) E-filing Impact for below-median risk score	-1.64***	-7.04***	-0.236	-15,099	-1.920**	-1,896*	-59,215
	(0.12)	(1.90)	(0.144)	(18,966)	(0.910)	(1,023)	(51,804)
(IV) E-filing Impact for above-median risk score	-1.33***	-2.82*	0.161	25,357**	1.060	1,145*	35,866*
	(0.08)	(1.51)	(0.119)	(12,728)	(1.075)	(671)	(19,399)
P-val difference (Low risk / High risk):	0.031	0.085	0.035	0.078	0.034	0.013	0.081
Observations	934	925	934	1,067	1,067	1,067	934
Mean Outcome in control group (B&C) for:							
… Firms below median risk score	0.84	34.42	0.637	39,686	10.076	2,295	53,095
… Firms above median risk score	0.84	33.66	0.596	23,645	7.151	1,090	22,241
Mean Outcome in group A for:							
… Firms below median risk score	0.33	32.17	0.569	36,116	9.529	1,785	37,140
… Firms above median risk score	0.32	32.58	0.652	32,433	7.604	1,455	32,803

Note: The first two parts of the table present results from 2SLS regressions measuring the impact of e-filing adoption (instrumented by assignment to group A) on outcomes presented in colums. The last part of the table presents results from 2SLS regressions measuring the heterogeneous impact of e-filing adoption (instrumented by assignment to group A) by risk profile scores. For the heterogeneous analysis, samples are restricted to legal entities because risk scores are not calculated for individual enterprises. Robust standard errors in parentheses. All regressions include control dummies for strata. α: truncated at the 99th percentile. ***, **, * indicate significance at 1, 5 and 10%.

"naive" cost effectiveness analysis comparing program costs to the amount of money firms save from lower compliance costs[33] (using the average wage of an accountant in

[33] A full cost effectiveness analysis would account for other benefits such as savings in tax administration costs.

our sample) shows that potential benefits from compliance costs reduction more than compensate program costs after 7 months (Appendix C and Appendix Table A6 detail program costs and calculations).

Using our two measures of unofficial payments, we find no overall impact of e-filing, but observe different patterns by firm risk profile. For the survey question about how widespread unofficial payments are (Table 5 column 3), we find no overall impact either in the full sample or among legal entities. However, we find a decrease of 23.6 percentage points (only marginally statistically significant with p=0.103) among low-risk firms and a positive impact of 16 percentage points (not statistically significant) among high-risk firms and the difference between the two coefficients is significant (p=0.035).

Similarly, using the list experiment, we find opposite results for high- and low-risk firms. With the list experiment, since we measure the outcome at a group (rather than individual) level, we are unable to use the instrumental variable framework and instead analyze group-level differences to report intent-to-treat (ITT) estimates. Table 6 (columns 1 and 2) shows the results for the full sample. Among firms in the combined control group (Group B and Group C), firms presented with the longer list (including "making unofficial payments" to settle problems with the Tax Authority) report carrying out 1.194 actions on average compared with 1.119 among those presented with the shorter list. This difference (0.075) is statistically significant, indicating that 7.5 percent of those in the control group reported unofficial payments. In contrast, in Group A the difference is 0.02, which is not statistically significant. Comparing the results from the treatment and control groups in a difference-in-differences framework, we find a 5.5 percentage point lower prevalence of unofficial payments in Group A but this difference is not significant.

In columns 3-6 of Table 6 we analyze results from the list experiment separately for low-risk and high-risk firms. Among low-risk firms, using the same framework described above, we find a large (18 percentage point) difference in the share of firms that paid bribes between Group A and the combined control group, indicating that the movement

Table 3.6: Impact on Informal Payments Using a List Experiment

	(1)	(2)	(3)	(4)	(5)	(6)
	All Sample		**Below median of 2014 risk profile score**		**Above median of 2014 risk profile score**	
	Group B&C	Group A	Group B&C	Group A	Group B&C	Group A
Short list (4 questions without the question on informal payments):						
Mean	1.119	1.146	1.109	1.182	1.088	1.075
SE	0.02	0.027	0.03	0.046	0.027	0.035
N	361	246	138	99	136	80
Long list (5 questions, including the question on informal payments):						
Mean	1.194	1.166	1.252	1.143	1.187	1.214
SE	0.029	0.033	0.05	0.05	0.051	0.06
N	397	259	151	98	134	98
Difference short list - long list:						
Difference	0.075**	0.02	0.143**	-0.039	0.098*	0.139*
SE Difference	0.036	0.042	0.06	0.068	0.057	0.074
P-value T-test Difference	0.038	0.643	0.017	0.569	0.087	0.06
Difference in Difference with Control group:						
Difference in Difference		-0.055		-0.182**		0.041
SE Difference		0.056		0.092		0.093
P-value T-test Difference		0.326		0.048		0.658

Note: Endline survey data, Feb 2016. Colomn 3 to 6: samples restricted to legal entities because risk scores are not calculated for individual enterprises. ***, **, * indicate significance at 1, 5 and 10%.

to electronic filing and subsequent reduced interactions with tax collectors is effective at reducing unofficial payments. On the other hand, for high-risk firms we observe a positive but not significant impact of assignment to Group A on unofficial payments, indicating that e-filing did not have the same deterrent effect on bribe payments. We discuss potential reasons for these patterns in the following section.

As with unofficial payments, we find no overall impact of e-filing on tax payments, but observe opposite effects for firms above and below the median risk score. The top and middle panels of Table 5 (columns 4-7) show no statistically significant results for the four different measures of taxes paid (total taxes for the year from administrative records, its inverse hyperbolic transformation, median tax paid, as well as self-reported tax paid). Standard errors are, however, large and we cannot reject small positive or negative impacts.

As described in the conceptual framework, we expect that the impact of e-filing on firms will differ based on firms' experiences at baseline: firms for which meeting with a tax inspector served as a constraint on the minimum payments they could make would reduce their tax payments, whereas firms that received support from tax officials to reduce their tax liability would increase their tax payments. Our heterogeneous analysis of tax payments by firm risk of evasion at baseline provides evidence for this hypothesis, as shown in the bottom panel of Table 5.

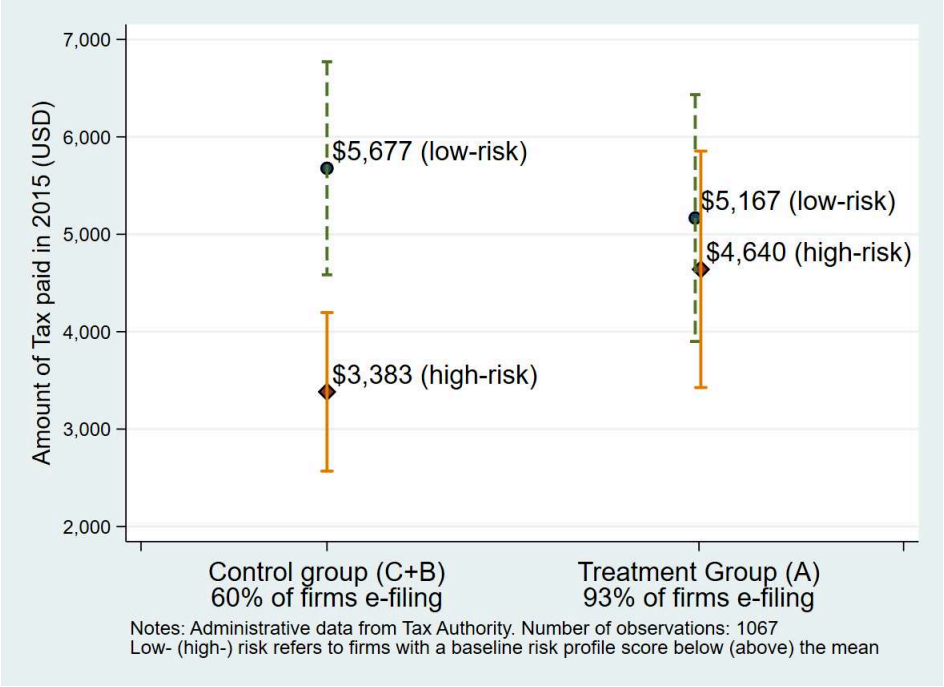
All four measures of tax payments show a similar pattern of impact from e-filing: there is a decrease in tax payments among low-risk firms and an increase in taxes paid among high-risk firms. These differences are statistically significant for the median and inverse hyperbolic sine transformation for low-risk firms (measures that are sensitive to having long tails in the distribution) and for the mean, median, and self-reported survey mean for high-risk firms.

These impacts are quantitatively large. Taking the total taxes for the year from the administrative data as an example, column 4 reveals an increase of TJS 25,357 ($3,600 USD) as a result of e-filing among high-risk firms (p=0.046). In contrast, among low-risk firms e-filing adoption results in firms paying TJS 15,099 ($2,160 USD) less in taxes, but this amount is not statistically significant (for this variable). The estimated impact on firms with above-median risk scores is significantly different than that for firms with below-median risk scores at the 10 percent level (p=0.078).

An important implication of these opposite impacts is that e-filing eliminates the tax gap that would otherwise exist between low-risk and high-risk firms. We show this result graphically in the figure 3. Among firms in the combined control group, high-risk firms pay substantially lower taxes than low-risk firms, a statistically significant difference of $2,300 (p=0.0018) likely reflecting evasion by high-risk firms. However, among firms in Group A, the difference between high- and low-risk firms falls to $527 and is not statistically significant. This result implies that e-filing helps to close the revenue gap between firms that were likely to be evading taxes and those that were not,

thereby promoting horizontal equity. Although e-filing does not change the total level of taxes paid, it changes the distribution of taxes paid across firms as low-risk firms pay less and high-risk firms pay more. As such, e-filing also has a potential redistribution effect that undoes the effect of tax officials colluding with high-risk firms to pay lower taxes and constraining low-risk firms to cover the shortfall.

Figure 3.3: E-filing Closes the Tax Revenue Gap between High- and Low-Risk Firms



We discuss below in Section 7.4 the possibility that other differences between high-risk and low-risk firms may be driving these results. We show that the results hold when we control for observable baseline differences between the two groups, suggesting this is not the case.

3.7.3 Mechanisms

This section provides additional evidence to understand the divergent results by risk group. The decrease in tax payment for low-risk firms is consistent with tax officials constraining them to an acceptable amount of tax to declare under paper filing. In

the combined control group, low-risk firms on average make positive payments more often than high-risk firms (8.3 months a year in contrast to 5.1 times for high-risk firms). Table 7 (column 1) shows that, among low-risk firms, those that e-file pay zero taxes two more months in a year on average, but this effect is not apparent for high-risk firms. The cumulative distribution function of taxes paid (Figure 4) provides additional evidence that interactions with tax officials were likely a constraint on the amounts low-risk firms declared. Figure 4 (Panel B) shows that, among low-risk firms, Group A firms paid lower taxes than control group firms, but primarily in the lower end of the distribution, which is consistent with the existence of a previous lower bound.

In addition, the simultaneous reduction in both unofficial payments and tax payments for low-risk firms suggests that the unofficial payments were more likely not for collusion to pay lower taxes but for extortion. Less-frequent interaction with tax officials due to e-filing therefore reduces the occurrence of bribe-giving.

Whereas the impact on tax payments for low-risk firms occurs primarily on the extensive margin (number of months paying positive taxes), Table 7 (column 2) indicates that the increase in tax payments for high-risk firms occurs on the intensive margin (the amount of taxes paid, conditional on paying in a given month). Similarly, the cumulative distribution function shows that, among high-risk firms, the higher tax payment among Group A firms relative to the combined control group occurs mostly on the upper end of the distribution (Figure 4, panel C). This pattern would be consistent with high-risk firms—both treatment and control—not being constrained by tax officials on the minimum amount of tax they could pay (unlike low-risk firms). However, with e-filing, treatment firms at the upper-end of the distribution lose support to reduce high levels of tax liabilities.

For high-risk firms, the increase in tax payments is consistent with their losing the opportunity to collude with tax officials to reduce their tax liabilities. From anecdotal evidence, one of the deterrents to evasion under e-filing is higher transaction costs for collusion, because after a firm submits a declaration online it is difficult to change it

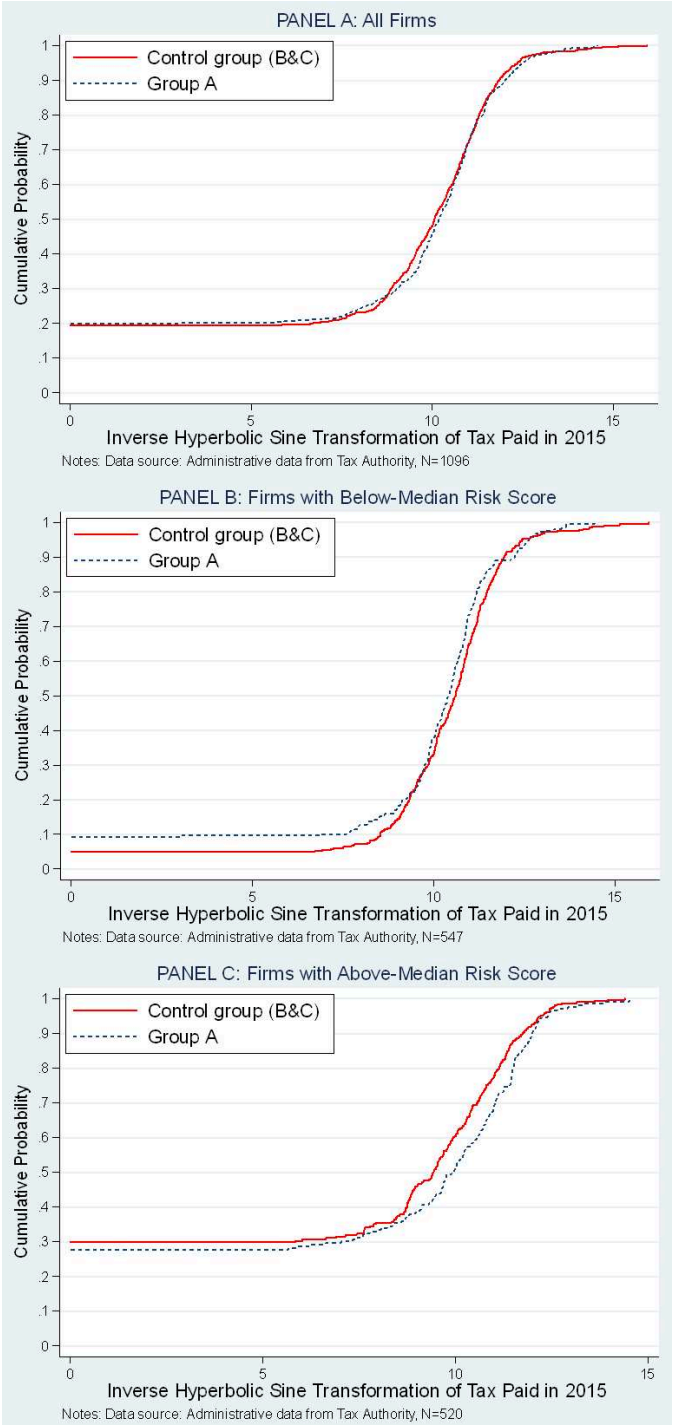
Table 3.7: Impact of E-filing Adoption: Mechanisms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Administrative data				**Survey data**		
Dependent variables:					Monthly time spent by type of task: (hours)		
	# months with a positive amount of tax paid in 2015	Tax paid in 2015 divided by # of paiments	Tax paid in Jan-June 2015	Tax paid in Jul-Dec 2015	*Collate records*	*Submit tax returns and get reconciliation act (including travel time)*	*Prepare primary documents used for tax purposes*
Overall Sample:							
(ITT) Impact of Assignment to Group A	-0.05	841**	1,211	79	-0.01	-1.12***	-0.45
	(0.23)	(396)	(1,536)	(1,469)	(0.14)	(0.06)	(0.33)
(IV) E-filing Impact (all firms)	-0.16	2,936**	3,725	242	-0.04	-3.33***	-1.35
	(0.72)	(1,397)	(4,693)	(4,515)	(0.4)	(0.14)	(0.97)
Observations	1,498	1,267	1,498	1,498	1,252	1,252	1,252
Mean outcome control group (B&C)	7.38	3,772	13,766	14,331	21.78	1.69	9.49
Mean outcome group A	7.31	4,578	14,998	14,482	21.78	0.59	8.99
E-filing Impact, Legal Entities Sample:							
(IV) E-filing Impact (Legal Entities)	-0.42	4,077**	4,386	426	0.29	-3.54***	-1.51
	(0.84)	(1,897)	(5,882)	(5,647)	(0.47)	(0.18)	(1.09)
Observations	1,096	881	1,096	1,096	925	925	925
Mean outcome control group (B&C)	6.54	4,441	14,973	16,046	22.26	1.84	9.44
Mean outcome group A	6.44	5,606	16,536	16,295	22.36	0.6	8.89
Impact by Baseline Risk Profile Score:							
(IV) E-filing Impact for below-median risk score	-2.3*	2,669	-12,106	-9,030	-0.7	-3.9***	-2.4
	(1.2)	(2,785)	(10,145)	(9,235)	(0.7)	(0.3)	(1.7)
(IV) E-filing Impact for above-median risk score	0.9	6,270**	18,089**	7,944	1.2*	-3.2***	-0.8
	(1.1)	(2,821)	(7,169)	(6,604)	(0.6)	(0.2)	(1.4)
P-val difference (Low risk / High risk):	0.051	0.382	0.016	0.139	0.042	0.025	0.479
Observations	1,067	880	1,067	1,067	925	925	925
Mean Outcome in control group (B&C) for:							
… Firms below median risk score	8.279	4,509	20,104	19,783	22.37	1.85	9.67
… Firms above median risk score	5.11	4,344	10,460	13,073	22.13	1.82	9.18
Mean Outcome in group A for:							
… Firms below median risk score	7.67	5,379	17,054	17,540	22.14	0.61	8.9
… Firms above median risk score	5.47	5,926	16,786	15,766	22.61	0.58	8.870

Note: The first two parts of the table present results from 2SLS regressions measuring the impact of e-filing adoption (instrumented by assignment to group A) on outcomes presented in colums. The second part of the table presents results from 2SLS regressions measuring the heterogeneous impact of e-filing adoption (instrumented by assignment to group A) by risk profile scores. For the heterogeneous analysis, samples are restricted to legal entities because risk scores are not calculated for individual enterprises. Robust standard errors in parentheses. All regressions include control dummies for strata. α: truncated at the 99th percentile. ***, **, * indicate significance at 1, 5 and 10%.

(unlike declarations filed on paper, which are easy to change). From the survey data, we find some additional evidence consistent with high-risk firms becoming less able to rely on assistance from colluding with tax officials. We find that the amount of time

Figure 3.4: CDF of Tax Paid in 2015 (Inverse Hyperbolic Sine Transformation) for the Whole Sample and by Risk Profile Score



firms spent daily collating records *increases* by 1.2 hours among more risky firms, while among low-risk firms there is no significant impact (p=0.042 for the difference between the two coefficients) (Table 7 column 5), suggesting that high-risk firms may now need to pay more attention to preparing their tax declaration submissions themselves.

