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Vulnerability and Inequality in Times of Crises

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THÈSE

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Vulnerability and Inequality in Times of Crises

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Abstract

This thesis examines the behaviours and interactions of various economic agents in developing countries in the crisis context. From the 2008 financial crisis in Vietnam, the Tunisian Revolution to the Covid-19 crisis in Tunisia, it aims to answer questions about (i) the vulnerability of firms and labor market to crisis, (ii) their responses, and (iii) the impact of government intervention following the crises on firms and labor market.

The first chapter looks at the effects of the pandemic on Tunisian small and medium-sized enterprises (SMEs) and examines their adaptation processes during the first lockdown. Three simultaneous shocks are examined employing a Difference-in-Differences (DID) framework applied to the national firm census: the labor input shock, the demand shock and the intermediate input shock. We show that SME performance in the first year of the crisis was heavily affected by a combination of labor input, demand and intermediate input shocks, but only the effects of the intermediate input shock persisted in the following year. Using our own firm survey, we examine three kinds of adaptation strategies: workplace and process adaptation, and trade credit. We find that firms in non-essential sectors were less able to adapt during the first lockdown, suggesting that firm adaptation seems to be more driven by capability than by necessity.

The second chapter assesses the effect of the counter-cyclical credit subsidy in Vietnam during the 2008 financial crisis. Using the provincial variation in the employment market share of the state-owned commercial banks (SOCBs) and Difference-in-Differences technique, we find that the subsidy helped firms to increase its new investment rate and total employment. Credit-constrained firms, particularly young and small firms in rural areas, experienced more significant enhancements in total outlay, employment, and investment. There was no evidence of an apparent bias favoring

local public firms. However, firms in higher SOCB market share provinces also had a significantly higher level of financial revenue following the subsidy, suggesting that a part of the program was channelled into speculative activities. The results not only advocate the pro-stabilization government point of view but also suggest that the local dominance of the SOCBs in terms of branch market share helped to channel the subsidised credit to firms, especially firms in the provinces where the banking outreach was limited.

In the last chapter, we analyze the impact of education, technology, structural change and public employment and wage policies on Tunisia's earnings inequality before and after the revolution breakpoint. Based on labor force surveys from the last two decades, a recentered-influence function (RIF) decomposition is performed to assess the contribution of relevant determinants of inequality change. We find that earnings inequality decreased significantly during the period of investigation in Tunisia, mainly due to the decrease in the public-private wage gap and in the sector wage gaps on the demand side, and the decreasing education premia on the supply side. After the Revolution, the closing process of private-public wage gap halted as the public sector turned to the pro-poor wage policy, and the routinization began to impact the Tunisian earnings distribution in the same way as observed in developed countries.

Résumé

Les deux premières décennies du 21^e siècle ont été marquées par une série de crises économiques, politiques et naturelles, qui ont laissé des empreintes persistant sur le paysage mondial. Parmi celles-ci se distingue la crise financière mondiale de 2008 qui a entraîné une récession économique généralisée ayant des répercussions dans de nombreux pays. Simultanément, les tensions géopolitiques et les soulèvements ont conduit à des changements significatifs dans les structures de gouvernance et de pouvoir. Le début du Printemps arabe en 2010 a marqué une période de bouleversements sociaux et politiques généralisés au Moyen-Orient, exprimant une demande collective de changement. Et plus récemment, la pandémie de Covid-19 est apparue comme une crise mondiale sans précédent, impactant à la fois la santé publique et l'économie, laissant une marque indélébile qui persiste encore aujourd'hui.

Malgré leur rareté, ces événements, une fois qu'ils se produisent, peuvent être imprévisiblement durables et dévastateurs. De nombreuses preuves empiriques ont montré que les crises politiques et financières entraînent des pertes considérables en emplois et en production et freinent la croissance économique. Néanmoins, les impacts de ces crises ne sont pas homogènes parmi les entreprises et les individus au sein des pays. Les petites et moyennes entreprises (PME) sont particulièrement les plus touchées par les crises en raison de leurs ressources limitées et de leur capacité de gestion faible.

Cette thèse s'intéresse aux impacts des crises sur les petites entreprises et les travailleurs dans les pays en développement. Plus précisément, elle aborde trois sujets: (i) l'impact de la crise économique sur la performance des PME et leur réponse à ces chocs adverses; (ii) l'effet de l'intervention contracyclique du gouvernement sur les petites entreprises; et (iii) le changement dans la dynamique de l'inégalité et ses déterminants suite à un soulèvement politique.

Le premier chapitre vise à décomposer les impacts de trois chocs induits par le Covid-19 sur les PME tunisiennes : le choc d'offre de travail, le choc de demande et le choc d'intrants intermédiaires. Nous exploitons la variation exogène de ces chocs entre les industries pour estimer un modèle des doubles différences. Le choc d'offre de travail capture l'exposition au risque de fermeture, en utilisant une variable binaire

qui prend la valeur 1 si une entreprise opère dans une industrie non essentielle. Le choc de demande reflète la diminution de la demande des ménages et est approximé par la moyenne industrielle des changements dans les prévisions de revenus annuels des entreprises américaines avant et après l'épidémie de Covid-19. Enfin, le choc d'intrants intermédiaires capture les perturbations potentielles dans la fourniture de intrants et est mesuré par la part industrielle des entreprises rencontrant des contraintes d'approvisionnement en intrants intermédiaires selon l'Enquête de suivi du Covid-19 de la Banque mondiale sur les entreprises.