The e-filing enrollment behavior of high-risk firms provides additional insight into the differential impact on tax payment. As noted in the discussion of e-filing adoption results, risk score is negatively correlated with e-filing adoption in the combined control group, suggesting that firms with high risk scores anticipated receiving a negative impact. In addition, we find evidence that firms in the treatment group are more likely to stop e-filing during the course of the year, an effect concentrated among high-risk firms: the drop-out rate for high-risk firms is 21 percent, relative to 9 percent for low-risk firms (Appendix Table A7).[34] In contrast, in the control group, the drop-out rates for high-risk and low-risk firms are similar at 3 percent. This finding is consistent with the notion that firms in Group A may have interpreted the logistical support for e-filing registration to mean that registration was compulsory. Given that e-filing led to an increase in tax payment for high-risk firms, it is not surprising that they were more likely to stop using it.

In line with the decline in e-filing among Group A high-risk firms, we examine whether the impact of e-filing on tax payments fades over time. It does. Whereas there is a strong and statistically significant increase in tax payments for Group A high-risk firms from January to June, the analogous result for July to December is smaller and loses statistical significance (Table 7, columns 3 and 4). In contrast, given the more modest drop in e-filing among Group A low-risk firms, the impact on taxes paid from January to June is similar to the impact from July to December and remains statistically significant for the tax payment measures for which it was statistically significant for the full period in Table 5 (regressions available on request).

[34] Appendix Table A7 shows the differences in the drop-out rate only among firms that registered for e-filing and, as such, the coefficients are descriptive, not causal. The analysis continues only until June 2015 because the data from July to December do not report e-filing use for each month.

The abandonment of e-filing by Group A high-risk firms can also explain the result that, unlike for low-risk firms, among high-risk firms no reduction in bribe payments occurs. Since the survey measuring this outcome took place in January/ February 2016, one year after program implementation, we have only a one-time measure of this outcome, which occurs after a sizable proportion of the high-risk firms have dropped out of e-filing. Since the impact on tax payments has dissipated by then, it is reasonable to assume that any collusion arrangements have resumed, such that we see no negative impact of assignment to the treated group upon the prevalence of bribes. Instead, from the list experiment (Table 6), we observe relatively high levels of bribes (10-14 percent) among high-risk firms in both treated and control groups.

3.7.4 Robustness Checks

This section discusses potential concerns to a causal interpretation of the heterogenous results obtained by baseline risk profile of firms.

Controlling for Other Sources of Impact Heterogeneity

One potential concern is that, since the baseline risk profile score of firms is correlated with other firm characteristics (Table 2), if the impacts of e-filing adoption are heterogeneous across these characteristics then initial differences in these characteristics between low- and high-risk firms may be driving our heterogeneous analysis by risk score. For example, suppose that e-filing has greater impacts on firms in a certain sector and results in those firms paying higher taxes. If firms in that sector also have higher risk scores, this effect could drive the heterogeneous results found by risk profile score.

To examine this possibility, we allow the effect of e-filing adoption to vary with other firm characteristics. To do so, we estimate the following equation for a set of H

potential explanators K_h:[35]

$$Y_i = \beta_0 + \gamma Efile \widehat{*LowRisk} + \alpha Efile \widehat{*HighRisk} + \sum_{h=1}^{H} \pi_h Efile \widehat{*LowRisk} * K_{h,i} + \sum_{h=1}^{H} \mu_h Efile \widehat{*HighRisk} * K_{h,i} + \sum_{h=1}^{H} \varphi_h K_{h,i} + \rho HighRisk + \lambda X_i + \epsilon_i \tag{3.5}$$

As in previous analyses, $Efile \widehat{*LowRisk}$, $Efile \widehat{*HighRisk}$ and other interactions terms are instrumented by assignment to group A (interacted with the same variables). For the variables K_h, we use variables that are significantly correlated with the risk scores and across which the effects of e-filing adoption could plausibly be heterogeneous. We use the following variables: *operating in the trade sector* (this sector of activity may benefit more from e-filing adoption), *declaring no employees* (one-(wo)man businesses may have simpler taxes and benefit less from e-filing), *rayon* (interactions with officials may vary across different tax offices) and *monthly amount of time spent on tax related activities* (firms with high tax compliance costs may benefit more from e-filing). All variables K_h are demeaned so we can still interpret γ and α as the impact of e-filing on low-risk and high-risk firms respectively, measured at the mean of the other variables.

Results of these estimations are presented in Table 8 and show that our main results are robust to the introduction of these additional controls. γ and α coefficients have similar magnitude and statistical significance as in Table 5.

Adjustment for Multiple Hypothesis Testing

To reduce the risk of over-rejection of the null hypothesis due to multiple inference, we correct p-values for multiple hypothesis testing. We do that using the False Discovery Rate (FDR) control method introduced by Benjamini et al. (2006) and described in Anderson (2008). This method provides sharpened two-stage q-values adjusted to account for the expected proportion of all rejections that are type-I errors. As described

[35] We follow the same strategy as in De Mel et al. (2009).

Table 3.8: Heterogeneous Impact by Baseline Risk Profile Score Including Additional Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Tax paid in 2015$^{\alpha}$					**Inverse hyperbolic of tax paid in 2015**				
(IV) E-filing Impact for below-median risk score	-12,821	-11,116	-15,762	-16,833	-10,194	-1.677*	-1.676*	-1.854**	-1.952*	-1.543
	(20,536)	(17,728)	(19,950)	(19,834)	(20,443)	(0.925)	(0.885)	(0.915)	(0.999)	(1.013)
Sharpened two stage q-values					0.808					0.362
(IV) E-filing Impact for above-median risk score	25,016**	29,879**	31,741**	26,276**	38,812**	1.026	2.031**	1.080	0.981	2.098**
	(12,738)	(13,143)	(14,669)	(13,108)	(15,771)	(1.077)	(0.881)	(1.110)	(1.093)	(0.894)
Sharpened two stage q-values					0.068					0.094
P-val difference (Low risk / High risk):	0.121	0.068	0.064	0.074	0.065	0.057	0.003	0.043	0.049	0.008
Controling for heterogeneity of E-filing impact with variable:	Trader	No employee	Technological Practices Implemented	Time spent on tax	All variables together	Trader	No employee	Technological Practices Implemented	Time spent on tax	All variables together
Observations	1,067	1,067	1,067	1,057	1,057	1,067	1,067	1,067	1,057	1,057
R-squared	0.049	0.106	0.046	0.046	0.087	0.119	0.287	0.128	0.120	0.262

Note: 2SLS regressions measuring the heterogeneous impact of e-filing adoption (instrumented by assignment to group A) by risk profile scores. Samples restricted to legal entities because risk scores are not calculated for individual enterprises. Robust standard errors in parentheses. All regressions include control dummies for strata. α: truncated at the 99th percentile. Sharpened two-stage q-values corrected for multiple hypothesis testing as described in Anderson (2008). ***, **, * indicate significance at 1, 5 and 10%.

by Anderson (2008), "FDR control is well suited to exploratory analysis because it allows a small number of type I errors in exchange of greater power than [other methods like] Familywise error rate control." We correct p-values obtained from the estimation of equation (5) which regresses our main outcomes on interactions between e-filing (instrumented by treatment assignment), high/low risk scores and other variables across which results could also be heterogeneous discussed in the previous subsection.

These results are presented in Table 8 and show that p-values for the positive impact of e-filing among high risk firms are robust to FRD control adjustment (P-value equal to 0.068 for the outcome tax paid in 2015).

Heterogeneity Analysis using Machine Learning

The fact that we did not pre-specify our heterogeneous analysis by risk score in a pre-analysis plan is a limitation of the study as it raises the concern for type I error

and overfitting.[36] To address this concern, we take advantage of the recent progress in machine learning methods used to study heterogeneity of impact of randomized experiments. In addition to the theoretical papers available such as Athey and Imbens (2016), Athey et al. (2019) and Chernozhukov et al. (2018a), there is now a growing number of empirical papers using machine learning for such analyses (for example, Davis and Heller, 2017, Hussam et al., 2018, Carter et al., 2019).

We follow the methodology described in Chernozhukov et al. (2018b) which is based on the double/ debiased machine learning approach developed by Chernozhukov et al. (2018a). A key principle of this methodology is to focus on few important features of the heterogeneity instead of trying to estimate all the possible heterogeneity. This method relies on repeated data splitting between training and test samples. Inference is obtained by taking the adjusted medians of p-values and confidence intervals obtained from multiple data splits which allows taking into account the uncertainty coming from parameter estimation and data splitting. We use this method to answer two questions: first, is there any heterogeneity? And, second, what are the characteristics of the most and least affected groups?

To answer the first question, we use random forest to compute the best linear predictor (BLP) of impact heterogeneity.[37] The heterogeneity term presented in column (2) of Appendix Table A9 shows that there is detectable heterogeneity of impact on total tax paid in 2015 (the heterogeneity parameter is however not significant for the inverse hyperbolic sine transformation of the tax paid in 2015).

Second, we perform classification analysis and compute the average baseline characteristics of the 50 percent most affected and least affected firms defined in terms of the random forest predicted effect. In this context, the 50 percent least affected would also include firms for whom e-filing had a negative impact on taxes paid. This analysis is

[36] We were unable to do this as we did not have access to the risk score before program implementation.

[37] First, we compare among different machine learning methods to compute the best linear predictor (BLP) of impact heterogeneity following Chernozhukov et al. (2018b) and we focus on the random forest as it gives the most precise results (See Appendix Table A8).

Table 3.9: Classification Analysis using Random Forest: Baseline Characteristics of the Most and Least Affected

	(1) Bottom 50% of predicted effect	(2) Top 50% of predicted effect	(3) Difference (90% CI)	(4) q-value difference$^{\mu}$
Total Tax Paid in 2015:				
Risk profile score in 2014	59	67	9	
	(55.98,62.74)	(64.04,70.84)	(3.606,13.50)	0
Risk profile score in 2014 above median	0.43	0.55	0.11	
	(0.367,0.487)	(0.484,0.605)	(0.027,0.197)	0.05
Sector of activity is Trade	0.36	0.27	-0.08	
	(0.305,0.418)	(0.216,0.328)	(-0.163,-0.005)	0.112
Number of employees	3.49	3.95	0.39	
	(3.039,3.933)	(3.485,4.389)	(-0.247,1.046)	0.522
Share of technological practices implemented	0.65	0.67	0.02	
	(0.605,0.703)	(0.618,0.717)	(-0.055,0.085)	1
Time spent on tax related activities monthly (hours)	6.479	6.421	-0.02	
	(6.102,6.852)	(6.051,6.792)	(-0.571,0.527)	1
Inverse Hyperbolic SINE transformation of Tax Paid in 2015				
Risk profile score in 2014	56.45	69.51	13.51	
	(53.12,59.79)	(66.20,72.87)	(8.937,18.12)	0.001
Risk profile score in 2014 above median	0.369	0.604	0.236	
	(0.311,0.428)	(0.545,0.663)	(0.153,0.319)	0.001
Sector of activity is Trade	0.369	0.258	-0.116	
	(0.313,0.424)	(0.203,0.314)	(-0.194,-0.037)	0.011
Number of employees	3.701	3.766	-0.015	
	(3.260,4.154)	(3.309,4.209)	(-0.638,0.633)	0.5
Share of technological practices implemented	0.621	0.705	0.084	
	(0.571,0.670)	(0.656,0.754)	(0.015,0.154)	0.027
Time spent on tax related activities monthly (hours)	6.359	6.52	0.149	
	(5.992,6.738)	(6.153,6.896)	(-0.365,0.670)	0.5

Note: Baseline average characteristics of the 50% most and least affected firms according to Random Forest predictions. Medians over 100 splits. 90% confidence intervals computed using double/debiased machine learning as described in Chernozhukov et al. (2018). μ: Sharpened two-stage q-values as described in Anderson (2008).

presented in Table 9. The results show that for the total tax paid in 2015, the average risk profile score is 13 points higher among the 50 percent most affected than among the 50 percent least affected. Similarly, for the inverse hyperbolic sine transformation of tax paid, on average, the risk profile score is 22 points higher among the 50 percent most affected than among the 50 percent least affected. The results are similar using an indicator for being above median risk score as the baseline characteristic: For the

total tax paid in 2015, the share of firms with risk score above the median (high-risk firms) is 13 percentage points lower among the 50 percent least affected, compared to the 50 percent most affected. A similar pattern holds for the inverse hyperbolic transformation of tax paid. These differences are statistically significant (even when correcting for multiple hypothesis testing).

Finally, still using random forest, we look at the relative "importance" of each baseline covariate in explaining heterogeneity of impact by looking at the frequency with which they are used as splitting variable in the random forest. Frequencies are then adjusted to give more weights to splits that occur earlier in the tree (Carter et al. (2019) use the same measure in their appendix on machine learning). For our two main outcomes, tax paid and the inverse hyperbolic sine transformation of tax paid, the risk profile score is the most "important" variable according to this measure (see Figure A1 in the appendix). We interpret these results as additional evidence that the risk profile score is important to explain heterogeneity in the impact of e-filing.

3.8 Conclusion and Policy Implications

This paper presents some of the earliest evidence on the impact of electronic tax filing. We find that firms' baseline likelihood of tax evasion is an important determinant of their willingness to use e-filing, as well as of the impact e-filing has on them. For firms in a baseline collusive equilibrium with tax officials, e-filing disrupts that collusive relationship and causes them to pay significantly higher taxes. These high-risk firms are also less likely to sign up for e-filing voluntarily and, when they do (potentially due to perceived compulsion), they are more likely to stop e-filing, indicating a preference to continue interacting directly with tax officials. On the other hand, for firms in a non-collusive equilibrium, e-filing results in lower tax payments as tax inspectors no longer constrain them to pay higher taxes (possibly higher than their true liability). At the same time, low-risk firms benefit from e-filing by becoming less exposed to coercive demands for unofficial payments. These opposing patterns of impact on tax payments

close the revenue gap that would otherwise exist between high-risk and low-risk firms.

Over time, e-filing use has continued to expand in Tajikistan. The overall impact on tax revenue from the introduction of e-filing (beyond the encouragement design considered in this study) would depend on the distribution of high-risk and low-risk firms among the total population that adopts e-filing and the relative magnitudes of the respective increase and decrease in tax payment among these two groups. Beyond the impact on tax payments, the tax authority stands to derive significant system-wide efficiency gains. Back-of-the-envelope calculations indicate that, at current e-filing rates, the tax authority frees up over 5,800 tax-official-hours each month that can be reallocated to other activities likely higher in marginal productivity than receiving tax declarations.[38]

This study's findings provide lessons extending beyond e-filing to other technologies designed to increase efficiency and reduce corruption. First, our results highlight the importance of selection among potential users. Those who anticipate negative benefits from the new technology due to expected constraints on their behavior may be the least likely to adopt. However, this may be the population segment of greatest interest. As a result, governments must weigh carefully the capacity constraints of potential users in adopting a new technology, with the potential of risky types opting out, when deciding whether to make new technologies mandatory. In Tajikistan, while e-filing was not mandatory, updated policies require that firms which start e-filing may not revert to paper filing.

Second, our results underscore the possibility of heterogeneous effects of technology. The impact of technology introduced to replace human discretion will depend on the way that discretion was previously exercised. If discretion produces worse outcomes, technology may improve outcomes (as we find with higher tax payments among high-risk firms and lower bribe payments among low-risk firms). However, if discre-

[38]This calculation assumes that a tax official spends six minutes on each tax declaration. This is a conservative estimate as the firms in our baseline survey report tax officials spending an average of 18 minutes checking their reports.

tion produces desirable outcomes (such as monitoring firms), technology may have an unanticipated effect of producing less desirable outcomes. Lastly, on a related note, our results on the distributional consequences of e-filing emphasize the potential of technology to correct possible patterns of bias resulting from human discretion.