Dans l'ensemble, nous constatons que la performance des PME en 2020 a été fortement affectée par une combinaison de chocs liés à l'offre de travail, à la demande et aux intrants intermédiaires, mais seul l'effet du choc d'intrants intermédiaires a persisté en 2021. De plus, les chocs causés par la pandémie ont exacerbé la division entre les entreprises exportatrices/étrangères et les entreprises domestiques, car elles ont démontré une meilleure adaptabilité et résilience. Nos résultats soulignent également que l'adaptation des entreprises semble être davantage motivée par la capacité que par la nécessité. De plus, les entreprises plus jeunes et plus grandes étaient plus enclines à adopter une adaptation des processus. Enfin, les gestionnaires titulaires de diplômes universitaires ont montré une plus grande tendance au télétravail, tandis que les gestionnaires expérimentés ont bénéficié d'un meilleur accès au crédit commercial.

Le deuxième chapitre examine l'effet de la subvention de crédit contracyclique au Vietnam pendant la crise financière de 2008. L'un des principaux sujets de ce débat est le compromis entre l'efficacité à long terme et la stabilité à court terme. Plus précisément, le point de vue pro-allocation préconise des normes élevées/sanctions par défaut pour dissuader les entreprises peu productives, tandis que le point de vue pro-stabilisation préfère des normes faibles/sanctions par défaut pour sauver autant d'entreprises que possible. Ce dernier soulève généralement plusieurs préoccupations, notamment le risque de défauts massifs, une forte inflation future et une allocation inefficace à long terme. Une des raisons sous-jacentes est la possibilité de substitution de prêt, qui peut être à la fois motivée par l'entreprise et par la banque. Plus précisément, les banques peuvent demander aux clients les plus risqués de rembourser leurs dettes existantes avec la garantie ou le prêt subventionné, tandis que les entreprises sont également motivées à renégocier un taux d'intérêt plus bas pour leurs prêts existants.

La substitution du prêt non subventionné à faible risque par le prêt subventionné à haut risque augmente donc le risque agrégé de défauts.

La mise en œuvre de politiques contracycliques pose encore plus de défis dans les pays en développement. Des crédits basés sur les connections, le favoritisme envers les entreprises publiques, l'absence d'un système d'évaluation et de suivi efficace, ainsi que les disparités dans le développement des marchés financiers locaux sont des caractéristiques prévalentes du monde en développement. Ces facteurs ont tendance à aggraver le problème de mauvaise allocation des programmes de soutien aux entreprises. Par conséquent, cela nécessite davantage d'études et de preuves pour contribuer à une meilleure conception des politiques de crise dans le contexte de ces pays.

Suite à la crise financière mondiale de 2008-2009, le gouvernement vietnamien a introduit un programme de subvention d'intérêt sans précédent visant à stimuler la reprise des entreprises nationales. Le prêt subventionné était principalement alloué par le système de banque commerciale d'État (BCE), étant donné sa position dominante sur le marché. Par conséquent, nous estimons un modèle des doubles différences pour évaluer l'impact de la subvention sur les entreprises privées locales en utilisant la variation provinciale dans la part de marché des agences des BCE.

Nous constatons que le programme a atténué les contraintes de crédit des entreprises pendant la crise et a augmenté l'emploi et l'investissement des entreprises. De plus, les jeunes et petites entreprises dans les provinces avec une plus grande part de marché des BCE ont bénéficié d'une augmentation plus élevée des crédits totaux, de l'emploi et de l'investissement par rapport à celles dans les provinces avec une part de marché des BCE plus faible. De plus, il n'y avait pas de preuve d'un biais en faveur des entreprises publiques locales. Cependant, les entreprises situées dans les provinces où les BCE dominent ont démontré un niveau de revenu financier significativement plus élevé, ce qui implique une spéculation des crédits subventionnés. Ce chapitre présente deux contributions principales. Premièrement, il fournit des preuves microéconomiques sur l'efficacité d'une subvention massive contracyclique dans le contexte d'un pays en développement. Deuxièmement, il évalue le rôle des banques d'État en tant qu'instrument pour compenser la disparité spatiale des conditions financières locales, en particulier pendant la période de crise.

Les résultats défendent le gouvernement en faveur de la stabilisation, plus précisément, la subvention a aidé les entreprises à augmenter leur taux de nouveaux investissements et leur emploi total. Il suggère également que la domination locale des BCE en termes de part de marché des agences a contribué à orienter le crédit subventionné vers les entreprises dans le besoin, en particulier les entreprises dans les provinces où la portée bancaire est limitée. Par conséquent, si la politique est correctement conçue et que les BCE sont bien surveillées, elles peuvent encourager la reprise économique et contribuer à atténuer les défaillances du marché.

Enfin, le dernier chapitre examine l'évolution de l'inégalité avant la révolution et pendant la transition politique vers la démocratie en Tunisie. En adoptant une perspective du marché du travail, nous nous concentrons sur l'évolution de la distribution des revenus et de ses déterminants. Nous testons la contribution de différents facteurs mis en évidence dans la littérature sur les pays développés et en développement, et ajoutons le rôle du secteur public, étant donné son importance dans le contrat social de la région du Moyen-Orient et de l'Afrique du Nord (MOAN). Notre objectif est d'identifier les régularités expliquées par des facteurs structurels, et de mettre en évidence les changements qui ont pu survenir en raison de l'augmentation des pressions sociales, résultant du changement de régime.

Sur la base des enquêtes sur la population active des deux dernières décennies, une décomposition de la fonction d'influence recentrée (FIR) est effectuée pour évaluer la contribution des principaux déterminants du changement d'inégalité. Cela nous permet de contribuer au débat sur la dynamique de l'inégalité des revenus dans les économies en transition. Le principal résultat est que l'inégalité des revenus diminue significativement au cours de la période étudiée en Tunisie, principalement en raison de la diminution de l'écart salarial public-privé et de l'écart salarial sectoriel du côté de la demande, et de la diminution des primes d'éducation du côté de l'offre. L'augmentation des rendements marginaux aux emplois à faible salaire mais de moyenne intensité de tâches routinières (ITR), la diminution du rendement de l'expérience et la diminution de l'écart salarial régional sont également trouvées pour avoir contribué au déclin de l'inégalité globale des revenus.