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Appendices

Appendix A

Chapter 1

Figures

Figure A1: Timeline

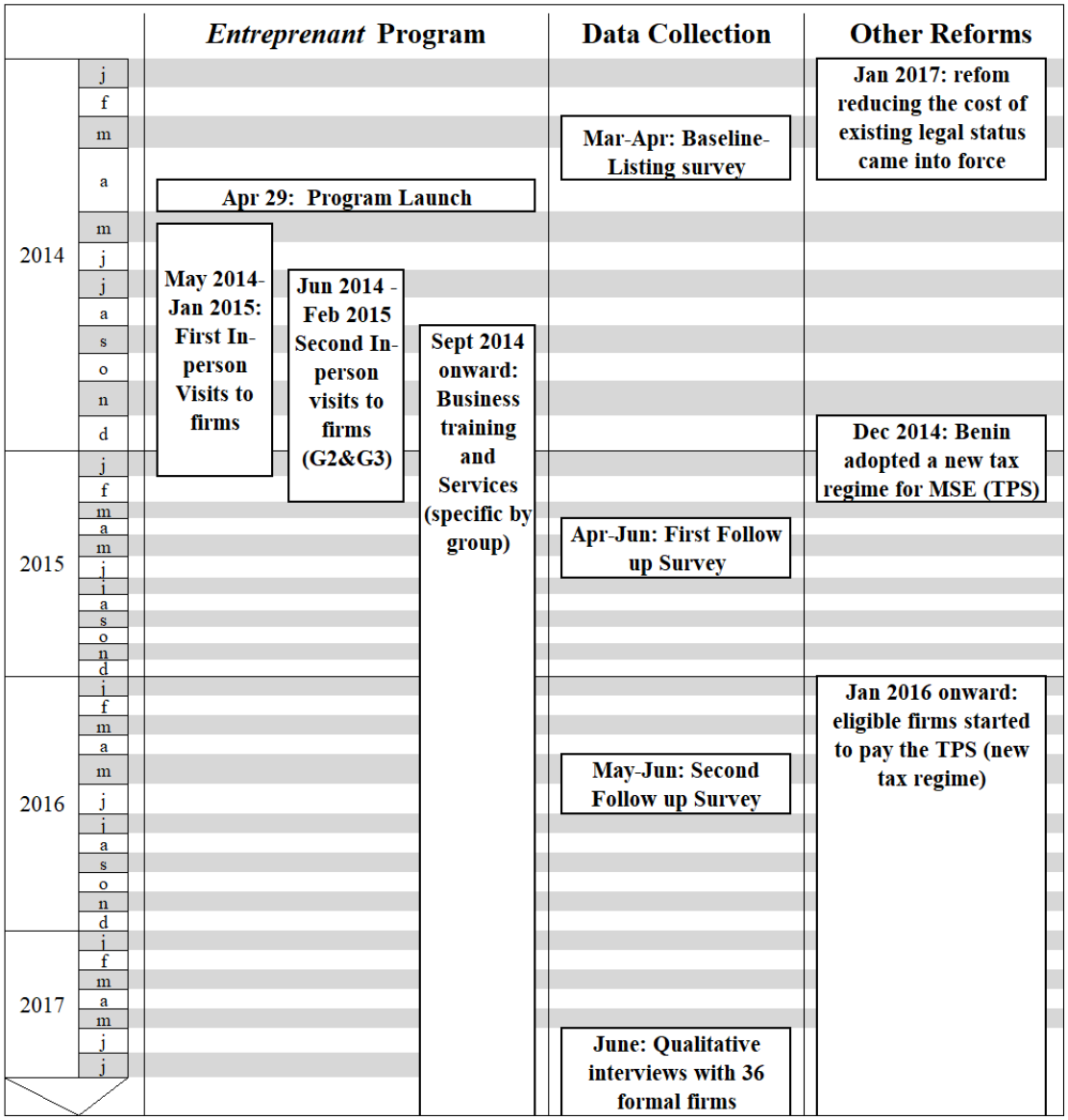


Figure A2: Evaluation Design

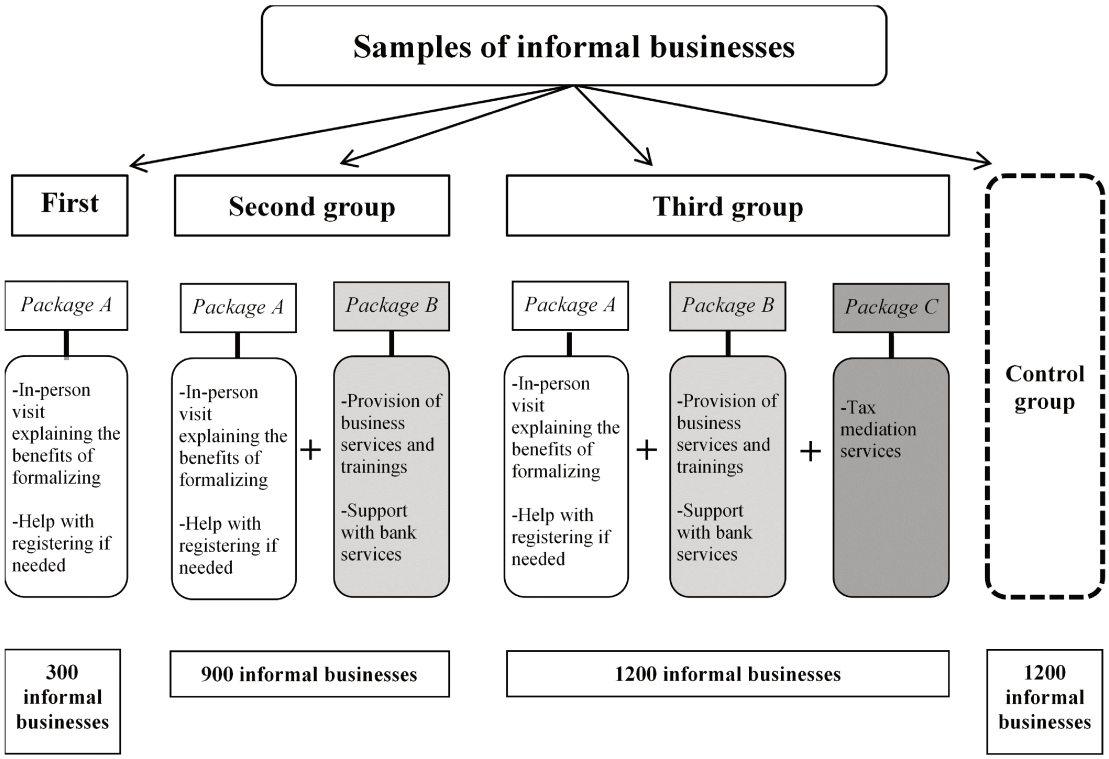
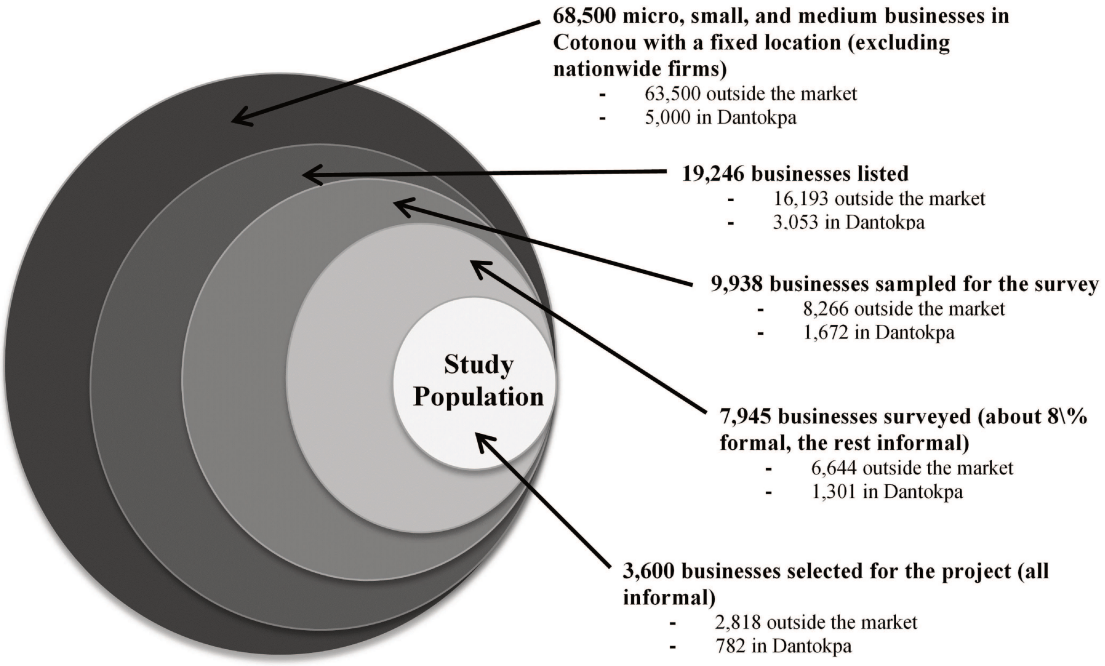


Figure A3: Sampling strategy and Survey completion rates



Tables

Table A1: Potential Benefits and Costs of Formalization in Benin

Type of status	(1) Informal (fixed location)	(2) Entreprenant status	(3) Individual enterprises	(4) Limited liability company	(5) Trader card[1]
Cost of the status	n.a.	Free of charge	CFAF 10,000 (USD 17)	CFAF 17,000 (USD 29)	Extra CFAF 5,000 (USD 8)
Time to register	n.a.	1 day	1 day	1 day	1 day
Maximum Turnover	n.a.	CFAF 30 million for traders. CFAF 20 million for craftmen, CFAF 10 million for services	No	No	No
Needs to pay taxes	55% pay taxes	Yes with tax exemptions after formalization[2]	Yes with tax exemptions after formalization[2]	Yes with tax exemptions after formalization[2]	Yes with tax exemptions after formalization[2]
Open business bank account	No (or difficult)	Yes	Yes	Yes	Yes
Apply to a bank loan	Requires collateral	Yes	Yes	Yes	Yes
Export license	No	No	No	Yes (need to get an export card)	Yes (need to get an export card)
Can work with large private companies	Possible but complicate	Yes	Yes	Yes	Yes
Access to large public contract	No	No	No	Yes	Yes
Access to small public contract	No	Yes	Yes	Yes	Yes
Access to governement training and services program with the CGA	No	Yes at annual cost of CFAF 120,000 (USD 200) (except for group 2 and 3)	Yes at annual cost of CFAF 120,000 (USD 200)	Yes at annual cost of CFAF 120,000 (USD 200)	Yes at annual cost of CFAF 120,000 (USD 200)
Registered at the chamber of Commerce	No	Yes	Yes	Yes	Yes
Provide invoices to customers for tax purposes	No	Yes	Yes	Yes	Yes
Register more than one activity for the firm	n.a.	No	Yes	Yes	Yes

Notes: [1]: For the trader card, businesses also need to get the individual enterprise status. [2]: Businesses that formalized and that had not paid taxes before, have a tax exemption for the first year after formalization. In practise, this tax exemption applied to all businesses that became formal even those already paying tax. In addition, if they register to the CGA, they can get a reduction of 40% in the amount of taxes due for the following 3 years.
1 USD = 596 CFAF (exchange rate on June 1st, 2016)

Table A2: Balance Checks Among Study Population

	(1) Mean [SD] in Control Group	(2) Difference between […] and Control group: Group 1	(3) Group 2	(4) Group 3	(5) N	(6) P-values joint tests G1=G2=G3=0
Firm owner characteristics						
Female owner[α]	0.63	*[used for randomization stratification]*				
	[0.483]					
Age of the owner	39.25	1.13	0.56	-0.2	3,557	0.113
	[10.75]	(0.73)	(0.46)	(0.41)		
Firm owner has at least some formal education	0.707	-0.034	-0.004	0.026	3,591	0.158
	[0.456]	(0.032)	(0.02)	(0.018)		
Firm characteristics						
Trade[α]	0.551	*[used for randomization stratification]*				
	[0.498]					
Services	0.259	0.007	-0.001	0.007	3,596	0.936
	[0.438]	(0.023)	(0.014)	(0.013)		
Craft	0.165	-0.008	-0.01	-0.008	3,596	0.883
	[0.371]	(0.023)	(0.014)	(0.013)		
Firm area in m²	19.02	5.99*	-0.21	-2.31	3,590	0.055*
	[42.13]	(3.15)	(1.96)	(1.75)		
Business connected to electricity network	0.617	-0.001	0.008	0.002	3,594	0.984
	[0.486]	(0.034)	(0.021)	(0.019)		
Number of employee	1.18	-0.04	-0.02	0.02	3,596	0.861
	[1.68]	(0.09)	(0.06)	(0.05)		
The firm does any form of accounting	0.173	0.013	-0.001	0.015	3,594	0.678
	[0.378]	(0.027)	(0.017)	(0.015)		
Amount of sales in an average week	60,828	73	281	-1,052	3,596	0.755
	[57,039]	(2,257)	(1,405)	(1,255)		
Amount of profit in the last month	46,249	139	316	1,156	3,596	0.791
	[44,867]	(2,135)	(1,329)	(1,188)		
Firm owner owns a bank account[α]	0.22	*[used for randomization stratification]*				
	[0.414]					
Taxes						
Firm pays taxes	0.561	-0.013	-0.017	-0.022	3,560	0.687
	[0.496]	(0.033)	(0.021)	(0.018)		
Amount of taxes paid in the previous year	19,450	-3,867**	-306	-657	3,482	0.269
	[28,146]	(1,952)	(1,211)	(1,077)		
P-values of joint orthogonality tests for:						
Group 1 versus control group	0.181					
Group 2 versus control group	0.915					
Group 3 versus control group	0.576					

Notes: Baseline survey data (March 2014). Column 1: Standard deviations presented in brackets. Columns 2-4: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on treatment dummies, controlling for strata dummies (dummies for each triplet). **α**: Variables used to stratify the randomization and therefore not used for balancing tests . ***, **, * indicate statistical significance at 1, 5 and 10%.

Table A3: Follow-up Surveys Attrition

	(1)	(2)	(3)	(4)	(5)	(6)
	Mean [SD] in Control Group	Difference between […] and Control group				P-values joint tests
		Group 1	Group 2	Group 3	N	G1=G2=G3=0
Two years follow-up survey results (May-June 2016):						
Surveyed and business still operating	0.712	0.006	0.012	0.009	3,596	0.937
	[0.453]	(0.033)	(0.02)	(0.018)		
Surveyed with short phone survey and business still operating	0.037	0.005	-0.007	0.004	3,596	0.599
	[0.188]	(0.014)	(0.009)	(0.008)		
Surveyed and business shut down	0.081	-0.006	0.015	0.008	3,596	0.635
	[0.273]	(0.021)	(0.013)	(0.012)		
Surveyed and business owner deceased	0.012	0.015**	-0.006	-0.004	3,596	0.058*
	[0.108]	(0.007)	(0.005)	(0.004)		
Survey attrition (refused, not found, sickness, traveling, maternity leave..)	0.159	-0.02	-0.014	-0.018	3,596	0.61
	[0.366]	(0.026)	(0.016)	(0.014)		
Including refused to answer	0.083	0.001	-0.013	-0.005	3,596	0.759
	[0.276]	(0.02)	(0.012)	(0.011)		
One year follow-up survey results (April-May 2015):						
Surveyed and business still operating	0.811	0.008	-0.023	-0.013	3,596	0.575
	[0.392]	(0.029)	(0.018)	(0.016)		
Surveyed with short phone survey and business still operating	0.01	0.015	0.002	0.014***	3,596	0.025**
	[0.1]	(0.009)	(0.006)	(0.005)		
Surveyed and business shut down	0.057	-0.002	0.008	0.007	3,596	0.844
	[0.232]	(0.018)	(0.011)	(0.01)		
Surveyed and business owner deceased	0.004	0	0.001	-0.003	3,596	0.57
	[0.065]	(0.004)	(0.003)	(0.002)		
Survey attrition (refused, not found, sickness, traveling, maternity leave..)	0.118	-0.023	0.012	-0.005	3,596	0.517
	[0.322]	(0.023)	(0.014)	(0.013)		
Including refused to answer	0.066	-0.007	0.006	0.009	3,596	0.749
	[0.248]	(0.018)	(0.011)	(0.01)		

Notes: Column 1: Standard deviations presented in brackets. Columns 2-4: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on treatment dummies, controlling for strata dummies (dummies for each triplet). ***, **, * indicate statistical significance at 1, 5 and 10%. Sample sizes by group are the following: control group: 1,197, group1: 301, group 2: 899, group 3: 1,199.

Table A4: Balance Checks among Businesses Surveyed at second follow-up survey

	(1) Mean [SD] in Control Group	(2) Difference between […] and Control group: Group 1	(3) Group 2	(4) Group 3	(5) N	(6) P-values joint tests G1=G2=G3=0
Firm owner characteristics						
Female owner[α]	0.627	*[used for randomization stratification]*				
	[0.484]					
Age of the owner	39.37	0.93	0.55	-0.01	3,035	0.407
	[10.58]	(0.81)	(0.51)	(0.46)		
Firm owner has at least some formal education	0.724	-0.049	-0.009	0.015	3,061	0.256
	[0.447]	(0.035)	(0.023)	(0.02)		
Firm characteristics						
Trade[α]	0.536	*[used for randomization stratification]*				
	[0.499]					
Services	0.262	0.017	0.006	0.005	3,064	0.915
	[0.44]	(0.026)	(0.017)	(0.015)		
Craft	0.176	-0.015	-0.023	-0.005	3,064	0.523
	[0.381]	(0.026)	(0.017)	(0.015)		
Firm area in m²	19.4	6.39*	0.5	-2.56	3,059	0.084*
	[43.52]	(3.77)	(2.39)	(2.14)		
Business connected to electricity network	0.617	-0.016	0.006	0.003	3,063	0.961
	[0.486]	(0.038)	(0.024)	(0.021)		
Number of employee	1.22	-0.07	-0.05	0.07	3,064	0.21
	[1.7]	(0.11)	(0.07)	(0.06)		
The firm does any form of accounting	0.174	-0.007	0.002	0.005	3,062	0.976
	[0.379]	(0.03)	(0.019)	(0.017)		
Amount of sales in an average week	59,792	174	968	-1,237	3,064	0.543
	[56,781]	(2,500)	(1,586)	(1,414)		
Amount of profit in the last month	46,563	648	-47	-979	3,064	0.821
	[45,839]	(2,345)	(1,488)	(1,327)		
Firm owner owns a bank account[α]	0.227	*[used for randomization stratification]*				
	[0.419]					
Taxes						
Firm pays taxes	0.555	-0.015	-0.027	-0.033	3,037	0.454
	[0.497]	(0.038)	(0.024)	(0.021)		
Amount of taxes paid in the previous year	19,779	-4,285**	-657	-1,413	2,976	0.227
	[28,779]	(2,160)	(1,369)	(1,214)		
P-values of joint orthogonality tests for:						
Group 1 versus control group	0.046					
Group 2 versus control group	0.45					
Group 3 versus control group	0.804					

Notes: Baseline survey data (March 2014). Column 1: Standard deviations presented in brackets. Columns 2-4: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on treatment dummies, controlling for strata dummies (dummies for each triplet). **α**: Variables used to stratify the randomization and therefore not used for balancing tests . ***, **, * indicate statistical significance at 1, 5 and 10%.

Table A5: Species Classification: Correlates of Been Formal in Listing Survey Data

	(1)
Dependent variable:	Formal Status
Operates in Tokpa Market	-0.211
	(0.157)
Woman business owner	-0.602***
	(0.111)
Age	0.037***
	(0.005)
Level of education (omit. No education)	
Primary school	0.089
	(0.185)
Secondary School	0.435***
	(0.159)
Higher level of education	0.757***
	(0.190)
Sector of activity (omit. Trade)	
Services	-0.271**
	(0.133)
Craftman	-1.018***
	(0.196)
Business created less than one year ago	0.150
	(0.159)
Connected to electricity network	0.910***
	(0.155)
Number of employee	0.095***
	(0.021)
The firm does any form of accounting	0.973***
	(0.111)
Has done any advertizing in the last 6 months	0.335*
	(0.177)
Log total amount of sales in an average week	0.227***
	(0.057)
Log amount of profit in the last month	0.126*
	(0.065)
Firm owner owns a bank account	1.487***
	(0.122)
Firm pays taxes	0.956***
	(0.142)
Constant	-10.378***
	(0.636)
Observations	7,829
Pseudo R-squared	0.365
Mean Dep. variable (Share of formal firms)	0.078
Share of informal firms in study sample "looking like formal species"	0.182

Note: Logit regression. Species Classification conducted using the "discrim logit" command in Stata

Table A6: Impact of the "leaflets intervention"

	(1) (IV) Formalized after May 2016 (Admin Data)
Received a leaflet	0.010
(Instrumented by assignment to leaflet group)	(0.006)
Observations	1,197
R-squared	0.050
Share of firm selected in Leaflet group that received it	0.706
Formalization rate in control (no leaflet) group	0.003

Note: Administrative data from GUFE: May, June and July 2016) and survey folow up data 2016. IV regressions, controlling for strata dummies (used to randomize the "leaflets intervention"). ***, **, * indicate statistical significance at 1, 5 and 10%.

Table A7: Impact on Other Intermediate Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Has done any type of advertising in the last 6 months[B]	**Standardized index of business presentation[η]**	**Value of inventories and raw materials[α]**	**Actual value of all investments done in the firm[α]**	**Number of customers in a typical week[α]**	**Has gained a new regular customer in the past 3 months**	**Introduced a new product or services in the last 12 months**	**Standard-ized index of trust in institutions**	**Subjective standard of living on a Cantril ladder[λ]**	**Anticipated Subjective standard of living in 5 years on a Cantril ladder[λ]**
1st stage: impact of treatment allocation:										
Group1 X year1 (b1)	-0.021	-0.016	-81,855	-492,949***	-3.33	-0.034		0.077	-0.046	-0.033
	(0.026)	(0.053)	(118,108)	(175,080)	(4.46)	(0.031)		(0.081)	(0.147)	(0.139)
Group2 X year1 (b2)	-0.037**	-0.025	-141,562*	-116,823	-3.63	-0.015		-0.001	-0.177*	-0.034
	(0.016)	(0.033)	(72,254)	(114,176)	(2.98)	(0.019)		(0.049)	(0.094)	(0.082)
Group3 X year1 (b3)	-0.031**	-0.008	-20,556	-102,287	-1.74	-0.020		0.068	-0.051	-0.080
	(0.014)	(0.029)	(66,740)	(101,130)	(2.62)	(0.017)		(0.043)	(0.086)	(0.076)
Group1 X year2 (c1)	0.037	-0.020	507,258**	306,979	-1.36	0.002	0.025		0.170	0.239*
	(0.029)	(0.050)	(243,549)	(256,853)	(4.74)	(0.031)	(0.035)		(0.173)	(0.145)
Group2 X year2 (c2)	0.016	-0.059*	364,556***	206,022	-6.07**	0.008	-0.012		0.189*	0.285***
	(0.018)	(0.031)	(122,084)	(139,484)	(2.96)	(0.020)	(0.023)		(0.099)	(0.080)
Group3 X year2 (c3)	0.002	-0.026	449,110***	143,176	-1.98	-0.003	0.003		0.279***	0.171**
	(0.015)	(0.027)	(127,183)	(127,976)	(2.59)	(0.018)	(0.021)		(0.091)	(0.074)
Observations	5,390	4,367	4,503	5,102	5,071	5,357	2,561	2,623	5,294	5,109
Mean Dep. var in control year1	0.134	00	572,740	1,693,253	46.46	0.799	.	-0.002	4.602	8.638
Mean Dep. var in control year2	0.153	-0.012	1,151,506	1,971,251	45.23	0.805	0.162	.	4.845	8.950
Adjusted R-squared	0.067	0.092	0.293	0.281	0.133	0.059	0.051	0.033	0.092	0.041
Test for impact constant…										
...accross treatments, year1 (b1=b2=b3)	0.849	0.900	0.232	0.088	0.820	0.854	0.000	0.369	0.461	0.869
...accross treatments, year 2 (c1=c2=c3)	0.455	0.588	0.820	0.805	0.421	0.877	0.621	0.000	0.660	0.442
Coef. are jointly 0 (b1=b2=b3=c1=c2=c3=0)	0.007	0.658	0.000	0.000	0.566	0.732	0.812	0.336	0.000	0.000
(IV) impact of Formalization:										
Formalization instrumented by 1st stage	-0.078	-0.150	679,408*	52,453	-15.20	-0.055	-0.000	0.243	0.352	0.323
treatment variables	(0.062)	(0.117)	(362,873)	(478,538)	(10.78)	(0.070)	(0.099)	(0.196)	(0.356)	(0.286)
P-values	0.213	0.200	0.061	0.913	0.158	0.437	0.999	0.214	0.323	0.259
Sharpened two-stage q-values[μ]	0.749	0.749	0.749	0.76	0.749	0.749	0.76	0.749	0.749	0.749

Note : Panel data from midline and endline surveys in 2015 and 2016. All regressions are controlling for strata dummies (dummies for each triplet). Standard errors (in parentheses) are clustered at the firm level. **α:** top-coded at the 99th percentile. **B:** controling for baseline value. **η:** the standardized summary index includes the following questions: "Is the business premise generally well organized?", "Is the premise generally clean and in good shape?", Are there posters or pictures advertizing some products or services in particular?", "Are prices of merchandizes visible inside the premise?", "Are commodities grouped by type?", "Are commodities globally clean and in good shape?" (last three questions were only asked to traders). **λ**: The Cantril ladder goes from 0 to 10 with 10 for the best situation possible.**μ**: Sharpened two-stage q-values as described in Anderson (2008) ***, **, * indicate statistical significance at 1, 5 and 10%

Table A8: Impact on Other Measures of Business Performance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Inverse hyperbolic of sales in the last day$^{\alpha\beta}$	**Inverse hyperbolic of sales in the last week$^{\alpha\beta}$**	**Inverse hyperbolic of Last month profit$^{\alpha\beta}$**	**Above the 95th percentile of the control group weekly sales distribution**	**Above the 95th percentile of the control group profit distribution**	**Hired someone in the last 6 months**	**Number of hours worked in the business last week by the owner**	**Sales > baseline Sales**	**Profit > baseline Profit**	**Sales > predicted Sales$^{\delta}$**	**Profit > Predicted Profit$^{\delta}$**
1st stage: impact of treatment allocation:											
Group1 X year1 (b1)	0.298	-0.073	0.135	-0.041***	-0.002	0.000	-7.30***	-0.016	-0.041	-0.003	0.002
	(0.345)	(0.327)	(0.302)	(0.015)	(0.015)	(0.044)	(1.98)	(0.034)	(0.030)	(0.035)	(0.036)
Group2 X year1 (b2)	0.454**	0.160	-0.073	0.003	0.008	0.004	-2.85**	-0.004	-0.011	-0.006	-0.016
	(0.210)	(0.190)	(0.189)	(0.009)	(0.009)	(0.027)	(1.14)	(0.020)	(0.018)	(0.022)	(0.022)
Group3 X year1 (b3)	0.023	0.018	-0.038	0.000	0.005	0.055**	-4.12***	0.006	-0.006	0.003	-0.003
	(0.188)	(0.175)	(0.172)	(0.009)	(0.009)	(0.024)	(1.06)	(0.018)	(0.016)	(0.019)	(0.020)
Group1 X year2 (c1)	-0.972***	-0.294	-0.243	0.009	0.006	0.017	1.17	-0.042	-0.031	-0.006	0.012
	(0.368)	(0.326)	(0.310)	(0.019)	(0.018)	(0.028)	(1.75)	(0.034)	(0.031)	(0.037)	(0.036)
Group2 X year2 (c2)	-0.212	-0.423**	-0.492**	0.017*	-0.001	-0.016	0.89	-0.039*	-0.043**	-0.026	-0.013
	(0.218)	(0.204)	(0.199)	(0.010)	(0.010)	(0.017)	(1.06)	(0.020)	(0.018)	(0.022)	(0.022)
Group3 X year2 (c3)	-0.165	-0.193	-0.258	0.008	0.001	0.009	1.84*	-0.040**	-0.023	-0.030	-0.003
	(0.192)	(0.178)	(0.176)	(0.009)	(0.010)	(0.016)	(0.98)	(0.018)	(0.016)	(0.019)	(0.020)
Observations	5,918	6,043	5,874	5,408	5,410	4,081	5,422	6,043	5,874	6,043	5,874
Mean Dep. var in control year1	6.646	9.753	9.727	0.046	0.049	0.226	61.75	0.359	0.256	0.477	0.448
Mean Dep. var in control year2	6.292	9.509	9.303	0.056	0.053	0.118	66.7	0.324	0.251	0.454	0.415
Adjusted R-squared	0.125	0.138	0.123	0.131	0.148	0.077	0.112	0.134	0.187	0.113	0.102
Test for impact constant…											
...accross treatments, year1 (b1=b2=b3)	0.166	0.728	0.825	0.024	0.839	0.232	0.129	0.771	0.517	0.925	0.837
...accross treatments, year 2 (c1=c2=c3)	0.106	0.585	0.538	0.701	0.946	0.344	0.704	0.997	0.608	0.814	0.811
Coef. are jointly 0 (b1=b2=b3=c1=c2=c3=0)	0.002	0.052	0.105	0.038	0.974	0.226	0.000	0.074	0.211	0.610	0.992
(IV) impact of Formalization:											
Formalization instrumented by 1st stage	-0.156	-0.545	-1.027	0.028	0.019	0.081	-7.35*	-0.101	-0.109	-0.076	-0.032
treatment variables	(0.832)	(0.803)	(0.814)	(0.035)	(0.036)	(0.066)	(4.36)	(0.080)	(0.071)	(0.087)	(0.088)
P-values	0.851	0.498	0.208	0.411	0.596	0.220	0.092	0.207	0.128	0.382	0.716
Sharpened two-stage q-values$^{\mu}$	0.938	0.938	0.938	0.938	0.938	0.938	0.938	0.938	0.938	0.938	0.938

Note : Panel data from midline and endline surveys in 2015 and 2016. All regressions are controlling for strata dummies (dummies for each triplet). Standard errors (in parentheses) are clustered at the firm level. **α:** top-coded at the 99th percentile. **B:** controling for baseline value. **μ**: Sharpened two-stage q-values as described in Anderson (2008). **δ:** Profits/sales predicted using the comand "predict" in Stata and OLS regressions of profits/sales on baseline characteristics (same variables as in table A5). ***, **, * indicate statistical significance at 1, 5 and 10%

Table A9: Mechanisms Explaining Take up on Formalization

	(1) Mean [SD] Control Group	(2) Difference between […] and Control group: Group 1	(3) Group 2	(4) Group 3	(5) N	(6) P-values of joint test G1=G2=G3=0
PANEL A: formal businesses (according to survey): two main reasons why registered:						
Being able to open a bank account/ It is easier to get a loan	0.196	-0.14	0.189	-0.037	367	0.358
	[0.401]	(0.24)	(0.19)	(0.164)		
To comply with the law/get access to the legal system/not been fined or asked for bribes	0.478	-0.118	-0.273	-0.199	367	0.635
	[0.505]	(0.268)	(0.212)	(0.183)		
It gives access to new markets (public administration and large companies)	0.413	-0.503**	-0.223	-0.313*	367	0.147
	[0.498]	(0.233)	(0.185)	(0.16)		
Better reputation/social acceptance for the business	0.217	0.069	-0.057	-0.102	367	0.783
	[0.417]	(0.227)	(0.18)	(0.156)		
It gives access to government or NGO program (including the CGA)	0.043	0.545**	0.31	0.415**	367	0.079*
	[0.206]	(0.246)	(0.195)	(0.168)		
Including:						
It gives access to CGA benefits	0	0.328	0.19	0.326*	367	0.223
	[0]	(0.239)	(0.189)	(0.164)		
Other	0.152	0.331**	0.244*	0.235**	367	0.131
	[0.363]	(0.161)	(0.127)	(0.11)		
PANEL B: informal businesses: two main reasons why not registered:						
Answered that she is going to formalize soon	0.176	0.003	0.003	0.007	2,217	0.991
	[0.381]	(0.039)	(0.025)	(0.023)		
High registration costs / registration process complicate or time consuming	0.319	-0.104**	-0.016	0.016	2,217	0.079*
	[0.466]	(0.048)	(0.031)	(0.028)		
Doesn't see any benefits of formalization / the business is too small	0.309	0.065	-0.005	0.014	2,217	0.571
	[0.462]	(0.048)	(0.031)	(0.028)		
It increases the amount of taxes to be paid/ risk of tax inspection	0.284	-0.052	-0.004	-0.027	2,217	0.599
	[0.451]	(0.046)	(0.03)	(0.027)		
Doesn't have enough information on formalization	0.089	0.015	-0.018	-0.047***	2,217	0.02**
	[0.285]	(0.028)	(0.018)	(0.017)		
Doesn't have a legal ID	0.014	0.021	0.015	0.008	2,217	0.244
	[0.116]	(0.014)	(0.009)	(0.009)		
More paperwork / it requires to do accounting	0.006	0.021*	0.000	0.014*	2,217	0.104
	[0.079]	(0.012)	(0.008)	(0.007)		
More corruption	0.005	-0.011	-0.002	-0.002	2,217	0.459
	[0.07]	(0.007)	(0.004)	(0.004)		
Husband forbid it	0	0.001	0.003	0.003	2,217	0.667
	[0]	(0.004)	(0.003)	(0.003)		
Other	0.015	0.033**	-0.003	0.014	2,217	0.077*
	[0.121]	(0.015)	(0.01)	(0.009)		

Notes: Data from second follow-up survey (June 2016). Column 1: Standard deviations presented in brackets. Columns 2-4: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on treatment dummies, controlling for strata dummies (dummies for each triplet). ***, **, * indicate statistical significance at 1, 5 and 10%.

Table A10: Implementation Costs

	(1)	(2)	(3)	(4)	(5)
	TOTAL COSTS		**Share**	**Share**	**Share**
	In CFAF	**In USD**	**Group 1**	**Group 2**	**Group 3**
Costs associates to GUFE (one-stop-shop for formalization)					
Set up costs:					
-Set up costs of Hardware and Sofware: 3 computers including softwares and buying and setting up the server	4,500,000	7,550	12.5%	37.5%	50%
-Investments required to edit Entreprenant cards: printer and software	12,500,000	20,973	12.5%	37.5%	50.0%
Variable costs:					
-Salary of GUFE entreprenant staffs : Two full-time staffs for 18 months, and one for 12 months	21,600,000	36,242	12.5%	37.5%	50%
-Hardware and sofware: Maintenance for 2 years	6,812,344	11,430	12.5%	37.5%	50%
-Office supplies	5,190,000	8,708	12.5%	37.5%	50%
Costs associates to the CGA (implementing agency)					
Set up costs:					
- Initial training of CGA advisors	13,450,000	22,567	5.1%	42.0%	52.8%
- Motorbikes for CGA advisors (including insurance)	19,200,000	32,215	5.1%	42.0%	52.8%
- Office and mobile phones (one phone for each advisor)	1,250,000	2,097	5.1%	42.0%	52.8%
- Hardware and sofware: computers, servers and equipements	35,553,000	59,653	5.1%	42.0%	52.8%
- Set up costs of upgrading CGA office	1,010,000	1,695	5.1%	42.0%	52.8%
Variable costs:					
- Salary of CGA staffs for 2 years: CGA supervisor, 24 advisors (10 of them only for 14 months) and one hotline	175,144,000	293,866	5.1%	42.0%	52.8%
- CGA overheads: printing, administrative fees, office supplies, water and electricity	12,979,560	21,778	5.1%	42.0%	52.8%
- Transportation costs: gasoline	18,600,000	31,208	5.1%	42.0%	52.8%
- Communication	11,160,000	18,725	0.0%	44.3%	55.7%
- Maintenance of hardware and sofware:	6,147,000	10,314	5.1%	42.0%	52.8%
- Office rent	9,600,000	16,107	5.1%	42.0%	52.8%
- Group trainings organization: office supplies and coffee breaks	16,500,000	27,685	0.0%	44.3%	55.7%
Total Set up costs	87,463,000	146,750	6.5%	41.2%	52.3%
Total Variable costs	283,732,904	476,062	5.5%	41.7%	52.8%
Total costs of program implementation	371,195,904	622,812	5.7%	41.6%	52.7%

Notes: Data on costs and group allocation from CGA and GUFE. 1 USD = 596 CFAF (exchange rate on June 1st, 2016)

Table A11: Expected Increase in Tax Revenue

	CFAF			USD		
	All	Looking like formal species	At least secondary education	All	Looking like formal species	At least secondary education
Businesses that formalized in treatment groups	395	108	222	395	108	222
Average anual turnover (2014)	2,893,504	3,796,144	2,912,773	4,855	6,369	4,887
Share of businesses paying any tax in 2014	0.551	0.75	0.584	0.551	0.75	0.584
Average amount paid in 2014 (conditional on paying any tax)	44,301	55,004	47,912	74	92	80
Average amount of tax paid in 2014	24,006	40,994	27,692	40	69	46
Expected tax amount after formalization	50,908	69,769	51,816	85	117	87
Expected increase in tax revenue: (Tax in new system - Average paid in 2014)	27,185	29,319	24,249	46	49	41
Variable cost per formalization with treatment 1	539,058	413,997	369,640	904	695	620
Number of years before tax revenue are greater than cost per formalization in Group 1$^{\alpha}$	19	13	14	19	13	14
Assuming a (one time) 20% increase in turnover:						
Expected increase in tax revenue	30,929	32,308	27,282	52	54	46
Number of years before tax revenue are greater than cost per formalization in Group 1$^{\alpha}$	16	12	13	16	12	13
Assuming a 60% increase in turnover (upper bound of impact on turnover in Table 7):						
Expected increase in tax revenue	49,509	58,513	45,053	83	98	76
Number of years before tax revenue are greater than cost per formalization in Group 1$^{\alpha}$	10	6	7	10	6	7
Assuming a 10% annual increase in turnover						
Total expected increase in tax revenue after 5 years$^{\alpha}$	180,894	203,446	165,122	304	341	277
Total expected increase in tax revenue after 10 years$^{\alpha}$	577,299	687,190	543,408	969	1,153	912
Number of years before tax revenue are greater than cost per formalization in Group 1$^{\alpha}$	10	8	8	10	8	8

Notes: 1 USD = 596 CFAF (exchange rate on June 1st, 2016). See Tables 5 and A6 for more details on program costs.
α : including one year of tax exemption following firm formalization

Table A12: Panel Data: Heterogeneous Impact of Formalization on Firm Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Heterogenous variables:	**Female owner**			**Operating in Dantokpa market**			**Doesn't look like formal species**			**Does not have secondary education**			**Index of business size below median**		
Dependent variables:	Profits$^{\alpha}$	Index of profits and sales	Number of emplo· yees$^{\alpha}$	Profits$^{\alpha}$	Index of profits and sales	Number of emplo· yees$^{\alpha}$	Profits$^{\alpha}$	Index of profits and sales	Number of emplo· yees$^{\alpha}$	Profits$^{\alpha}$	Index of profits and sales	Number of emplo· yees$^{\alpha}$	Profits$^{\alpha}$	Index of profits and sales	Number of emplo· yees$^{\alpha}$
Impact of Formalization on dep. var. for heterogeneous variable=0															
Formalized (Gufe data)	-16,140	0.039	0.29	-15,696	-0.225*	-0.09	-47,233	0.015	-0.46	-22,447	0.111	-0.44	-11,342	-0.097	-0.05
(Instrumented by treatment assignment)	(19,827)	(0.177)	(0.49)	(12,898)	(0.124)	(0.34)	(29,063)	(0.295)	(0.77)	(18,721)	(0.189)	(0.37)	(22,347)	(0.228)	(0.54)
Sharpened two-stage q-values$^{\mu}$	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Impact of Formalization on dep. var. for heterogeneous variable=1															
Formalized (Gufe data) x Heterog. var.	10,419	-0.100	-0.86	66,261	1.978**	-0.05	53,158	-0.009	0.46	27,451	-0.277	0.73	6,628	0.154	-0.16
(Instrumented by Group$_i$ x year$_t$ x Heterog. var.)	(26,919)	(0.280)	(0.62)	(59,162)	(0.781)	(0.63)	(33,261)	(0.340)	(0.85)	(31,897)	(0.347)	(0.71)	(26,586)	(0.284)	(0.62)
Sharpened two-stage q-values$^{\mu}$	1	1	1	1	0.52	1	1	1	1	1	0.982	1	1	1	1
Observations	5,874	5,926	6,206	5,874	5,926	6,206	5,874	5,926	6,206	5,874	5,926	6,206	5,874	5,926	6,206
R-squared	0.328	0.406	0.471	0.326	0.370	0.474	0.326	0.407	0.474	0.327	0.406	0.471	0.329	0.404	0.474
Mean heterogenous variable	0.621	0.622	0.624	0.193	0.196	0.198	0.823	0.824	0.820	0.594	0.593	0.59	0.506	0.505	0.502
Formalization rate in Control hetero=0	0.037	0.037	0.035	0.025	0.024	0.024	0.053	0.052	0.049	0.039	0.038	0.036	0.031	0.03	0.03
Formalization rate in Control hetero=1	0.014	0.013	0.014	0.015	0.013	0.014	0.016	0.015	0.016	0.011	0.01	0.012	0.014	0.014	0.014
Mean Outcome control year1 hetero=0	60,623	-0.067	1.606	45,481	-0.124	1.316	81,683	0.241	1.744	62,789	0.023	1.074	68,219	0.159	1.669
Mean Outcome control year2 hetero=0	62,985	-0.037	1.646	50,227	-0.085	1.347	83,543	0.232	1.792	62,399	0.011	1.248	68,881	0.16	1.703
Mean Outcome control year1 hetero=1	48,918	0.009	0.856	83,291	0.393	0.433	46,930	-0.078	0.996	46,554	-0.05	1.179	39,120	-0.188	0.617
Mean Outcome control year2 hetero=1	49,424	0.018	0.986	72,117	0.326	0.771	47,799	-0.057	1.101	48,966	-0.012	1.221	40,281	-0.166	0.759

Note : Panel data from midline and endline surveys in 2015 and 2016. All regressions including control for baseline values of the dependent variable (if available) and strata dummies (dummies for each triplet). α: truncated at the 99th percentile. μ: Sharpened two-stage q-values as described in Anderson (2008). ***, **, * indicate statistical significance at 1, 5 and 10%

Table A13: Baseline Characteristics of Businesses that Attended Businesses Training

	(1)	(2)	(3)	(4)
	Formal firms at listing survey	**Newly formalized firms in group 2 and group 3**		
		Attended business training	Did not attend business training	T-test col(2)=col(3)
Number of observations	608	242	120	
Firm owner characteristics				
Female owner	0.419	0.483	0.558	0.181
	[0.494]	[0.501]	[0.499]	
Age of the owner	43.6	39.2	37.8	0.151
	[10.5]	[9.1]	[8.1]	
Business owner has some formal education	0.884	0.851	0.842	0.812
	[0.32]	[0.357]	[0.367]	
Business owner has some secondary education	0.74	0.562	0.558	0.948
	[0.439]	[0.497]	[0.499]	
Firm characteristics				
Trade	0.584	0.397	0.583	0.001***
	[0.493]	[0.49]	[0.495]	
Services	0.26	0.298	0.233	0.2
	[0.439]	[0.458]	[0.425]	
Craft	0.09	0.273	0.15	0.009***
	[0.287]	[0.446]	[0.359]	
Firm area in m²	52.5	22.4	15.2	0.109
	[106.5]	[48]	[13.6]	
Business connected to electricity network	0.898	0.785	0.667	0.015**
	[0.303]	[0.412]	[0.473]	
Number of employee	2.961	1.459	1.3	0.48
	[4.59]	[2.006]	[2.011]	
The firm does any form of accounting	0.642	0.244	0.258	0.764
	[0.48]	[0.43]	[0.44]	
Amount of sales in an average week	542,167	52,321	60,617	0.143
	[4,434,990]	[44,957]	[60,543]	
Amount of profit in the last month	223,041	48,782	47,194	0.745
	[726,068]	[44,169]	[42,538]	
Firm owner owns a bank account	0.789	0.356	0.378	0.687
	[0.409]	[0.48]	[0.487]	
Firm pays taxes	0.836	0.54	0.58	0.474
	[0.371]	[0.499]	[0.496]	
Amount of taxes paid in the previous year	316,636	24,910	23,180	0.641
	[2,591,065]	[34,111]	[30,211]	
Thinks that it's difficult to know in advance how much taxes she will have to pay	0.725	0.596	0.795	0.001***
	[0.447]	[0.492]	[0.406]	
Ratio tax/ annual profit for all businesses	0.128	0.062	0.059	0.754
	[0.221]	[0.099]	[0.085]	
Ratio tax/ annual profit for businesses paying taxes	0.169	0.118	0.102	0.314
	[0.313]	[0.11]	[0.09]	

Notes: sources: listing-baseline survey March 2014

A.1 Details of Intervention Implementation

The advisors from CGA delivered the program to each business owner following four main steps:

1. First visit: A CGA advisor conducted a first visit to each business to explain the benefits of becoming an entreprenant, with this content specific by group, and to distribute informational leaflets. If a business owner was not present on the day of the visit, the CGA advisor attempted to call the owner on the phone. If the owner could not be reached, the CGA advisor made another attempt by trying a visit or a call in different moments of the day. After four attempts (visits or calls), the business was considered as not interested.