La décomposition de la tendance globale en période pré- et post-révolution révèle des changements plus intéressants. Les rendements de l'éducation et du changement

structurel contribuait toujours à une hausse des inégalités après la Révolution, mais ce n'était pas le cas pour l'écart salarial public-privé et les rendements des emplois de différents niveaux d'ITR. La réduction de l'écart salarial privé-public s'est arrêté après la Révolution, car le secteur public a adopté une politique salariale favorable aux travailleurs peu qualifiés. En même temps, le rendement aux emplois à faible ITR a légèrement augmenté plus que celui des emplois à forte ITR pendant la transition vers la démocratie. En d'autres termes, la routinisation a commencé à avoir un impact sur la distribution des revenus en Tunisie de la même manière que cela a été observé dans les pays développés.

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List of Abbreviations

DID	Difference in Differences
DOT	Dictionary of Occupational Titles
ENPE	Tunisian Population and Employment Survey
GSO	General Statistics Office of Vietnam
INS	Tunisian Institute of Statistics
ISCO	International Standard Classification of Occupations
JSBC	Joint Stock Commercial Banks
JVBC	Joint Venture Commercial Bank
MENA	Middle East and North Africa
NAT	Tunisian Nomenclature of Activities
NNP	Tunisian Nomenclature of Occupations
O*NET	U.S. Occupational Information Network
OB	Oaxaca-Blinder
OLS	Ordinary Least Squares
PCI	Vietnam's Provincial Competitiveness Index
RBTC	Routine Bias Technical Change
RIF	Recentered-Influence Function
RNE	Tunisian Business Registry
RTI	Routine-Task Intensity
SIC	Standard Industrial Classification
SME	Small and Medium-Sized Enterprises
SOCB	State Owned Commercial Bank
TWFE	Two-Way Fixed Effects
VCCI	Vietnam Chamber of Commerce and Industry
VNCI	Vietnam Competitiveness Initiative
VSBP	Vietnam Bank for Social Policies
WBES	World Bank Enterprise Surveys
SOE	State Owned Enterprise

Introduction

The first two decades of the 21st century have been marked by an array of crises spanning economic, political, and natural spheres, each leaving enduring imprints on global landscapes. Among these stands out the 2008 global financial crisis which resulted in a widespread economic downturn that reverberated across countries. Simultaneously, geopolitical tensions and uprisings led to significant shifts in governance and power structures. The onset of the Arab Spring in 2010 delineated a period of widespread social and political upheaval across the Middle East, resonating a collective demand for change. And most recently, the Covid-19 pandemic emerged as an unparalleled global crisis, impacting both public health and the economy, leaving an indelible mark that still continues to persist.

Despite their rarity, these events, once they happen, can be unpredictably long lasting and devastating. Many empirical evidences have shown that political and financial crises lead to considerable losses in jobs and output ([Abadie and Gardeazabal, 2003](#); [Reinhart and Rogoff, 2009](#); [Bordo and Meissner, 2015](#)) and dampen the economic growth ([Alesina et al., 1996](#); [Aisen and Veiga, 2013](#); [Bordo and Meissner, 2015](#)). Using a sample of 180 economies, an IMF report indicates that approximately 85 percent of economies that experienced a banking crisis in 2007–2008 are still operating at output levels below pre-crisis trends ([IMF, 2018](#)). This number drops to around 60 percent for countries that were not directly exposed to a banking crisis in that period. [Matta et al. \(2019\)](#) find that the adverse impact of the Arab Spring on the Tunisian economy ranges from -5.1 percent to -6.4 percent of GDP over the three years following the event.

Nevertheless, the impacts of these crises seem to exhibit a heterogeneous pattern across firms and individuals within countries. For instance, according to [Cowling et al. \(2018\)](#), the 2008 financial crisis had a long-lasting scarring effect on small and medium enterprises (SMEs). [Deyoung et al. \(2015\)](#) find that the financial crisis led to a reduction

in credit availability for SMEs. Studying the Covid-19 crisis, [Apedo-Amah et al. \(2020\)](#); [Alekseev et al. \(2022\)](#) confirm the disproportionate impact of the crisis on small firms.

The literature on distributional impacts of the crises, [Atkinson and Morelli \(2011\)](#) and [Piketty and Saez \(2013\)](#) for instance, shows mixed evidences due to the reverse causality between inequality and economic shocks. Meanwhile, [Meyer and Sullivan \(2013\)](#) and [Bodea et al. \(2021\)](#) find the effect of financial crises on economic inequality particularly strong in the long run.

This thesis is concerned with the impacts of crises on small business and workers in the developing world. More precisely, it addresses three topics:

1. The impact of economic crisis on SME performance and how they response to these adverse shocks.
2. The effect of government's countercyclical intervention on small businesses.
3. The change in inequality dynamic and its determinant following a political upheaval.

The first chapter seeks to disentangle the impacts of three shocks induced by the Covid-19 on Tunisian SMEs: labor supply shock, demand shock and intermediate input shock. We exploit the exogenous variation of these shocks across industries to estimate a Difference-in-Differences model. Labor supply shock captures exposure to the risk of closure, using a dummy variable which takes the value 1 if a firm operates in a non-essential industry. Demand shock captures the decrease in households' purchasing power and is proxied by the industrial mean of changes in US firms' annual earnings forecast before and after the Covid-19 outbreak. Finally, intermediate input shock captures the potential disruptions in input provision and is measured as the industrial share of firms having intermediate input constraints from the World Bank's Enterprise Survey Follow-up on Covid-19.

Overall, we find that SME performance in 2020 was heavily affected by a combination of labor input, demand and intermediate input shocks, but only the effect of the intermediate input shock persisted in 2021. Additionally, the shocks caused by the pandemic exacerbated the divide between outward-looking and domestic firms as outward-looking firms and those owned by foreign entities demonstrated better adaptability and resilience. Our findings also highlight that firm adaptation seems

to be more driven by capability than by necessity. Furthermore, younger and larger firms, along with exporters and foreign-owned businesses, were more inclined to adopt process adaptation. Finally, managers with university degrees exhibited a greater tendency toward teleworking, whereas experienced managers benefited from improved access to trade credit.