2. Second visit: For businesses receiving package B, the same CGA advisor called, arranged, and confirmed a meeting, which took place approximately two weeks after the first visit, and provided 1-2 hours of personalized training. If a business owner was not present on the planned day of the second visit or could not be reached, the CGA advisor made another attempt by trying a visit or call in different moments of the day. After 3 attempts (visits or calls), the business was considered not interested. Registration at GUFE was not mandatory to be eligible to this second visit. For those also receiving package C, the CGA advisor devoted additional time in reviewing the procedures to calculate the taxes to pay, and the option of receiving tax mediation help, if necessary.

3. Formalization decision: After having received the first and/or the second visit, business owners decided whether or not to register as entreprenants at GUFE.

4. Provision of additional benefits: Businesses in treatment groups 2 and 3 could also register with CGA, and receive counselling and business training (group sessions). Businesses in group 3 could benefit from tax mediation services with CGA, if needed. Finally, businesses could open a bank account with specific conditions at BoA or Orabank.

More information on take-up of group 2 and 3 on services offered by the CGA:
In total, out of the 302 firms in group 2 and 3 that registered with the CGA (83% of firms that became formal), 272 (90% of firms registered with the CGA) attended at least the first module on basic accounting, 225 (74%) also attended the second module on tax and 206 (68%) also completed the third module on access to banking. 141 firms (47%) also attended an optional training. Among these firms 58 chose the optional module on initiation to business management, 44 on "how to increase sales and market access" and 39 on "how to write a business plan"). Table A13 shows a comparison of baseline characteristics of firms in group 2 and 3 between firms that formalized and attended the business training with the CGA, and firms that formalized but chose not to attend. Trainings were less attractive to firms operating in the trade sector and more attractive to firms working in services or to craftsmen. Firm owners who attended the trainings are less likely to be women and are slightly older (but these two results are not significant). Other baseline characteristics like the level of education or if the firm

Country	Togo	Senegal	Burkina Faso
Legal status	Individual Enterprises	Individual Enterprises	Individual Enterprises
Registration Cost	CFAF 25,400 (USD 45)	CFAF 14,000 (USD 24)	CFAF 40,500 (USD 70)
Time required (official)	24h	24h	n.a.
One-stop-shop for formalization	Yes	Yes	Yes
Document required (in addition to legal ID, pictures and forms)	No additional document	Residency Certificate Marriage Certificate	Residency Certificate from the city hall Marriage Certificate Residency Certificate from the tax administration
Tax System	Simplified regime	Simplified regime	Simplified regime

was paying any tax look similar in the two groups.

Comparison with other legal regimes in other countries in West Africa: Although the entreprenant status was officially introduced legally in the 17 OHADA countries, to our knowledge, to date it has only been fully implemented in Benin. Other countries have not yet passed the law to enforce and to define the entreprenant. However, other countries have existing statuses for individual enterprises that look similar to the entreprenant status. The main difference between most of these statuses and the entreprenant status is that these alternatives are usually not free and are often more complicated in terms of time and administrative documentation required. The table below shows information on similar statuses in Togo, Senegal and Burkina Faso.

Characteristics of the CGA advisors who implemented the program: The 14 CGA advisors in charge of doing the in-person visits were highly qualified. They all hold a masters degree in business, management or accounting. When the program started, there were, on average, 34.4 years old and had 8.2 years of relevant professional experience, mainly in the private sector as an accountant or in private organizations doing business counselling or training.

In comparison to similar programs implemented in other contexts and, in particular, to the study in Sri Lanka by de Mel et al (2013), the CGA advisors are also different in two important dimensions. First the CGA is a semi-public organization while in Sri Lanka the program was implemented by research assistants. And second, CGA advisors have a lot of experience with the private sector as accountants, advisors or trainers. This experience was probably useful to convince firms that formalization could be good for them.

Finally, the fact that firms included in this study are relatively small also means that they were not used to dealing or speaking with accountants or business counsellors (at baseline, less than 10% of business owners had ever participated in business training). As such, the CGA advisors were likely seen as more knowledgeable about the way to conduct business than would be the case with young research assistants or students used in other studies, and so firms may have been more willing to follow their recommendations.

A.2 Details of Sampling Procedure

Sampling protocols for inside and outside the market were different:

- For Danktopa market, we used a precise map of the market made by the public company managing markets in Benin (SOGEMA). This map allowed to divide geographically the market in small areas. We then randomly selected areas in the markets in which 50% of the businesses (with fixed location) where sampled for the survey.

- For other neighborhoods of Cotonou, we were able to obtain detailed maps of each of the 144 neighborhoods in Cotonou. Those maps allowed the easy identification of ilots (blocks), the official administrative unit within a neighborhood. We used this administrative unit as a reference for the listing survey sampling. We then used information given by the tax administration (and confirmed by the survey company) in order to characterize neighborhoods as high or low firm density areas. We randomly sampled 38% of ilots in high density neighborhoods and 10% of the ilots in low density neighborhoods. In each ilots 68% of businesses where sampled for the survey in average.

Overall, 19,246 businesses were listed. The listing survey allowed us to estimate the total number of businesses operating in Cotonou (with a fixed location, excluding international and nationwide businesses and liberal professions) to be approximately 68,500, including around 5,000 in Dantokpa market. Among those 19,246 businesses, 9,938 businesses were randomly selected to be surveyed. 7,945 (80%) businesses were successfully surveyed, 1,000 (10%) businesses refused to be surveyed, and 995 (10%) businesses were dropped because the business owner was not available or not reached after 4 attempts. Figure A3 details the listing survey results inside and outside the market.

From the 7,945 businesses surveyed, a population of 3,596 businesses was then selected to participate in the study based on the following goals:

- Drop businesses already formal

- Drop businesses that will probably not cooperate in the future or which will be probably difficult to find (i.e. businesses that refused to provide information on profits or turnover during baseline survey)

- Trim the database from (a) businesses very close to formalization who would have formalized anyway and (b) businesses very far from formalization which would not be interested by the program

- Remove businesses that ever got a loan from a commercial bank that will most probably not been interested by the program (less than 3% of informal businesses)

- Reduce the standard deviation of the main outcomes (profit and turnover)[1]

- Include a sufficient number of businesses in Dantokpa market.[2]

A.3 Measurement of Key Outcomes

Our main outcomes are measured as follows:

Formalization:

- Main measure: formal according to GUFE data. The firm is identified as having formalized according to administrative data provided by GUFE, using the matching process described in Appendix 4.

- Alternative measures:

  - Declared that the business is formal: the business owner reports that their business has some form of formal status in the follow-up survey.
  - Showed a document: the business owner reported that their business was formal in the follow-up survey and could show a document to prove this.
  - Formality or found in admin data: classified as formal if they declare the business is formal in the follow-up survey, or they are matched in the GUFE data.
  - Showed a document or found in the GUFE data: formal according to either our main measure or our showing a document measure.

Variables used in heterogeneity analysis:

- Female owner: owner of the firm is female at baseline.

- Operates in Dantokpa market: the firm is located in Dantokpa market at baseline.

- Trader: the business type is trader at baseline.

[1] Outside Dantokpa market we excluded businesses with sales or profit lower than CFAF 12,000 (USD 20), profit greater than CFAF 150,000 (USD 252) or sales greater than CFAF 400,000 (USD 671). In Dantokpa market, we excluded businesses with sales or profit lower than CFAF 10,000 (USD 17), profit greater than CFAF 200,000 (USD 336) or sales greater than CFAF 500,000 (USD 839).

[2] We choose to take 22% of the total study population from Dantokpa market to have the same share of businesses from the market as in the 2008 firm census (INSEA, 2008).

- Doesn't look like formal species: Looking like a formal business owner is based on the predicted probability of being formal from a logit of formality status on baseline characteristics. This logit uses the data collected during the listing/baseline survey on 7,829 businesses who accepted the survey. Among them, 608 (7.8%) were formal at the time of the survey. We used the following baseline characteristics in the logit: operating in Dantokpa market, gender, age, only primary education, only JHS or SHS level, higher level of education, operating in services, craftsman, business created less than 1 year ago, firm connected to electricity network, total number of employees, firm is doing some accounting, have done any advertising in the last 6 months, log of total amount of sales in an average week, log amount of last month profit, firm owner owns a bank account, the firm pays taxes, have done any advertising in the last 6 months (and controls for missing levels of these variables). Using the "predict" command in STATA, we end up classifying as "looking more like formal" 654 (18.2%) businesses out of the 3,596 in the study sample. Appendix Table A5 shows this logit. This classification was done before we got access to any follow-up data and was mentioned in the pre-analysis plan on the AEA social science registry website.

- Index of business size below median: an index of baseline business size was constructed as the average of standardized z-scores (using mean and standard deviation of the control group) of baseline profits, sales, and number of employees, and then firms were classified as being above or below the median on this index.

- Does not have secondary education: owner has less than secondary education at baseline

- One visit or fewer from tax inspectors: the owner had received one visit or fewer from tax inspectors in the last year at baseline (2013). Intermediate firm outcomes:

- Has a bank account: the business has a bank account of any type that they use for their business, according to the follow-up survey.

- Loan contracted: the business has received a loan from a commercial bank or microfinance institution, according to follow-up survey.

- Attended business training in the past year: the business owner reports having attended a business training in the past year in the follow-up survey.

- Firm does any form of accounting: the firm reports keeping accounts in the follow-up survey.

- Share of business practices implemented: the proportion of 26 business practices taken from McKenzie and Woodruff (forthcoming) that the firm is implementing at the time of the follow-up survey.

- Index of tax harassment: a summary index averaging standardized z-scores (using control means and standard deviations) of the questions "was asked to pay a bribe by a tax inspector in the last 6 months", "received a sexual suggestion or other

inappropriate request from a tax inspector in the last 6 months", "was threatened with business closure by a tax inspector in the last 6 months", "received more than 1 visit by a tax inspector in the last 6 months", "received at least one visit by a labor or hygiene inspector", "feels that he/she paid more taxes than they should have according to the law", and "thinks that tax officials override their duty and ask firms to pay too much taxes".

- Has sold goods to the public administration or to a large company (more than 50 employees) in last 3 months: reports doing this in the follow-up survey.
- In the last month, a client asked for a receipt: reports doing this in the follow-up survey.

Firm performance outcomes:

- Total sales in the last day: total sales from the last day in CFAF, reported in the follow-up survey and truncated at the 99th percentile. Coded as zero for firms which have closed.
- Total sales in the last week: total sales from the last week in CFAF, reported in the follow-up survey, and truncated at the 99th percentile. Coded as zero for firms which have closed.
- Last month profit: the response in CFAF to the direct question "what was the total amount of your profits last month?", coded as zero for firms which have closed, and truncated at the 99th percentile.
- Summary index of sales and profits: the average of standardized z-scores (using control means and standard deviations) of total sales in the last day, total sales in the last week, and last month profit.
- Total number of employees: the total number of employees reported in the follow-up survey as working in the firm, including permanent and casual workers, coded at zero for firms which have closed and truncated at the 99th percentile.
- Any tax paid for business activity: based on whether the owner reports paying business taxes on the follow-up survey.
- Sum of all taxes paid in last year: the amount in CFAF of all business taxes reported in the follow-up survey as paid by the firm in the past year, coded as zero for firms which are closed, and truncated at the 99th percentile.

A.4 Matching program data to administrative data on formalization

This appendix describes the protocol to match businesses in the administrative database on formalization provided by the GUFE (around 550 businesses every month) with the program data (3,596 informal businesses prior to the program start).

Information available:
We had the following information in both databases:

- Surname of the business owner. It can be written with different spellings in each database.
- Between 1 and 5 first names. In GUFE data we usually have more than one first name. In the program data we only have one first name in most of the cases.
- The business activity as described by the owner (no codes). The business activity is missing for 30% of businesses in the GUFE data.
- Business addresses. In the GUFE data addresses were given by the business owner whereas in the program data, we are using "official" addresses used by the tax administration (there are 144 neighborhoods in Cotonou). In practice only neighborhoods can be matched. In GUFE data, there are few missing variables and some cases for which the neighborhood does not belong to the official list of neighborhoods.
- Gender of the business owner.
- Phone number of the business owner.

Definition of a match:
We consider it to be a match if: (i) the surname, at least one first name, the activity, and the neighborhood match or (ii) if surname and at least one first name match and either the activity, the neighborhood or the phone number also match, and the others are missing (or does not exist for the neighborhood or the phone number).

Method of matching:
We used first the STATA command "reclinck" designed for fuzzy name matching. This command uses record linkage methods to generate matching scores. For this first step, we used tree variables: surname, first name and gender. As a second step, we looked manually (in an Excel file) to all matches and validate each match only if names, activity and neighborhood were consistent in both databases.
The "reclink" command allows inputting different weights to match on each of the three variables used (surname, first name and gender). In order not to rely on the weights used, we reiterate the process with different weights until no additional matches were found.
Since it is possible that the first name in the program data corresponds to the second name in the GUFE data, we also reiterate the whole process for all combinations of first to fifth names. Surname and first name were inverted in one of the two databases. So we also reiterate the process with other combination of surname and first names.

Checking that the matching method is working:
To assess whether our matching method is working efficiently, we used the following methods:

1. First we looked at whether we could find additional matches using a more usual method of matching. That is looking at the two lists (sorted by surnames) and trying to find each business of the GUFE data in the program database. So it means looking mainly at businesses with surnames starting with the same letters. We were not able to find any additional matches.

2. Secondly, we looked at the proportion of business which formalized with the entreprenant status during the first 3 months after program launch. Indeed, most businesses which formalized with the entreprenant status should be also in the program data (in theory they are the only businesses aware of this new status). We matched 78% (119/153) of the newly registered entreprenants.

3. We then took the 34 businesses which formalized with the entreprenant status and were not matched with the program data and we tried harder to match these businesses. We took the program data and looked at all the businesses in the same neighborhood as the unmatched businesses. We were able to find 6 new matches. These 6 matches are very imperfect matches with surnames somewhat different and first name sometimes different. For two cases, the match was not done with our main method because the surname is missing in the program data.

As a result of this process, we use a conservative definition of a match between the business names in the two databases as "two businesses with a close surname, and at least one close first name, and either the same phone number, or the same sector of activity and an address in the same neighborhood." Using this definition, the likelihood that a business in the program database was considered as formal, whereas the business was in reality not formal, was very low. The opposite case (i.e. a business was considered as informal, whereas it is in reality formal) is however possible, so this measure of formalization may underestimate the actual number of businesses which formalized in all groups. We therefore also supplement the administrative measure of formalization with survey measures.

A.5 Estimating Future Additional Tax Revenue from Newly Formalized Firms

Formalization is expected to provide additional tax revenue for the Government. We used our baseline data to estimate this increase in tax revenue, which corresponds to the amount of taxes the business will pay after formalizing, minus what they would have paid if they remained informal.

Taxes paid by businesses that formalized because of the program:
Businesses that formalized because of the program obtained a full tax exemption for one year (in addition, those also registered with the CGA get a reduction of 40% in the amount of taxes due for the following 3 years, which we do not include in Table 6 which is based on group 1).

In the new tax system introduced in 2016, taxes depend on firm's turnover and sector of activity and are determined using the following scale:

New Tax System (Taxe Professionnelle Synthétique)

Turnover (CFAF)	Taxes paid Traders	Taxes paid Other activities
0 - 1 000 000	6,250	10,000
1 000 001 - 2 500 000	21,875	35,000
2 500 001 - 5 000 000	46,875	75,000
5 000 001 - 10 000 000	93,750	150,000
10 000 001 - 15 000 000	156,250	250,000
15 000 001 - 20 000 000	218,750	350,000
20 – 50 million	1,25% of turnover	2% of turnover

The level of turnover in 2014, measured during the baseline survey, serves as an estimate of future turnover. Businesses that formalized in the treatment groups had an average annual turnover of CFAF 2.8 million (USD 4,900). Using the new tax rates presented in previous table, it gives an expected amount of annual taxes of CFAF 51,000 (USD 85). If the program was able to target firms looking more like formal firms, we estimate that these firms would be paying CFAF 70,000 (USD 117). These calculations are presented in table A11.

Taxes paid by the same businesses if they remained informal:
We use the taxes paid by the same businesses in 2014 (when they were still informal) to estimate the taxes that they would have to pay, had they remained informal. The average amount of taxes paid in 2014 was CFAF 24,000 (USD 40). [3]

Additional tax revenue
The following assumptions need to be accounted when estimating the additional tax revenues for the Government:

- Businesses declare the same turnover to the tax administration than the turnover they declared during the survey;
- The new tax system introduced in 2016 will apply only to formal businesses, and informal businesses will pay the same amount of taxes as before program implementation;
- Businesses that formalized will remain formal and they will start to pay taxes once the tax exemption they benefited during the first year expires.

Based on these assumptions and on previous calculations, the expected increase in tax revenue is CFAF 27,000 (USD 46). This amount would be slightly higher is only firms

[3] This average is lower than the minimum TPU that was required by the law, i.e. CFAF 21,600, because it takes into account businesses that did not pay any taxes.

looking like formal firms were targeted (CFAF 29,000 or USD 49). This increase comes mainly from businesses that were not paying taxes before the program (they will start paying taxes after becoming formal), and to a small extent because the new tax system leads to higher levels of taxes from businesses that choose to formalize (in the treatment groups). Given the previously mentioned assumptions (100 percent of firms pay taxes and declare 100 percent of their revenue), this is an upper bound estimate of the gain in tax revenue.

If we compare this finding with the cost per formalization, the additional benefits in terms of increased tax revenue are considerably lower than the costs (CFAF 27,000 versus CFAF 539,000 for group 1).

If we compare the cumulative tax revenue that the Government will receive in a period of time, with the initial cost of having registered a firm, it would take 19 years for this program to be cost effective in term of tax revenue received from businesses in group 1 (35 years from businesses in group 2, 29 years from businesses in group 3) (See Table 6).

Appendix B

Chapter 2

Tables

Table B1: Impact of Formalization on Other Economic Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Female Business owners			**Male Business owners**		
Dependent variables:	Mean in Control group [SD]	Diff. with Treatment group (ITT)	Impact of formali-zation (LATE)	Mean in Control group [SD]	Diff. with Treatment group (ITT)	Impact of formali-zation (LATE)
Summary index of profit and sales	0	0.009	0.063	0	0.128	0.578
	[1]	(0.066)	(0.473)	[1]	(0.088)	(0.401)
Variables included in the index:						
Total sales in the last day$^{\alpha}$ (CFAF)	26,716	-529	-3,798	12,934	7,865**	36,340**
	[46,435]	(3,155)	(22,668)	[32,819]	(3,309)	(15,882)
Total sales in the last week$^{\alpha}$ (CFAF)	143,190	5,364	38,535	95,777	9,935	45,389
	[228,484]	(15,458)	(110,926)	[200,314]	(14,838)	(67,806)
Last month profits$^{\alpha}$ (CFAF)	63,133	23	166	70,994	143	665
	[89,487]	(5,686)	(40,969)	[95,248]	(7,188)	(33,434)
Other measures of profit and sales:						
Inverse hyperbolic of sales in the last day	7.785	-0.028	-0.203	6.087	0.118	0.546
	[4.682]	(0.297)	(2.13)	[4.887]	(0.36)	(1.668)
Inverse hyperbolic of sales in the last week	11.111	-0.106	-0.76	10.211	0.119	0.542
	[3.148]	(0.205)	(1.481)	[3.64]	(0.259)	(1.183)
Inverse hyperbolic of last month profits	10.854	-0.339*	-2.439*	10.484	-0.061	-0.285
	[2.068]	(0.182)	(1.361)	[3.526]	(0.276)	(1.283)
Sales > predicted sales$^{\delta}$	0.372	0.014	0.104	0.346	-0.013	-0.061
	[0.484]	(0.032)	(0.228)	[0.476]	(0.035)	(0.161)
Profits > predicted profits$^{\delta}$	0.231	-0.011	-0.08	0.369	-0.047	-0.216
	[0.422]	(0.027)	(0.196)	[0.483]	(0.035)	(0.166)
Sales > baseline sales	0.537	0.006	0.046	0.491	-0.013	-0.059
	[0.499]	(0.032)	(0.232)	[0.501]	(0.037)	(0.17)
Profits > baseline profits	0.459	0.012	0.088	0.506	0.015	0.069
	[0.499]	(0.033)	(0.238)	[0.501]	(0.038)	(0.177)
Other Outcomes:						
Number of employee	1.197	0.04	0.283	1.956	0.039	0.176
	[1.749]	(0.107)	(0.757)	[2.34]	(0.162)	(0.722)
Hired someone in the last 6 months	0.093	0.008	0.055	0.191	0.024	0.108
	[0.291]	(0.018)	(0.131)	[0.394]	(0.029)	(0.132)
Number of hours worked in the business last week by the owner	65.826	0.647	4.591	66.941	-1.306	-5.841
	[20.729]	(1.298)	(9.228)	[20.165]	(1.509)	(6.761)
Total amount of tax paid in the last year	13,710	-509	-3,562	21,841	-5,268**	-23,379**
	[23,377]	(1,447)	(10,156)	[32,962]	(2,129)	(9,734)
Contracted a loan in 2014-16 (any type)	0.449	0.034	0.241	0.283	-0.037	-0.167
	[0.498]	(0.032)	(0.231)	[0.451]	(0.032)	(0.146)
Share of business practises implemented (26 questions)$^{\eta}$	0.297	-0.011	-0.078	0.307	0.009	0.039
	[0.153]	(0.01)	(0.073)	[0.181]	(0.013)	(0.059)
Has gained a new regular customer in the past 3 months	0.853	-0.013	-0.094	0.742	0.014	0.06
	[0.354]	(0.024)	(0.17)	[0.439]	(0.032)	(0.144)
Subjective standard of living on a Cantril ladder$^{\lambda}$	5.092	0.193	1.39	4.509	0.208	0.932
	[2.021]	(0.137)	(1.01)	[1.952]	(0.148)	(0.658)
Anticipated subjective standard of living in 5 years on a Cantril ladder$^{\lambda}$	9.021	0.167*	1.181*	8.798	0.073	0.309
	[1.513]	(0.093)	(0.668)	[1.603]	(0.127)	(0.539)
Observations		1,080			809	

Notes: Administrative data on formalization and Endline survey data (May 2016). Column 1 and 4: Standard deviations presented in brackets. Columns 2 and 5: coefficient and robust standard error (in parentheses) from an OLS regression of the firm owner/firm characteristic on a treatment dummy, controlling for strata dummies. Columns 3 and 6: coefficient and robust standard error (in parentheses) from a 2SLS regression controling for strata dummies with formalization instrumented by treatment dummy. **α**: top-coded at the 99th percentile. **δ**: Profits/sales predicted using the command "predict" in Stata and OLS regressions of profits/sales on baseline characteristics (from Table 1). **η**: see appendix 1 for the list of questions. **λ**: The Cantril ladder goes from 0 to 10 with 10 for the best situation possible ***, **, * indicate statistical significance at 1, 5 and 10%.

Table B2: Household Characteristics of Entrepreneur (Control Group Only)

	(1) **Female Business owners** (Control group only) Mean [SD]	(2) **Male Business owners** (Control group only) Mean [SD]
Household composition:		
Total number of household members (excluding respondent)	5.8 [2.086]	5.941 [2.584]
Number of household members depending financially on the respondent	3.348 [2.157]	4.603 [2.468]
Number of children	3.388 [1.642]	3.441 [2.189]
Polygamous / partner is polygamous	0.24	0.125
Partner's occupation:		
Taking care of the family	0.003	0.14
Working	0.924	0.783
Including self-employed informal entrepreneur	0.478	0.651
Including working in public sector or in a formal compai	0.329	0.055
Earned higher revenue than partner in 2015	0.345	0.912
Contribution to household expenditures in 2015 (in %):		
Own personal expenditures of the respondent	7.5	45.5
Partner's personal expenditures	89.5	95.8
Food	46.3	83.7
Health	38.7	87.7
Housing	23.1	94.1
Transfers outside the household:		
Regularly send money outside the household	0.4	0.537
Regularly receive money from outside the household	0.125	0.077
Lottery 1: Willingness to pay to hide a windfall transfer:		
Willing to pay a positive price	0.11	0.217
Share of the grant willing to pay to hide income	0.046	0.096
Share conditional on positive willingness to pay	0.414	0.444
Lottery 2: Willingness to pay to get full control over a transfer (instead of a 50/50 allocation):		
Willing to pay a positive price	0.226	0.232
Share willing to pay to to get full control over the transfe	0.079	0.088
Share conditional on positive willingness to pay	0.348	0.379
Lottery 1 and lottery 2 combined:		
Willing to pay a get more control over a windfal transfer (WTP >0 at any lottery)	0.241	0.279
Observations	345	272

Notes: Source: Endline survey data May 2016, control group only. Standard deviations presented in brackets.

Table B3: Attrition at Endline Survey

	(1)	(2)	(3)	(4)
	Female business owners		**Male business owners**	
Dependent variables:	Mean in Control group [SD]	Difference with Treatment group	Mean in Control group [SD]	Difference with Treatment group
Final study sample (surveyed at endline, still operating and married or with a partner)	0.458	0.031	0.614	-0.014
	[0.499]	(0.023)	[0.487]	(0.028)
Reasons for exclusion from final study sample:				
Surveyed and no partner	0.243	-0.009	0.117	0.003
	[0.429]	(0.019)	[0.322]	(0.019)
Including single	0.098	-0.003	0.097	0.008
	[0.298]	(0.013)	[0.296]	(0.018)
Including divorced/separated	0.053	-0.001	0.011	0.002
	[0.224]	(0.01)	[0.106]	(0.006)
Including widow/widower	0.092	-0.006	0.009	-0.007*
	[0.289]	(0.013)	[0.095]	(0.004)
Surveyed and business shut down	0.085	-0.002	0.074	0.028*
	[0.279]	(0.012)	[0.263]	(0.017)
Surveyed and business owner deceased	0.013	-0.003	0.009	-0.002
	[0.114]	(0.005)	[0.095]	(0.005)
Survey Attrition (refused, not found, sickness, traveling, maternity leave…)	0.163	-0.014	0.151	-0.022
	[0.37]	(0.016)	[0.359]	(0.02)
Including refused to answer	0.084	-0.007	0.081	-0.01
	[0.277]	(0.012)	[0.274]	(0.015)
Observations: *entreprenant* study sample	2,263		1,333	
Observations: final study sample	1,080		809	

Notes: Endline survey data (June 2016). Column 1 and 3: Standard deviations presented in brackets. Columns 2 and 4: coefficients and standard errors (in parentheses) from an OLS regression of attrition variables on a treatment dummy, controlling for strata dummies. ***, **, * indicate statistical significance at 1, 5 and 10%.

Table B4: Balancing Tests on Post Attrition Sample

	(1)	(2)	(3)	(4)
	Female business owners		**Male business owners**	
	Mean in Control group [SD]	Difference with Treatment group	Mean in Control group [SD]	Difference with Treatment group
Age of the owner	40.11	0.17	37.18	0.16
	[9.93]	(0.62)	[9.2]	(0.65)
Owner has some formal education	0.672	-0.006	0.82	-0.003
	[0.47]	(0.03)	[0.385]	(0.028)
At least some secondary education	0.368	-0.01	0.478	-0.015
	[0.483]	(0.03)	[0.5]	(0.036)
Operates in Trade[1]	0.684	-	0.243	-
	[0.466]	-	[0.429]	-
Operates in Services	0.22	0.009	0.32	0.009
	[0.415]	(0.017)	[0.467]	(0.032)
Operates in Craft	0.096	-0.013	0.371	-0.013
	[0.295]	(0.016)	[0.484]	(0.033)
Firm area in m²	14.68	-0.92	31.25	0.42
	[12.26]	(0.79)	[78.17]	(5.87)
Business connected to electricity network	0.559	0.045	0.706	-0.023
	[0.497]	(0.031)	[0.456]	(0.033)
Number of employee	1.11	-0.02	1.63	0.11
	[1.7]	(0.1)	[1.72]	(0.13)
Number of non-paid family help	0.635	-0.057	0.213	0.019
	[1.017]	(0.064)	[0.594]	(0.042)
The firm does any form of accounting	0.162	-0.012	0.21	0.003
	[0.369]	(0.023)	[0.408]	(0.029)
Amount of sales in an average week	69,079	-5,472	49,788	1,898
	[63,594]	(3,573)	[50,104]	(3,417)
Amount of profit in the last month	47,446	-298	47,182	1,277
	[48,365]	(3,268)	[42,506]	(3,247)
Firm owner owns a bank account[1]	0.19	-	0.298	-
	[0.393]	-	[0.458]	-
Firm pays taxes	0.518	-0.024	0.657	-0.012
	[0.5]	(0.029)	[0.476]	(0.035)
Amount of taxes paid in the previous year	16,386	-1,086	26,433	-828
	[27,668]	(1,636)	[30,647]	(2,243)
Observations	1,080		809	

Notes: Baseline survey data (March 2014). Column 1 and 4: Standard deviations presented in brackets. Columns 2 and 5: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on a treatment dummy, controlling for strata dummies. 1: variables used for stratification. ***, **, * indicate statistical significance at 1, 5 and 10%.

Table B5: Characteristics of Firms in Treatment Group by Formalization Status

	(1)	(2)	(3)	(4)	(5)	(6)
	Female business owners			**Male business owners**		
	Did not formalize (Treatment group)	Newly formalized (Treatment group)	P-val T-test (1)=(2)	Did not formalize (Treatment group)	Newly formalized (Treatment group)	P-val T-test (4)=(5)
Panel A: Baseline survey data						
Age of the owner	40.4	40	0.728	37	38	0.252
Owner has some formal education	0.636	0.807	0.000***	0.808	0.85	0.253
At least some secondary education	0.332	0.465	0.006***	0.413	0.599	0.000***
Operates in Trade	0.689	0.632	0.226	0.238	0.224	0.734
Operates in Services	0.227	0.246	0.666	0.336	0.333	0.955
Operates in Craft	0.079	0.114	0.215	0.351	0.388	0.434
Firm area in m²	13.4	14.7	0.319	31.5	34.1	0.737
Connected to electricity network	0.577	0.719	0.004***	0.651	0.789	0.002***
Number of employee	1.061	1.193	0.425	1.679	1.939	0.173
	[1.608]	[1.693]			[2.028]	
Number of non-paid family help	0.586	0.509	0.44	0.208	0.265	0.312
	[0.984]	[0.98]			[0.634]	
The firm does any form of accounting	0.132	0.219	0.015**	0.192	0.259	0.094*
Amount of sales in an average week	66130	55175	0.061*	51028	51187	0.974
	[59,213]	[45,270]			[46,044]	
Amount of profits in the last month	48344	41879	0.217	47604	50175	0.554
	[53,633]	[36,290]			[41,695]	
Firm owner owns a bank account	0.161	0.252	0.02**	0.234	0.472	0.000***
Firm pays taxes	0.504	0.474	0.552	0.639	0.648	0.846
Amount of taxes paid in the previous year	14387	19139	0.06*	23485	32935	0.001***
	[22,898]	[31,170]			[38,175]	
Panel B: Endline survey data						
Total number of household members (excluding respondent)	5.662	5.752	0.721	6.154	6.054	0.731
	[2.528]	[2.115]			[2.553]	
Number of household members who depend financially on the respondent	3.116	3.221	0.657	4.836	4.565	0.344
	[2.338]	[2.223]			[2.441]	
Number of children	3.347	3.425	0.651	3.428	3.259	0.396
	[1.673]	[1.746]			[1.744]	
Polygamous / partner's polygamous	0.221	0.147	0.108	0.114	0.096	0.629
Observations	621	114		390	147	

Notes: Sources: Panel A: Post-attrition listing-baseline survey (March 2014). Panel B: Post-attrition endline survey (May 2016). Standard deviations presented in brackets.

Table B6: Robustness of the Results when Excluding Entrepreneurs Who Attended a Business Training Session in the Treatment Group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Female Business owners					**Male Business owners**				
		All Sample (similar to Tables 2 and 3)		**Excluding those who attended a business training**			**All Sample** (similar to Tables 2 and 3)		**Excluding those who attended a business training**	
	Mean in Control group [SD]	Diff. with T. group (ITT)	Impact of formali-zation (LATE)	Diff. with T. group (ITT)	Impact of formali-zation (LATE)	Mean in Control group [SD]	Diff. with T. group (ITT)	Impact of formali-zation (LATE)	Diff. with T. group (ITT)	Impact of formali-zation (LATE)
First stage: treatment impact on firm formalization:										
Formalized (Gufe administrative data)	0.017	0.141***		0.048***		0.048	0.224***		0.084***	
	[0.131]	(0.02)		(0.014)		[0.214]	(0.028)		(0.023)	
Impact on contributions to partner's and household's expenses:										
Share of partner's personal expenditures	7.529	-2.145*	-15.41*	-2.106*	-45.09	45.515	-5.83**	-26.111**	-3.739	-44.207
paid by the respondent (in %)	[21.811]	(1.26)	(9.252)	(1.274)	(30.003)	[36.989]	(2.721)	(12.448)	(2.823)	(35.533)
Share of household's food expenditures	46.299	-2.924	-20.798	-3.31*	-69.326	83.739	-2.915*	-13.042*	-2.179	-25.907
paid by the respondent (in %)	[28.066]	(1.862)	(13.651)	(1.899)	(44.58)	[19.018]	(1.546)	(7.073)	(1.591)	(20.396)
Impact on willingness to pay to get more control over a windfall transfer:										
Willing to pay to get more control over a	0.241	0.07**	0.495**	0.069**	1.451*	0.279	-0.063**	-0.282*	-0.061*	-0.723
windfall transfer (at least to one lottery)	[0.428]	(0.03)	(0.221)	(0.03)	(0.756)	[0.45]	(0.032)	(0.146)	(0.033)	(0.439)
Impact on other outcomes										
Index of investment and willingness to	0	0.161**	1.142**	0.138**	2.881*	0	-0.01	-0.045	-0.02	-0.241
invest in the business	[1]	(0.065)	(0.475)	(0.066)	(1.524)	[1]	(0.068)	(0.307)	(0.071)	(0.853)
Index of savings and transfers	0	-0.146**	-1.041**	-0.153**	-3.212*	0	-0.064	-0.288	-0.082	-0.972
	[1]	(0.062)	(0.468)	(0.064)	(1.652)	[1]	(0.074)	(0.336)	(0.077)	(0.966)
Index of separation of business and	0	-0.065	-0.459	-0.11*	-2.31	0	0.171**	0.763**	0.047	0.558
household	[1]	(0.064)	(0.466)	(0.065)	(1.549)	[1]	(0.076)	(0.333)	(0.076)	(0.9)
Observations		1,080		995			809		714	

Notes: Administrative data on formalization and Endline survey data (May 2016). Column 1 and 6: Standard deviations presented in brackets. Columns 2, 4, 7 and 9: coefficient and robust standard error (in parentheses) from an OLS regression of the firm owner/firm characteristic on a treatment dummy, controlling for strata dummies. Columns 3, 5, 8 and 9: coefficient and robust standard error (in parentheses) from a 2SLS regression controling for strata dummies with formalization instrumented by treatment dummy. **α**: top-coded at the 99th percentile. ***, **, * indicate statistical significance at 1, 5 and 10%.