The second chapter investigates the effect of the counter-cyclical credit subsidy in Vietnam during the 2008 financial crisis. One of the main topics of this debate is the trade-off between the long-term efficiency and the short-term stability. More precisely, the pro-allocation viewpoint advocates a high standard/ default sanction to discourage low-productivity firms while the pro-stabilization prefers a low standard/ default sanction to save as many firms as possible (Goodhart et al., 2023). The latter usually raises several concerns, including the risk of massive defaults, high future inflation and ineffective long-term allocation. One of the underlying reasons is the possibility of loan substitution which can be both firm-driven and bank-driven. More precisely, banks can ask the riskiest clients to repay their existing debts with the guarantee or subsidised loan while firms are also motivated to renegotiate a lower interest rate for their existing loans. The substitution of unsubsidised low-risk loan with the subsidised high-risk loan hence increases the aggregate risk of defaults (Altavilla et al., 2021).

Implementing countercyclical policies poses even more challenges in developing countries. Connected lending, bias towards State-Owned Enterprises (SOEs), the absence of an efficient evaluation and monitoring system, and disparities in local financial market development are prevalent characteristics in the developing world. These factors tend to exacerbate the misallocation problem of the stimulus packages. Therefore, it necessitates more studies and evidences to contribute to a better policy design in the context of these countries.

Following the global financial crisis of 2008-2009, the Vietnamese Government introduced an unprecedented interest subsidy program aimed at assisting the recovery of domestic firms. The subsidised loan was mainly allocated through the state-owned commercial bank (SOCB) system, given the strong market power of the SOCBs. Therefore, we estimate a Difference-in-Differences model to evaluate the impact of the subsidy on local private firm using the provincial variation in the branch market share of

the SOCBs.

We find that the program relieved firm credit constraints during the crisis and increased firm employment and investment. Furthermore, young and small firms in higher SOCB market share provinces benefited from a higher increase on total outlay, employment and investment compared with their counterparts in lower SOCB market share provinces. In addition, there was no evidence of a bias toward local public firms. However, companies located in provinces where the SOCBs dominated had shown a significantly higher level of financial income, which implies speculation of subsidized loans. The contribution of this chapter is twofold. First, it provides micro evidences on the effectiveness of the massive counter-cyclical subsidy in the context of a developing country. Second, it assesses the role of state-owned banks as an instrument to compensate the spatial disparity in local financial conditions, especially during a crisis.

The results advocate the pro-stabilization government point of view, more precisely, the subsidy helped firm to increase its new investment rate and total employment. It also suggests that the local dominance of the SOCB in terms of branch market share helped to channel subsidised credit to firms in need, especially firms in the provinces where the banking outreach is limited. Therefore, if the policy is appropriately designed and the SOCB are well monitored, it can encourage the economy recovery and help mitigating the market failures.

Finally, the last chapter investigates the evolution of inequality before the revolution and during political transition to democracy in Tunisia. Adopting a labor market lens, we focus on the evolution of earnings' distribution and its determinants. We test the contribution of different factors highlighted in the literature on developed and developing countries and add the role of the public sector, given its importance in the MENA social contract. Our aim is to identify regularities explained by structural factors, and highlight changes that may have occurred due to increasing social pressures, resulting from regime change.

Based on labor force surveys from the last two decades, a recentered-influence function (RIF) decomposition is performed to assess the contribution of the main determinants of inequality change. This allows us to contribute to the debate on earnings inequality dynamics in transition economies. The main result is that earnings

inequality decreases significantly during the period of investigation in Tunisia, mainly due to decreases in the public–private wage gap and the sector wage gap on the demand side and the decreasing education premia on the supply side. The increase in marginal returns to low-wage but average-Routine-task-intensity (RTI) jobs, the falling return to experience, and the decreasing regional wage gap are also found to have contributed to the decline in overall earnings inequality.

Breaking down the overall trend into pre- and post-revolution period reveals more interesting changes. The contribution of education premia and structural change to the overall inequality were still disequalizing after the Revolution, but this is not the case for the public-private wage gap and RTI. The closing process of private-public wage gap halted after the Revolution as the public sector turned to the pro-poor wage policy. Meanwhile, the return to low-RTI job slightly increased more than the return to high-RTI the during the transition-to-democracy. In other words, the routinization began to impact the Tunisian earnings distribution in the same way as observed in developed countries.

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Chapter 1

The Great Lockdown and the Small Business: Impact, channels and adaptation to the Covid pandemic

The Great Lockdown and the Small Business: Impact, channels and adaptation to the Covid pandemic

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Abstract

In this paper we estimate the effects of the pandemic on Tunisian small and medium-sized enterprises (SMEs) and examine their adaptation processes during the first lockdown. Three simultaneous shocks are examined employing a Difference-in-Differences (DID) framework applied to the national firm census: the labor input shock, the demand shock and the intermediate input shock. We show that SME performance in the first year of the crisis was heavily affected by a combination of labor input, demand and intermediate input shocks, but only the effects of the intermediate input shock persisted in the following year. Using our own firm survey, we examine three kinds of adaptation strategies: workplace and process adaptation, and trade credit. We find that firms in non-essential sectors were less able to adapt during the first lockdown, suggesting that firm adaptation seems to be more driven by capability than by necessity.