Table B7: Main Results for All Treatment Groups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Female Business owners							**Male Business owners**						
		T1	T2	T3	P-value of test…				T1	T2	T3	P-value of test…		
Dependent variables:	Control group	Package A only[a]	Packages A and B[b]	Packages A, B and C[c]	T1= T2	T1= T3	T2= T3	Control group	Package A only[a]	Packages A and B[b]	Packages A, B and C[c]	T1= T2	T1= T3	T2= T3
First stage: treatment impact on firm formalization:														
Formalized (Gufe administrative data)	0.017	0.122**	0.161***	0.151***	0.521	0.6	0.755	0.048	0.193***	0.237***	0.265***	0.529	0.246	0.509
	[0.131]	(0.056)	(0.032)	(0.03)				[0.214]	(0.062)	(0.042)	(0.037)			
Impact on contributions to partner's and household's expenditures:														
Share of partner's personal expenditures	7.529	-5.445	-4.465**	-3.384*	0.807	0.573	0.611	45.515	-4.38	-2.939	-5.83	0.842	0.821	0.508
paid by the respondent (in %)	[21.811]	(3.717)	(2.121)	(1.973)				[36.989]	(6.321)	(4.331)	(3.827)			
Share of household's food expenditures	46.299	-4.366	0.113	-1.634	0.418	0.586	0.554	83.739	-1.708	-5.271**	-1.916	0.387	0.954	0.178
paid by the respondent (in %)	[28.066]	(5.113)	(2.931)	(2.734)				[19.018]	(3.606)	(2.47)	(2.183)			
Impact on willingness to pay to hide a windfall transfer:														
Willing to pay to get more control over a	0.241	-0.005	0.077	0.055	0.381	0.481	0.656	0.279	0.011	-0.029	-0.041	0.617	0.462	0.801
windfall transfer (at least to one lottery)	[0.428]	(0.086)	(0.049)	(0.046)				[0.45]	(0.07)	(0.048)	(0.042)			
Positive willingness to pay to hide a cash	0.11	0.021	0.1**	0.081**	0.287	0.37	0.637	0.217	-0.007	-0.036	-0.033	0.687	0.68	0.952
transfer to partner (lottery 1)	[0.314]	(0.069)	(0.04)	(0.037)				[0.413]	(0.063)	(0.043)	(0.038)			
Positive willingness to pay to avoid sharing	0.226	-0.002	0.059	0.06	0.511	0.462	0.985	0.232	-0.078	-0.056	-0.037	0.764	0.534	0.678
a cash transfer with partner (lottery 2)	[0.419]	(0.085)	(0.049)	(0.046)				[0.423]	(0.064)	(0.044)	(0.039)			
Impact on other outcomes														
Index of separation of business and	0	0.04	-0.225**	-0.012	0.183	0.775	0.044**	0	-0.12	0.25**	0.32***	0.057*	0.011**	0.555
household	[1]	(0.184)	(0.105)	(0.098)				[1]	(0.17)	(0.117)	(0.103)			
Index of investment and willingness to	0	0.374**	0.155	0.066	0.243	0.07*	0.374	0	-0.05	0.121	-0.06	0.314	0.949	0.079*
invest in the business	[1]	(0.173)	(0.099)	(0.093)				[1]	(0.149)	(0.102)	(0.09)			
Index of savings and transfers	0	0.128	-0.345***	-0.169*	0.013**	0.083*	0.081*	0	-0.019	-0.121	0.022	0.584	0.806	0.206
	[1]	(0.174)	(0.1)	(0.093)				[1]	(0.164)	(0.112)	(0.099)			
Observations	345	76	286	373				272	81	196	260			

Notes: Administrative data on formalization and Endline survey data (May 2016). Column 1 and 8: Standard deviations presented in brackets. Columns 2, 3, 4, 9, 10, 11: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on treatment dummies, controlling for strata dummies. a: Package A of incentives includes information delivered in-person and registration assistance. b: Package B includes access to free business training and bank services. Package C includes tax mediation services. ***, **, * indicate statistical significance at 1, 5 and 10%.

B.1 Outcome definitions

This appendix presents the definition of all outcomes used in this paper, organized by Table in which they appear.

- Formalization: equal 1 if the business is formal according to GUFE data and 0 otherwise. To construct this variable, administrative data provided by the GUFE were used. These data were matched with the survey data using information on names, activity, address and phone number and the STATA command "reclinck" designed for fuzzy matching. This command uses record linkage methods to create matching scores. "Potential matches" (matches with a high enough score) were then manually checked and validated. The matching process and all the checks conducted to validate this process are described in more details in the appendix 4 of Benhassine et al. (2018).

Variables in Table 1 (measured at baseline survey):

- Female owner: owner of the firm is female at baseline.
- Age of the owner: Reported age of the owner at baseline
- Owner has some formal education: Firm owner ever went to school at baseline
- At least some secondary education: owner has at least some secondary education at baseline
- Operates in trade: the business operates in trade at baseline.
- Operates in services: the business operates in services at baseline.
- Operates in craft: the business operates in craft at baseline.
- Firm area in m2: area of firm premises estimated by the surveyor at baseline.
- Connected to electricity network: the firm is connected to the electricity network at baseline
- Number of employee: Number of employee working in the firm at baseline, including permanent and casual employees and not including the firm owner. Truncated at the 99th percentile.
- Number of non-paid family help: Number of family help working regularly for the firm and who are not paid at baseline
- The firm does any form of accounting: the owner declares keeping any form of written account at baseline.
- Amount of sales in an average week: Amount of sales in an average week in CFAF, reported in the baseline survey, and truncated at the 99th percentile.

- Amount of profits in the last month: the response in CFAF to the direct question "what was the total amount of your profits last month?", and truncated at the 99th percentile.
- Firm pays taxes: equal to one if the firm paid any tax in the year before the baseline survey.
- Amount of taxes paid in the previous year: total amount of taxes paid in the year before the baseline survey, and truncated at the 99th percentile.

Variables in Table 2 (measured at endline survey):

- Share of partner's personal expenses paid by the respondent (in %): Respondents were asked to estimate their personal contribution in percentage to the personal expenses of their partner. The following examples were provided: clothes, shoes and jewelry.
- Share of household's food expenses paid by the respondent (in %): same question but for food expenses.
- Positive willingness to pay to get more control on a windfall transfer (at least to one lottery): equal to one if the respondent answered positively to at least one of the lottery questions and 0 otherwise.
- Lottery 1: Positive willingness to pay to hide a cash transfer to partner: equal to 1 if the respondent answered that she would prefer to receive CFAF 38,000 anonymously instead of CFAF 40,000 in front of her spouse, and 0 otherwise. CFAF 38,000 is the smallest amount that was offered to the respondent for this lottery.
- Lottery 2: Positive willingness to pay to avoid sharing a cash transfer with partner: equal to 1 if the respondent answered that she would prefer to receive CFAF 38,000 anonymously for herself in total instead of receiving CFAF 40,000 that would be split equally between her spouse and herself. CFAF 38,000 is the smallest amount that was offered to the respondent for this lottery.

Variables in Table 3 (measured at endline survey):

- Index of investment in the business: a summary index averaging standardized z-scores (using control means and standard deviations) of the questions "Value of inventories and raw materials", "Amount spent on inventories and raw materials in the previous month", "Value of all investments in the firm", "Contracted a loan in 2014-16 (any type)", "Interested in a bank loan", and "Would want someone to invest in the business in exchange of some ownership".
- Value of inventories and raw materials: Total value in CFAF and at current price of all business stocks, raw materials and spare parts. Truncated at the 99th percentile.

- Amount spent on inventories and raw materials in the previous month: Total of last month expenditure in raw materials and in goods or merchandise to be sold. Truncated at the 99th percentile.
- Value of all investments in the firm: Total value in CFAF and at current price of all investments made in the firm since its creation, truncated at the 99th percentile.
- Contracted a loan in 2014-16 (any type): the business has received a loan from a commercial bank, a microfinance institution, or another informal institution (money lender, relative...), according to follow-up survey
- Interested in a bank loan: respondent declare that she would be interested by a loan from a commercial bank.
- Would want someone to invest in the business in exchange of some ownership: The respondent declared that she would be okay with someone investing in her business in order to increase business size, even it is implies that this person would take part in the business decisions.
- Index of savings and transfers: a summary index averaging standardized z-scores (using control means and standard deviations) of the questions "Often saving money in case of an unanticipated event" and "Often sends money outside household"
- Often saving money in case of an unanticipated event: respondent declared that she is often of saving money in case of an unanticipated event.
- Often sends money outside household: respondent declared that she is regularly sending money outside her household.
- Often receives money from outside household: respondent declared that she is regularly receiving money from relatives outside her household.
- Index of separation of business and household: a summary index averaging standardized z-scores (using control means and standard deviations) of the questions "Owner separates business and personal resources" and "The firm does any form of accounting".
- Owner separates business and personal resources
- The firm does any form of accounting

Variables in Table 4:

- Willing to pay to get more control over a windfall transfer (at least to one lottery): same as in Table 2
- Baseline variables used to control for heterogeneity of impact are similar to the variables in Table 1

Variables in Table A1:

- Index of profits and sales: a summary index averaging standardized z-scores (using control means and standard deviations) of the questions: "Total sales in the last day", "Total sales in the last week" and "Last month profits".
- Total sales in the last day (CFAF): total sales from the last day in CFAF, reported in the endline survey and truncated at the 99th percentile.
- Total sales in the last week (CFAF): total sales from the last week in CFAF, reported in the endline survey, and truncated at the 99th percentile.
- Last month profits (CFAF): the response in CFAF to the direct question "what was the total amount of your profits last month?", and truncated at the 99th percentile.
- Inverse hyperbolic of sales in the last day: Inverse hyperbolic sine transformation of sales in the last day. It is defined by $log(y_i + (y_i^2 + 1)^{1/2})$.
- Inverse hyperbolic of sales in the last week: Inverse hyperbolic sine transformation of sales in the last week. It is defined by $log(y_i + (y_i^2 + 1)^{1/2})$.
- Inverse hyperbolic of last month profits: Inverse hyperbolic sine transformation of last month profits. It is defined by $log(y_i + (y_i^2 + 1)^{1/2})$.
- Sales > predicted Sales: Sales in the last week predicted using the command "predict" in Stata and OLS regressions of sales on baseline characteristics (from Table 1)
- Profits > predicted Profits: Last month profits predicted using the command "predict" in Stata and OLS regressions of profits on baseline characteristics (from Table 1)
- Sales > baseline Sales: Sales in the last week reported at endline are greater than sales in the last week reported at baseline
- Profits > baseline Profits: Last month profits reported at endline are greater than last month profits reported at baseline.
- Number of employee: number of employee working in the firm at endline, including permanent, casual work, apprentices and family helps, and excluding the firm owner.
- Hired someone in the last 6 months: including permanent, casual work, apprentices and family helps.
- Total amount of tax paid in the last year: total amount of tax paid by the entrepreneur for the firm in the last 12 months
- Contracted a loan in 2014-16 (any type): the business has received a loan from a commercial bank, a microfinance institution, or another informal institution (money lender, relative...), according to follow-up survey

- Share of business practices implemented: the proportion of 26 business practices taken from McKenzie and Woodruff (2017) that the firm is implementing at the time of the endline survey.
- Subjective standard of living on a Cantril ladder: The Cantril ladder goes from 0 to 10 with 10 for the best situation possible.
- Anticipated Subjective standard of living in 5 years on a Cantril ladder: The Cantril ladder goes from 0 to 10 with 10 for the best situation possible.

Variables in Table A2 (measured at endline):

- Total number of household members (excluding respondent): household members live with the respondent and regularly share meals with her.
- Number of household members depending financially on the respondent: a member is financially dependent if the respondent is paying for most of her expenses.
- Number of children: number of children who are alive.
- Polygamous / partner is polygamous: has or partner has more than one spouse or partner.
- Taking care of the family: The partner is not working, and her main activity is to take care of the family or to do household chores.
- Working: the partner of the respondent is working. It includes any type of activity, paid and not paid.
- Self-employed informal entrepreneur: partner is self employed in the informal sector (not registered with the administration with any formal status).
- Working in public sector or in a formal company: including self-employed in a formal company.
- Earned higher revenue than partner in 2015: answered that she had higher revenue than her partner in 2015. Answering that both partners had the same level of revenue was an option.
- Contribution to household expenditures in 2015 (in %): Respondents were asked to estimate their personal contribution in percentage to the total expenditure made by their household regarding different types of expenditure:
  - Own personal expenditures of the respondent: excluding gifts
  - Partner's personal expenditures: excluding gifts
  - Food
  - Health: total expenditure for all household members.
  - Housing: including rent and water and electricity bills.

Regularly send money outside the household Regularly receive money from outside the household

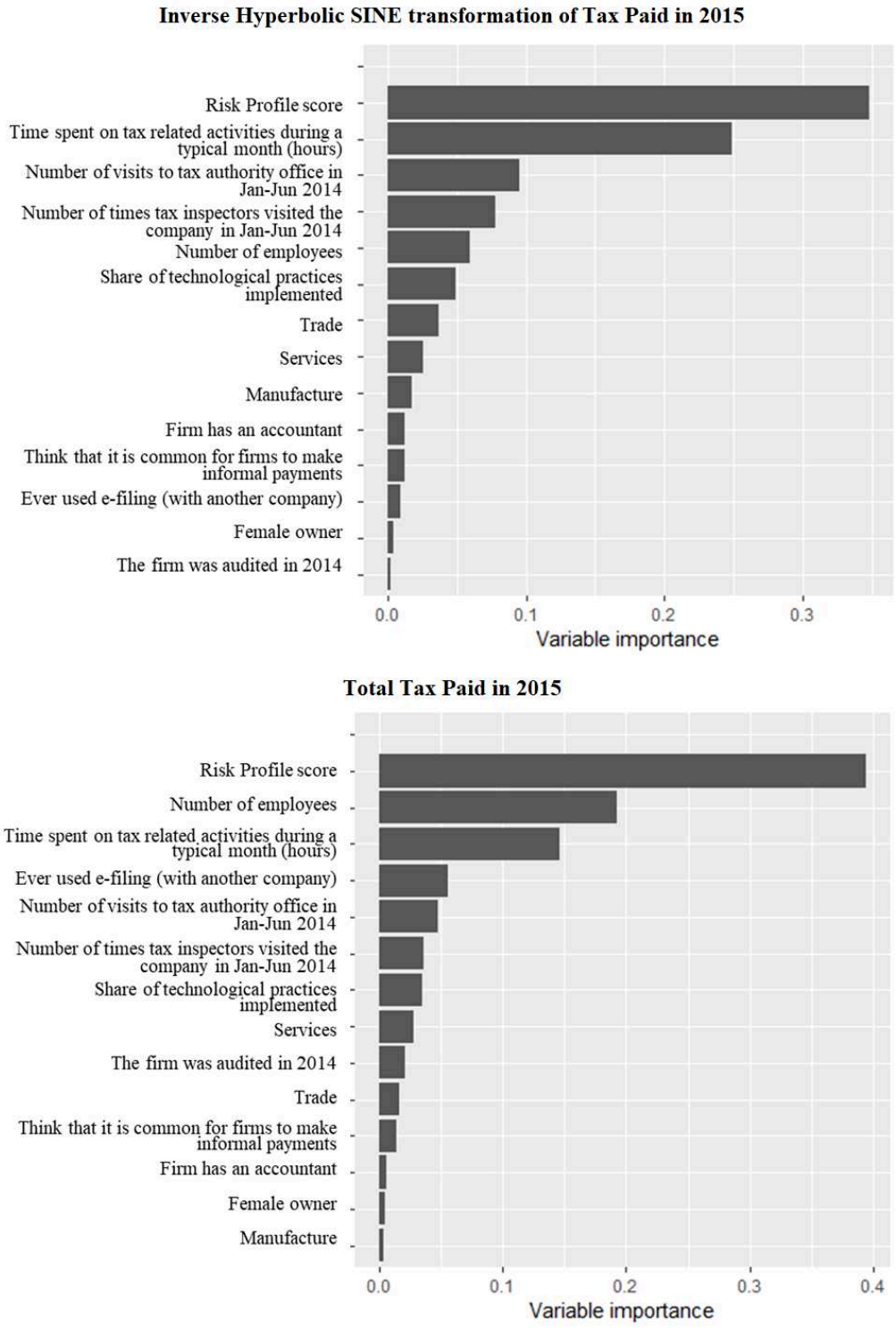
- Lottery 1: Willingness to pay to hide a windfall transfer
  - Willing to pay a positive price: equal to 1 if the respondent answered that she would prefer to receive CFAF 38,000 anonymously instead of CFAF 40,000 in front of her spouse, and 0 otherwise. CFAF 38,000 is the smallest amount that was offered to the respondent for this lottery.
  - Share willing to pay to hide income: Share of the cash transfer that the respondent is willing to pay to receive privately. The maximum amount that could be hidden was 50% of the transfer. Equal to zero if the respondent is not willing to hide at any price.
  - Share conditional on positive willingness to pay: Similar to the previous variable, except that the variable is equal to missing if the respondent is not willing to pay to hide at any (positive) price
- Lottery 2: Willingness to pay to get full control over a windfall transfer (instead of a 50/50 allocation)
  - Similar to Lottery 1
- Willing to pay a get more control on a windfall transfer (WTP ¿0 at any lottery): equal 1 if the willingness to pay is positive to at least one lottery question.

Appendix C

Chapter 3

Figures

Figure C1: Variable Importance in Explaining Treatment Impact Heterogeneity



Notes: This graph shows the frequency with with each variable is used as a splitting variable in the generalized random forest following Athey et al. (2018) and as described in the text.

Tables

Table C1: Attrition at Endline Survey

	Mean [SD] Control group	Difference between control group and […]			P-values of the test:	
		Group A	Group B	N	Group A= Group B	Group A= Group B= 0
Survey completed and firm still operating	0.84	0.007	0	1498	0.786	0.932
	[0.366]	(0.021)	(0.026)			
Survey completed and firm liquidated	0.127	-0.008	-0.023	1498	0.506	0.586
	[0.333]	(0.019)	(0.023)			
Survey not completed: not available or not found	0.023	0.009	0.023*	1498	0.307	0.226
	[0.15]	(0.009)	(0.014)			
Survey not completed: moved to another town	0.01	-0.008*	0	1498	0.205	0.11
	[0.099]	(0.004)	(0.007)			

Notes: Endline survey data 2015. Column 1: Standard deviations presented in brackets. Columns 2-3: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on treatment dummies, controlling for strata dummies. ***, **, * indicate significance at 1, 5 and 10%.

Table C2: Balance Checks by Initial Treatment Groups

	Mean [SD] Control group	Difference between control group and […]		N	P-values of the test Group A= Group B
		Group A	Group B		
PANEL A: Administrative data from Tax Committee (2014)					
Legal entities$^{\beta}$	0.734	-	-	1,498	-
	[0.442]				
Sector of activity is Trade$^{\beta}$	0.413	-	-	1,498	-
	[0.493]				
Sector of activity is Services$^{\beta}$	0.419	-	-	1,498	-
	[0.494]				
Sector of activity is Manufacturing	0.11	0.02	0.025*	1,498	0.699
	[0.313]	(0.012)	(0.014)		
Female owner	0.072	0.027	0.012	1,498	0.474
	[0.259]	(0.016)	(0.019)		
No employee	0.414	-0.019	-0.03	1,498	0.754
	[0.493]	(0.027)	(0.033)		
Number of employees	3.257	-0.089	0.119	1,498	0.376
	[3.431]	(0.189)	(0.24)		
The firms was audited in 2014	0.036	-0.006	0.000	1,498	0.642
	[0.187]	(0.01)	(0.013)		
Risk profile score in 2014$^{\lambda}$	62.1	1	2.8	1,067	0.433
	[28.7]	(1.8)	(2.3)		
Risk profile score in 2014 above median$^{\lambda}$	0.481	-0.004	0.034	1,067	0.351
	[0.5]	(0.033)	(0.04)		
PANEL B: Baseline Survey Data (2014)					
Firm has an accountant	0.72	0.044*	0.047	1,498	0.903
	[0.449]	(0.025)	(0.03)		
Share of technological practices implemented	0.547	0.016	-0.023	1,498	0.159
	[0.432]	(0.023)	(0.028)		
Number of visits to tax authority office in Jan-Jun 2014	6.373	0.136**	0.02	1,498	0.095*
	[0.978]	(0.061)	(0.066)		
Time spent on tax related activities during a	6.043	0.279*	0.461**	1,483	0.451
	[2.681]	(0.166)	(0.227)		
Number of times tax inspectors visited the	1.334	-0.032	-0.016	1,498	0.808
	[0.989]	(0.059)	(0.063)		
Ever used e-filing (with another company)	0.127	0.000	0.04	1,498	0.111
	[0.333]	(0.019)	(0.025)		
Think that it is common for firms to make informal payments	0.184	0.000	-0.014	1,498	0.591
	[0.388]	(0.022)	(0.026)		
P-values of joint orthogonality tests:		0.515	0.157		

Notes: Column 1: Standard deviations presented in brackets. Columns 2-3: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on treatment dummies, controlling for strata dummies. β: variables used for stratification. λ: Risk profile scores are only calculated for legal entities. α: P-values of joint orthogonality tests obtained from regressions of the treatment dummy on all the variables in the right-hand column (not used for stratification) and testing for all coefficients are jointly equal to zero. ***, **, * indicate significance at 1, 5 and 10%.