Keywords: Crisis, Covid-19, lockdown, SME, adaptation

JEL classification: D22, L25, O14, O16

1.1 Introduction

Understanding the nature of an economic shock and how firms adapt to it are key in mitigating its consequences, preparing for recovery and handling future shocks. The demand/supply nature of the Covid-19 crisis and the channels through which it was transmitted to the whole economy entail different policy implications (Baqae and Farhi, 2022). This crisis exposed economists and policy makers to an unprecedented level of complexity in terms of shocks, including various initial and high-order supply and demand shocks. The labor input shock resulted from the mandatory closure of businesses, the implementation of social distancing, the level of coronavirus infections or fear of infection. The shortage of intermediate inputs is the consequence of the reduction in labor witnessed by intermediate-input industries. Meanwhile, the demand shock resulted from the intersectoral and intertemporal shift in the composition of household expenditure. Households' demand for high contact-intensive goods and services such as dining out, entertainment, and travel was reduced, while demand for non-perishable food, sanitary products and healthcare services increased. Furthermore, they opted to postpone consumption in the present, referred to by Baldwin and Tomiura (2020) as the wait-and-see effect, which also occurred as a result of income loss due to the lockdown and other containment measures.

In this paper, our goal is to gather lessons from the pandemic and set up a framework of analysis that could be applied in response to future shocks. Our first aim is to quantify the impact of the crisis on SMEs and disentangle the main channels through which they were affected. Our second objective is to identify which types of SMEs performed better during the crisis and thereafter. Finally, we wish to understand which firms adapted better to the crisis and how. This knowledge can help improve the targeting of financial support to SMEs in developing countries.

The three channels through which the pandemic affected SMEs are the labor input shock, the demand shock and the intermediate input shock. Our key variables are the variation of these shocks across industries. The labor input shock captures exposure to the risk of closure, using a dummy variable which takes the value 1 if a firm operates in a non-essential industry. The demand shock captures the decrease in households' purchasing power and is proxied by the industrial mean of changes in US firms' annual earnings forecast before and after the outbreak of Covid-19. Finally, the intermediate

input shock captures the potential disruptions in input provision and is measured as the industrial share of firms experiencing intermediate input constraints derived from the World Bank's Enterprise Survey Follow-up on Covid-19. We run a Difference-in-Differences model on the panel data drawn from the Tunisia's national firm census.

While demand and supply shocks are the fundamental hazards, other factors may exert an influence by amplifying or mitigating these hazards. We identify three sources of amplification/mitigation: technological adaptation, credit constraint and firm heterogeneity. We first examine these sources using the national census. More precisely, we add a triple interaction of the shock measures with firm or industry characteristics to the baseline model. Firm characteristics include size, export status and foreign ownership whereas technological adaptation and credit constraint are proxied respectively by the industrial teleworkability and external finance dependence indices. To further investigate SMEs' actual adaptations in terms of technology and finance, we ran a survey of Tunisian SMEs right after the first lockdown. Three prominent kinds of adaptation implemented by firms were examined: workplace adaptation, process adaptation and the use of trade credit.

Overall, we find that SME performance in 2020 was heavily affected by a combination of labor input, demand and intermediate input shocks, but only the effect of the intermediate input shock persisted in 2021. Additionally, the shocks caused by the pandemic exacerbated the divide between outward-looking and domestic firms as outward-looking firms and those owned by foreign entities demonstrated better adaptability and resilience. Our findings also highlight that firm adaptation seems to be more driven by capability than by necessity. Furthermore, younger and larger firms, along with exporters and foreign-owned businesses, were more inclined to adopt process adaptation. Finally, managers with university degrees exhibited a greater tendency toward teleworking, whereas experienced managers benefited from improved access to trade credit.

Our paper contributes to the literature on the impacts of "negative shocks" on SMEs in three ways. Firstly, it is among a small number of papers that look at these impacts at the firm level in developing countries. The uniqueness of our data set makes it possible to estimate the effects of the Covid crisis on the entire Tunisian SME population and control for time-invariant unobservable heterogeneity. Moreover, working on two

years of observations allows us to study firms' behavior in the midst of crisis and recovery, whereas most papers have solely focused on the first months of the crisis. Furthermore, this paper quantifies the impact of various simultaneous shocks induced by the pandemic. From the technical point of view, we provide a comprehensive set of measures of shocks at the industry level. These measures neither limit themselves to the Tunisian context nor to the Covid context. Other measures of economic shocks can be constructed in the same manner for other countries and crises. From the practical point of view, being informed about which firms are more sensitive to certain shocks than others is important in order to enable better timing and targeting of public support. Finally, with our own survey on SMEs carried out after the first lockdown, we are able to provide evidence on the determinants of firm adaptation.

The rest of the paper is structured as follows. Section 1.2 reviews the relevant literature. Section 1.3 provides the context of the first lockdown and the Tunisian economy in 2020. The data and methodology are described in Section 1.4. Section 1.5 presents our results. Finally, Section 1.6 concludes.

1.2 Literature Review

Our paper relates to several strands of literature. The first one seeks to decompose shocks at the macroeconomic level. Given the vastness and prevalence of this literature, we only cite here the Covid-19 related papers. [del Rio-Chanona et al. \(2020\)](#) were among the first authors who predicted the first-order supply and demand shocks on sectoral output, employment and wages. They estimate that the Covid-19 crisis and containment measures reduced aggregate output by one fifth, total employment by one quarter and total wage income by nearly one fifth. The aggregate effects were dominated by supply shocks. [Brinca et al. \(2021\)](#) measure the shifts in labor supply and demand curves using a structural-vector-autoregression model and monthly sectoral data. They also found that more than two thirds of the aggregate drop in the growth rate of working hours growth rate during the lockdown could be attributed to the labor input shock. [Baqae and Farhi \(2020\)](#) and [Barrot et al. \(2021\)](#) focus on the first-order and second-order supply effects of social distancing measures and suggested that the nonlinearities of the production network, together with the heterogeneity of

the shocks, could make the second-order shock very costly in terms of its effects on output. [Guerrieri et al. \(2022\)](#) examine the demand shock triggered by the negative supply shocks and find that this secondary shock could be larger than the initial shock if the intersectoral elasticity of substitution was less than the intertemporal one. [Baqee and Farhi \(2022\)](#) incorporate nominal frictions into a disaggregated Keynesian model featuring both multiple sectors and multiple factors. In the presence of complementarities, negative supply shocks outweigh negative demand shocks in terms of output loss and generate Keynesian spillovers as well as further output loss. Lastly, [Pichler et al. \(2020\)](#) extend the traditional input-output model to account for simultaneous demand and supply shocks and factored in a degree of firm rationing to obtain the bottom-up impact estimates. They show the important amplification effects of the production network which were even greater in the presence of micro-level coordination failures. The common findings of this literature are that (i) labor supply supply shocks predominated during the lockdown; (ii) demand and supply shocks varied substantially across industries; (iii) the higher-order shocks were much larger than the initial shocks and (iv) nonlinearities, complementarities and market frictions, in most of the cases, amplified the shocks.

The literature studying the impact of Covid-19 more specifically at the firm level shows a heterogeneous impact depending mainly on firm size and the level of development of their country of operation. Based on a US survey of 28,000 firms, [Alekseev et al. \(2022\)](#) find that larger and older firms are more likely to continue operating during the crisis and that they were more concerned about demand shocks as opposed to supply shocks. [Apedo-Amah et al. \(2020\)](#) confirm the disproportionate impact on small firms with a survey of 51 countries and 100,000 businesses. Using a survey covering 35,000 small businesses in Latin America, [Guerrero-Amezaga et al. \(2022\)](#) predict a substantial impact in the medium term on small firms, due to the low levels of public assistance that these firms benefited from. Drawing on firm surveys in 38 countries, [Aga and Maemir \(2022\)](#) show that Sub-Saharan African firms are disproportionately impacted by the health crisis, due to structural pre-pandemic characteristics. The authors also find a higher propensity to adapt to shocks incurred as result of the Covid-19 pandemic in Sub-Saharan Africa, despite lower financial and technological resources. Using a panel survey of 5,000 UK firms, [Bloom et al. \(2020\)](#) highlight the major contraction

of less productive firms in 2020-21, which partly offsets the significant reduction in within-firm productivity on overall total factor productivity. Drawing on firm-level data on 34 countries, [Muzi et al. \(2022\)](#) also find a higher probability of exit of unproductive firms, characterized by low levels of digitalization and innovation. Recent significant contributions to this strand of literature also draw attention to resilience factors. For instance, [Barry et al. \(2022\)](#) study how three forms of corporate flexibility - workplace, investment and finance - affect firms' employment and investment plans. Notably, high workplace flexibility was not only important for planned employment growth, but also boosted planned capital spending when coupled with high investment flexibility. Using the domain/website density and data on small business performance aggregated at the metropolitan level, [Mossberger et al. \(2023\)](#) highlight the role of digital economic activity and its effect on the resilience of small businesses in the US metropolitan regions. Meanwhile, [Aristei and Gallo \(2023\)](#) conclude that sound environmental management practices relieved the impacts of the Covid-19 pandemic, while pre-crisis credit constraints acted as an amplifier of the negative impacts. Finally, [Chen et al. \(2023\)](#) show that exporting firms performed better during the lockdown by means of online operations, trade credit and asset sales.

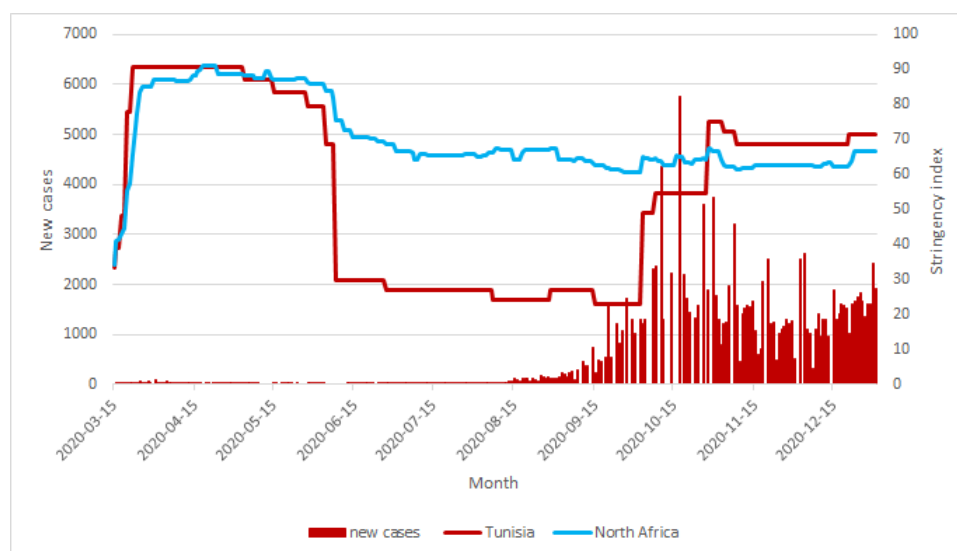
Our paper also draws on a third strand in the literature that looks at the effects of and responses to other shocks (financial crisis, terrorist attacks, etc.) at the firm level. These studies exploit the exogenous variation in the shocks or in the predisposition to shocks across industries or economies. For instance, [Tong and Wei \(2008\)](#) and [Isyuk \(2013\)](#) use the variation in sectoral demand sensitivity and firm financial constraints to isolate the effect of demand shock and credit supply shock on firm stock prices during the 2007-2009 financial crisis. The index of demand sensitivity was constructed by [Tong and Wei \(2008\)](#) based on the response of consumer confidence, proxied by firm stock prices, to the September 11 attacks. They find that firms were more affected by the contraction of credit than the reduction in consumer confidence. [Calomiris et al. \(2012\)](#) study the change in equity returns of firms around the world during the financial crisis. They find lower equity returns in firms that were sensitive to the global demand shock, the credit crunch and equity sales pressures. [Claessens et al. \(2012\)](#) compile firm-level data from 42 countries to study the three transmission channels of the financial crisis: credit supply, domestic demand and trade. They conclude that firms in higher demand- and

trade-sensitive industries experienced more output loss. [Nguyen and Qian \(2014\)](#) use a survey of Eastern European firms and reached the same conclusion, namely that the demand shock was more damaging to firms' sales and employment than the credit shock. In the same spirit, [Coviello et al. \(2022\)](#) examine firm responses to a persistent adverse demand shock using a quasi-experiment: the 2008 law imposing fiscal rules that affected only Italian municipalities with a population greater than 5,000. They show that firms responded to a persistent demand shock by cutting capital rather than labor.