Table C3: Balance Checks on Endline Survey Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All sample			**Below median of 2014 risk profile score (low risk)**			**Above median of 2014 risk profile score (high risk)**		
	Mean [SD] Control group (B&C)	Diff. in Group A	N	Mean [SD] Control group (B&C)	Diff. in Group A	N	Mean [SD] Control group (B&C)	Diff. in Group A	N
PANEL A: Administrative data from Tax Committee (2014)									
Legal entities$^{\beta}$	0.737	-	1,263	1	-	486	1	-	448
	[0.44]			[0]			[0]		
Sector of activity is Trade$^{\beta}$	0.401	-	1,263	0.346	-	486	0.252	-	448
	[0.49]			[0.477]			[0.435]		
Sector of activity is Services$^{\beta}$	0.425	-	1,263	0.512	-	486	0.567	-	448
	[0.495]			[0.501]			[0.496]		
Sector of activity is Manufacturing	0.124	0.008	1,263	0.104	0.004	486	0.119	0.011	448
	[0.33]	(0.012)		[0.306]	(0.018)		[0.324]	(0.023)	
Female owner	0.08	0.018	1,263	0.073	0.007	486	0.044	0.021	448
	[0.272]	(0.017)		[0.26]	(0.025)		[0.206]	(0.023)	
No employee	0.392	-0.015	1,263	0.197	0.003	486	0.422	-0.04	448
	[0.488]	(0.026)		[0.399]	(0.037)		[0.495]	(0.047)	
Number of employees	3.396	-0.157	1,263	4.294	-0.703**	486	3.519	0.16	448
	[3.563]	(0.191)		[3.795]	(0.321)		[3.967]	(0.375)	
The firms was audited in 2014	0.03	-0.009	1,263	0.062	-0.03*	486	0.015	0.011	448
	[0.172]	(0.009)		[0.242]	(0.018)		[0.121]	(0.014)	
Risk profile score in 2014$^{\lambda}$	61.9	-0.7	934	41.7	1.7*	486	83.6	-1.4	448
	[27.8]	(1.7)		[10.5]	(0.9)		[24.1]	(2.2)	
Risk profile score in 2014 above	0.483	-0.025	934	0	0.000	486	1	0.000	448
	[0.5]	(0.033)		[0]	(0.000)		[0]	(0.000)	
PANEL B: Baseline Survey Data (2014)									
Firm has an accountant	0.73	0.04	1,263	0.796	-0.026	486	0.752	0.074*	448
	[0.444]	(0.025)		[0.404]	(0.039)		[0.433]	(0.038)	
Share of technological practices	0.544	0.035	1,263	0.664	-0.026	486	0.651	0.108***	448
	[0.438]	(0.023)		[0.417]	(0.04)		[0.408]	(0.039)	
Number of visits to tax authority office in Jan-Jun 2014	6.398	0.13**	1,263	6.536	0.086	486	6.459	0.183	448
	[0.994]	(0.062)		[1.067]	(0.106)		[1.149]	(0.119)	
Time spent on tax related activities during a typical month (hours)	6.139	0.111	1,252	6.117	0.075	483	6.686	0.019	442
	[2.709]	(0.162)		[2.35]	(0.236)		[3.171]	(0.36)	
Number of times tax inspectors visited the company in Jan-Jun 2014	1.309	-0.038	1,263	1.26	-0.061	486	1.167	0.048	448
	[0.924]	(0.059)		[0.832]	(0.114)		[0.874]	(0.088)	
Ever used e-filing (with another company)	0.152	-0.01	1,263	0.208	-0.04	486	0.185	0.017	448
	[0.359]	(0.02)		[0.406]	(0.036)		[0.389]	(0.039)	
Think that it is common for firms to make informal payments	0.186	0.005	1,263	0.26	-0.053	486	0.178	0.009	448
	[0.389]	(0.022)		[0.439]	(0.037)		[0.383]	(0.037)	
P-values of joint orthogonality tests:	0.558			0.4			0.292		

Notes: Columns 1, 4, 7: Standard deviations presented in brackets. Columns 2, 5, 8: coefficients and standard errors (in parentheses) from an OLS regression of the firm owner/firm characteristic on a treatment variable (group A), controlling for strata dummies. β: variables used for stratification. λ: Risk profile scores are only calculated for legal entities. α: P-values of joint orthogonality tests obtained from regressions of the treatment dummy on all the variables in the right-hand column (not used for stratification) and testing for all coefficients are jointly equal to zero. ***, **, * indicate significance at 1, 5 and 10%.

Table C4: Correlation between 2014 Risk Score and 2015 Tax Paid and Audits Results

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables:	Tax paid in 2015		Inverse hyperbolic of tax paid in 2015		Total audit fine in 2015 (in TJS 1000)	Inverse hyperbolic of total audit fine in 2015 (in TJS 1000)
Standardized risk profile score in 2014	346	539	-1.287***	-1.229***	1.8	0.037**
	(1,904)	(2,416)	(0.119)	(0.144)	(2.1)	(0.017)
The firm was audited in 2015					58.5***	10.582***
					(9.1)	(0.119)
Controling for:						
- Trade, Services, gender, no employee, number of employees and tax office.	yes	yes	yes	yes	yes	yes
- Index of profit and turnover in Jun and Dec 2015		yes		yes		
Observations	1,424	934	1,424	934	1,424	1,424
R-squared	0.202	0.505	0.335	0.368	0.190	0.978
Mean Dependent Variable	33073	35969	8.561	9.118	6.9	1.249

Notes: OLS regresions with standard errors presented in parentheses. ***, **, * indicate significance at 1, 5 and 10%.

Table C5: Impact on E-filing Adoption by Baseline Risk Profile Scores

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All sample			**Below median of 2014 risk profile score (low risk)**			**Above median of 2014 risk profile score (high risk)**		
	Mean [SD] Control group (B&C)	Diff. in Group A	N	Mean [SD] Control group (B&C)	Diff. in Group A	N	Mean [SD] Control group (B&C)	Diff. in Group A	N
PANEL A: Administrative data from TC (Aug 2014-Dec 2015)									
Used E-filing	0.604	0.325***	1,498	0.626	0.321***	547	0.547	0.39***	520
	[0.489]	(0.02)		[0.485]	(0.032)		[0.499]	(0.035)	
Used E-filing conditional on survival	0.658	0.326***	1,275	0.681	0.32***	488	0.592	0.365***	474
	[0.475]	(0.019)		[0.467]	(0.029)		[0.492]	(0.035)	
Still using e-filing	0.563	0.224***	1,498	0.614	0.248***	547	0.537	0.209***	520
	[0.496]	(0.024)		[0.488]	(0.037)		[0.499]	(0.042)	
PANEL B: Endline survey data (Feb 2016)									
Firm used electronic filing to submit tax reports in 2015	0.579	0.427***	1,263	0.526	0.475***	486	0.53	0.488***	448
	[0.494]	(0.019)		[0.5]	(0.031)		[0.5]	(0.032)	
Found out about e-filing during intervention training	0.815	0.185***	1,263	0.792	0.202***	486	0.796	0.211***	448
	[0.388]	(0.015)		[0.406]	(0.025)		[0.403]	(0.026)	
Found out about e-filing from business network	0.154	-0.154***	1,263	0.176	-0.172***	486	0.152	-0.158***	448
	[0.362]	(0.014)		[0.382]	(0.024)		[0.36]	(0.024)	
Found out from another source (other training, tax Committee publication...)	0.03	-0.031***	1,263	0.031	-0.03***	486	0.052	-0.053***	448
	[0.172]	(0.006)		[0.174]	(0.01)		[0.222]	(0.014)	

Notes: Columns 1, 4, 7: Standard deviations presented in brackets. Columns 2, 5, 8: coefficients and standard errors (in parentheses) from an OLS regression of the firm outcome on a treatment variable (group A), controlling for strata dummies. Colomn 4 to 9: Sample restricted to legal entities because risk profile scores are only calculated for legal entities. ***, **, * indicate significance at 1, 5 and 10%.

Table C6: Cost-Effectiveness Analysis (only Accounting for Reduced Compliance Costs)

	Control Group	Group A	Group B
Number of firms	608	594	296
Number of training conducted	12	36	16
Program costs (in USD):			
Training organization (specific by group)	7,573	10,167	4,931
Logistical help to register to e-filing (group A only)	0	4,696	0
Total program costs	**7,573**	**14,863**	**4,931**
Cost effectiveness analysis :			
Cost per firm included in treatment (in USD)	12	25	17
Additional cost with respect to control Group (in USD)		13	
Program impact on e-filing adoption (from table 3)		0.34	
Cost per additional e-filing adoption (in USD)		**37**	
Program impact on compliance costs (in hours saved) (from Table 5)		-4.7	
Amount of money saved monthly by firms[α] (in USD)		5.5	
Number of months for private benefits in term of time saved to exceded program costs		**7**	

Note: Training costs include direct costs of organizating trainings (trainers salaries, equipement rental, calls to invite participants) and costs to develop training materials. Costs related to the logistical help to register include costs to call and visit firms for the software instalation and costs related to firms registration. Exchange rate from Oanda.com on January 1st 2016: USD 1 = TJS 6.99.
α: assuming the wage of the person in charge of tax declaration is in average USD 178 per month or USD 1.11 per hour.

Table C7: Share of Firms that Dropped out from E-filing some Time after their Registration

	(1) **Among those who registered for e-filing by June 2015:** Stopped using e-filing at some point after registration
Group A x Below median risk profile score in 2014	0.060**
	(0.030)
Group A x Above median risk profile score in 2014	0.172***
	(0.032)
Above median risk profile score in 2014	-0.029
	(0.027)
P-val difference	0.012
Observations	623
R-squared	0.144
Mean Dependent variable in control group (B&C) for:	
…all firms (with a risk profile score)	0.028
…firms below median risk profile score in 2014	0.031
…firms above median risk profile score in 2014	0.024
Mean Dependent variable in group A for:	
…all firms (with a risk profile score)	0.151
…firms below median risk profile score in 2014	0.089
…firms above median risk profile score in 2014	0.215

Notes: OLS regresions with standard errors presented in parentheses controling for gender of the owner, no employees, number of employees, strata dummies and all baseline survey variables presented in Table 2. Risk profile scores are only calculated for legal entities. ***, **, * indicate significance at 1, 5 and 10%.

Table C8: Comparison of Machine Learning Methods

	(1) Elastic Net	(2) Boosting	(3) Neutral Network	(4) Random Forest
Total Tax Paid in 2015				
Best BLP	114,673,400	166,030,500	118,545,200	189,435,300
Best GATES	4,434	9,413	5,157	13,980
Inverse Hyperbolic SINE transformation of Tax Paid in 2015				
Best BLP	0.37	0.42	0.34	0.46
Best GATES	0.24	0.26	0.22	0.38

Notes: Medians over 100 splits. BLP: Best Linear Predictors of the conditional average treatment effect. GATES: Group average treatement effect. Best BLP and GATES are computed following the methodology describe in Chernozhukov et al. (2018)

Table C9: Best Linear Predictors of the Conditional Average Treatment Effect using Random Forest

	(1) Average Treatment Effect (ATE)	(2) Heterogeneity loading parameter (HET)
Total Tax Paid in 2015	3,666	0.415
90% Confidence interval	(-6505,13543)	(0.117,0.722)
P-value	0.97	0.014
IHS of Tax Paid in 2015	-0.008	0.194
90% Confidence interval	(-0.628,0.615)	(-0.117,0.496)
P-value	1	0.448

Notes: Medians over 100 splits. Best Linear Predictors of the conditional average treatment effect computed with Random Forest, following the methodology describe in Chernozhukov et al. (2018)

C.1 Script Used to Invite Firms to Training

Good day. My name is "OPERATOR NAME". We are calling you from company "IMPLEMENTING PARTNER NAME" LLC. Our company in cooperation with the Tax Committee and the International Finance Corporation is holding a seminar. Your company - LLC "COMPANY NAME" is in the short-list of taxpayers we are inviting to participate in our training. Training will take place on "DATE AND TIME" at "PLACE". All participants will be given training and guidance materials on tax and taxation. Some firms will be selected to be registered for e-filing system free of charge. Due to limited resources, we cannot register all firms now, so the firms selected will be based on chance as chosen by a computer program. In this regard, please prepare and bring the following documents:

- Copy of the registration certificate
- Extract from the Unified State Registry
- Passport copy of Director
- Company Seal

This training will provide important information but it is optional and there will be no penalty for your firm if you do not attend. Thanks in advance for your participation. Telephone number for inquiries and information: xxx-xx-xx

C.2 Measurement of Key Variables and Outcomes

Baseline administrative data:

- Legal entities: equal 1 if the firm is a legal entity (75% of the sample) and 0 if it is an individual enterprise.
- Sector of activity: Sector of activity reported by the firm when registering
- Female owner: the firm owner is a woman
- Number of employees: Number of employees reported by the firm to the tax authority
- The firm was audited in 2014: equal 1 if the tax administration reported that the firm was audited in 2014.
- Amount of fine following an audit in 2014 (in TJS/1000): amount of fine in 2014 in TJS/1000, as reported in administrative data. Equal zero if the firm was not audited in 2014.
- Risk score in 2014: Risk score calculated by the tax authority in 2014 (see section on Data for a detailed description of the risk score)

Baseline survey data: (self-administered survey)

- Firm has an accountant: the firm reported that an accountant (full-time or part-time) is responsible for tax accounting (as opposed to the firm owner himself).
- Share of technological practices implemented: Share of technological practices implemented by the firm from the following list: "the firm has high speed internet on premises," "the firm uses emails for business communication," and "the firm maintains accounting and tax records in your organization electronically using a specialized program (such as Excel)."
- Number of visits to tax authority office in Jan-Jun 2014: Number of times any employees of the firm visited a tax authority office between January and June 2014.
- Time spent on tax-related activities during a typical month (hours): This variable is the sum of the total amounts of time spent during a typical month (in January-June 2014) on tax report preparation and on visiting a tax office (including travel time).
- Number of times tax inspectors visited the company in Jan-Jun 2014: number reported by the firm owner
- Ever used e-filing (with another company): Equals 1 if the respondent reported that he/she had ever used e-filing to submit a tax document with another company.
- Think that it is common for firms to make informal payments: answered that the following statement is always or often true: "It is common for firms in my line of business to have to pay some irregular 'additional payments/gifts' to tax officials."

E-filing use and registration:

- Used E-filing: equal 1 if the firm used e-filing at any time during the study period.

Firm outcomes from endline survey data:

- Number of visits per month to tax authority office in 2015: sum of all visits reported by the firm owner to any tax office and for any reason.
- Total time spent on tax-related activities by month in 2015 (hours): This variable is the sum of the total amounts of time spent during a typical month in 2015 on the following activities:
  - Collate records
  - Submit tax returns (including travel time)
  - Get the reconciliation act
  - Prepare primary documents used for tax purposes
- Think that it is common for firms to make informal payments: answered that the following statement is always or often true: "It is common for other companies to have to pay some irregular 'additional payments/gifts' to tax officials."

- Tax paid in 2015: Total amount of tax paid in 2015, calculated using the average (declared) amount of tax paid across two focal months of 2015 (June and December) multiplied by 12.

Firm outcomes from administrative data:

- Tax paid in 2015: Sum of all taxes paid in 2015 using monthly administrative data.
- Inverse hyperbolic of tax paid in 2015: Inverse hyperbolic sine transformation of tax paid in 2015. It is defined by $log(y_i + (y_i^2 + 1)^{1/2})$.
- Median of Tax paid in 2015
- Number of months with a positive amount of tax paid in 2015

List Experiment:
Respondents were asked the following question:
"Now, I will read a list of various actions that a company can take to solve or prevent problems with the Tax Administration. After I read the entire list, I would like you to tell me ***how many of these actions your company took in 2015"****.*

50 percent of the sample had to choose among a short list of answers (which did not include unofficial payments) and 50 percent among a longer list (which included unofficial payments). The selection was random and was stratified on firm legal and treatment status.

Short list of answers (50% of sample)	Long list of answers (50% of sample)
1. Received help from trade associations	1. Received help from trade associations
	2. Made unofficial payments or provided free services/goods
2. Had detailed discussions with tax officials	3. Had detailed discussions with tax officials
3. Provided additional documents	4. Provided additional documents
4. Pursued court action	5. Pursued court action

C.3 Cost Effectiveness Analysis Using Time Saved by Firms

Administering the program (organizing the trainings, inviting firms, and providing logistical support for e-filing registration to Group A firms) cost $25 per firm in Group A, compared to $17 per firm in Group B and $12 per firm in Group C (Table A6). Given the 34 percentage point difference in take-up between Group A and the control group, and the $13 per firm difference in program costs, the cost per additional e-filing adoption in Group A relative to the control group is $37. The lack of any significant difference

between adoption in Group B and the control group indicates that the relevant aspect of Group A treatment was the logistical help with registration.
The difference in program costs per firm between Group A and Group B (cost of logistical support for registration) is $8 per firm. Given the 30 percentage point difference between Group A and Group B, the cost per additional e-filing adoption in Group A relative to Group B is $27.
We can compare the program costs to the benefits accruing to firms from the reduction in compliance costs. Data limitations preclude our calculating other potential benefits of the program such as savings in tax administration costs. In addition, from the government's perspective, we detect no significant average effects on tax revenue (although any revenue impact would be a transfer from firms to the government). Table 5 estimates that firms save 4.7 hours each month they would otherwise have spent on tax-related activities. From survey data, the average wage of the person in charge of tax declaration in firms is $178 per month (or $1.11 per hour), creating an estimated $5.5 savings per firm each month. As such, it would take five to seven months for private benefits in terms of time saved to exceed program costs. Although firms may not necessarily be willing to pay the full costs of the program,[1] these results provide guidance for a social planner on types of interventions that may be considered in promoting e-filing adoption. Appendix Table A6 provides details on the cost effectiveness analysis.

C.4 Machine Learning Methodology

The key steps implemented (based on Chernozhukov et al. (2018a)) are as follows:

- We determine which Machine learning method is the most appropriate by computing the best BLP (Best linear predictor) and the best GATE (group average treatment effect). The results are available in appendix table TXa and show that the Random Forest method outperform the other methods (Elastic net, Boosting and Neutral Network). For the rest of the analysis, we focus on the Random Forest method which gives more precise results (results are consistent with the other methods but imprecise).

- Using Random Forest, we compute the BLP of impact heterogeneity. The heterogeneity term presented in column (2) of appendix table TXb shows that there is significant heterogeneity of impact on total tax paid in 2015 (the heterogeneity parameter is however not significant for the inverse hyperbolic sine transformation of the tax paid in 2015).

- The samples were split into two, with 50 percent each allocated to training and test samples. P-values were computed using medians across 100 splits.

[1] Take-up remained quite low when firms had to pay $40 to register and obtain a token.