1.3 First lockdown and Tunisian economy in 2020

In the wake of the trauma caused by the explosion in the number of confirmed cases of Covid-19 infection in Italy and France, Tunisia's main economic partners and preferred destinations of its migrants, the country imposed one of the strictest lockdowns in the world (stringency index of 91) from March 2020 (after the detection of the first infected case) to the beginning of May 2020. Borders and schools were closed, internal movements forbidden and only workplaces pertaining to essential industries (food, public utilities, etc.) were kept open ([Marouani and Krafft, 2022](#)).

Figure 1.1: Number of daily Covid cases and stringency of restrictions in Tunisia in 2020



Source: Author's creation using data by [Hale et al. \(2021\)](#)

The success in terms of low infections and the high economic cost (GDP decreased by 21% in the second quarter of 2020) led to the government lifting almost all restrictions in the summer of 2020, as shown in Figure 1.1. However, the resurgence of cases in fall 2020 led the authorities to reimpose high restrictions, particularly harmful for service sector firms which account for a high share of the Tunisian economy, resulting in a total GDP loss of 9% at the end of 2020. The cost was particularly high for SMEs given the limited provision and extension of financial support made available by the government. Only 25% of SMEs applied for or received any form of state assistance to overcome the crisis (Krafft et al., 2021).

1.4 Data and Methodology

1.4.1 Methodology

Shock evaluation

As mentioned above, the supply and demand shocks induced by the lockdown and Covid-19 were aggregate shocks, but their effects were notably heterogeneous across industries. We deploy these sectoral variations of shocks to decompose their effects on Tunisian SMEs.

As the baseline model, we apply the traditional two-way-fixed-effect (TWFE) DID specification. The model is set up as follows:

$$y_{ijrt} = \gamma_1 LS_j \cdot Post + \gamma_2 DS_j \cdot Post + \gamma_3 IS_j \cdot Post + \beta X_{ijr(t-1)} + \alpha_j + \eta_r + \lambda_t + \epsilon_{ijrt} \quad (1.1)$$

where y_{ijrt} is the annual sales of firm i in industry j and district r .¹ The dummy variable $Post$ takes the value 1 if a firm is observed in 2020 and the value 0 otherwise. α_j and η_r capture time-invariant industry-specific and district-specific effects, while λ_t accounts for the time trend. A set of firm covariates $X_{ijr(t-1)}$ controls for pre-crisis time-varying firm-level characteristics, including firm age (in logarithm), square of age, size, foreign ownership and export status. We adjust the standard errors by clustering them at the 4-digit NAT² industry level. The labor input shock, LS_j , measures exclusively the direct

¹Alternatively, in Appendix Tables, y_{ijrt} will also capture firm i employment.

²Following the 2009 Tunisian Nomenclature of Activities 2009.

effect of the mandatory lockdown in April and May 2020. The demand shock, DS_j , is a proxy for the demand shifts induced by the Covid-19 pandemic. The intermediate input shock, IS_j , measures sectoral exposure to intermediate input shocks. Details on the identification of these shocks are presented in section 1.4.2. Except for the labor input shock, which is a dummy, other shocks are standardized. We expect the estimations of γ_1 , γ_2 and γ_3 to be negative, meaning that the shocks have a negative association with firm sales.

One question arising from the initial analysis is whether specific firm characteristics, like size, export orientation, foreign ownership, or financial constraints, etc., drive the impact of shocks. This would imply heterogeneity in the impact of shocks across firms. To explore this heterogeneity, we re-estimate the baseline model and introduce, one at a time, the interactions between shocks and specific firm attributes that might influence the effect of the shocks:

$$y_{ijrt} = \pi_1 \text{Covariate}_{ij(t-1)} \cdot \text{Post} + \pi_2 \text{Covariate}_{ij(t-1)} \cdot \text{Shock}_j + \pi_3 \text{Shock}_j \cdot \text{Covariate}_{ij(t-1)} \cdot \text{Post} \\ + \gamma_1 LS_j \cdot \text{Post} + \gamma_2 DS_j \cdot \text{Post} + \gamma_3 IS_j \cdot \text{Post} + \beta X_{ijr(t-1)} + \alpha_j + \eta_r + \lambda_t + \epsilon_{ijrt} \quad (1.2)$$

where Shock_j is the labor input, demand, or intermediate input shock and $\text{Covariate}_{ijr(t-1)}$ is a set of relevant firm characteristics, which are detailed below.

Firm size is a fundamental characteristic considered in empirical analyses of firm performance during a crisis. Research indicates that smaller firms tend to experience disproportionately larger negative effects, attributed to their limited resources and the quality of their entrepreneurs (Gertler and Gilchrist, 1994; Varum and Rocha, 2013; Cowling et al., 2015; Apedo-Amah et al., 2020; Alejandro Fernández-Cerezo and Moral-Benito, 2023). Moreover, significant variation exists between and within subgroups of small firms, indicating that interventions aimed at all SMEs may not be efficient (Cowling et al., 2015; Brucal and Grover, 2023).

The relationship between firm resilience and export orientation is less straightforward. On the one hand, export-oriented firms have higher productivity, quality and exhibit learning-by-exporting behaviors, hence, they are expected to perform better during recession times (Atkin et al., 2017; Burger et al., 2017; Chen et al., 2023). On the other hand, firms with greater sensitivity to trade might be more vulnerable to

global crisis (Claessens et al., 2012). In this paper, we distinguish between partial and total exporters, defined by Articles 10 and 21 of the *Code d'Incitation aux Investissements*. These firms benefit from special tax exemptions, according to Articles 12 and 22 of the same law. Moreover, during the Covid-19 crisis, total exporters were granted the right to sell up to 100% of their output on the domestic market³.

The literature also suggests that firm resilience may vary based on the ownership structure, particularly between foreign-owned and locally-owned firms. Foreign-owned firms are expected to perform better because they are more productive and have access to international credit (Helpman et al., 2004; Burger et al., 2017; Georgopoulos and Glaister, 2018).

We also interact the shocks with two sectoral financial and technological characteristics (in this case $Covariate_{ijr(t-1)}$ is replaced by $Covariate_j$). Dependence on external financing sources has long been recognized as an important variable for predicting firm resistance to crises. The less firms depend on external financing resources, the fewer financial limitations they face (Braun and Larrain, 2005; Tong and Wei, 2011; Isyuk, 2013). Finally, crucial to firm resilience during the Covid-19 crisis was teleworkability - employees' capability to work from home. Studies on firm responses to Covid-19 suggest that teleworkability is a key factor influencing the resilience of firms. The construction of these two variables is presented below in section 1.4.2.

Firm adaptation to shocks

Facing strict mandatory closure, a firm in a non-essential industry can adjust its workplace practices by shifting all its activities online to allow its employees to work from home. Meanwhile, a firm in an essential industry, in response to mobility restrictions, can adapt its working processes and products to reduce physical contact among employees and with clients. Both firms, however, experienced a sudden loss in their revenue, requiring an urgent and rapidly implemented financial alternative in order to survive through the extended lockdown. In this paper, we study the mitigation effect of prominent firm adaptations to the labor input shock generated by the lockdown. For this purpose, we run a firm survey conducted after the first lockdown in 2020 and presented in detail in section 1.4.2. Three specific adaptations are examined: work-

³100% in food health product industries and 50% in other industries

place adaptation, process adaptation and the use of trade credit. The identification of these three forms of adaptation is also presented in section 1.4.2.

First, we look at the impact of the three shocks on firm sales change in our survey. Given that the survey data is cross-sectional, we adjust Equation 1.1 as follows:

$$y_{ijg} = \alpha_0 + \gamma_1 LS_j + \gamma_2 DS_j + \gamma_3 IS_j + \beta X_{ijg} + \alpha_j + \eta_g + \epsilon_{ijg} \quad (1.3)$$

where y_{ijg} is the percentage change in sales of firm i in industry j and region g during the lockdown compared to the same month of the previous year. α_j and η_g capture the unobserved industry- and region-specific effects. We adjust the standard errors by clustering them at the 2-digit NAT industry level. The level of fixed-effect controls and clusters is more aggregate than in Equations 1.1 and 1.2 as we have only 829 observations in the firm survey. In addition to the covariates included in the baseline equation, we incorporate firm import status and two manager characteristics – experience and education level – as control variables.

In order to investigate the determinants of firm adaptation, we replace the sales changes in Equation 1.3 by firm adaptations. The model below is estimated with linear probability estimator:

$$Adapt_{aijg} = \alpha_0 + \gamma_1 LS_j + \gamma_2 DS_j + \gamma_3 IS_j + \beta X_{ijg} + \alpha_j + \eta_g + \epsilon_{ijg} \quad (1.4)$$

where $Adapt_{aijg}$ is one of the three adaptation dummies.

In the last step, we introduce all three adaptation variables into Equation 1.3 to see whether firm adaptation strategies are associated to better performance:

$$y_{ijg} = \alpha_0 + \sum_{a=1}^3 \pi_a Adapt_{aijg} + \gamma_1 LS_j + \gamma_2 DS_j + \gamma_3 IS_j + \beta X_{ijg} + \alpha_j + \eta_g + \epsilon_{ijg} \quad (1.5)$$

1.4.2 Data and variable construction

Sectoral variables

Labor input shock: The mandatory closure during the lockdown manifested itself mainly as a labor input shock affecting non-essential industries, with stores and plants suddenly forced to close, and thousands of workers prohibited from leaving their houses

in order to go to work as a result of emergency measures imposed by the government. As Tunisia experienced a low infection rate during most of the year 2020, the main source of labor input shock in that year was due to the strict lockdown policy. We constructed our own list of essential (or non-essential) industries for Tunisia by gathering information from announcements by government agencies. We end up with a list of non-essential industries at the 4-digit NAT level. Our measure of the direct shock induced by the lockdown is a dummy which takes on the value 1 if the firm operated in a non-essential 4-digit industry, and 0 otherwise.

Demand shock: Following [Barry et al. \(2022\)](#) and [Hong et al. \(2020\)](#), we calculate the demand shock as the industrial mean of changes in US firms' annual earnings forecast before and after the outbreak of Covid-19. Given that February 20 is the starting date of the pandemic in the US, we use January 2020 as the most recent non-pandemic forecast period and May 2020 as the revision accounting for the pandemic. The data are provided by the Institutional Brokers' Estimate System (IBES)⁴. We calculate the firm-level change in forecasts made between January and May 2020, then take the average value at the 3-digit-NAICS (North American Industry Classification System) level. Finally the measure is mapped from the 3-digit NAICS to the 3-digit NAT codes. The demand shock is multiplied by -1 before being standardized so that the increase in a negative demand shock is negatively associated with firm performance.

The use of a US proxy of certain industry characteristics has been widely practiced in applied economics (see the survey by [Ciccone and Papaioannou \(2016\)](#)), as the US measure is deemed to have less distortions compared to less developed economies. For instance, demand sensitivity in the US in the wake of the September 11 terrorist attacks ([Tong and Wei, 2008](#)) has been deployed in various papers to estimate the effects of the financial and sovereign debt crises on firms across the world ([Tong and Wei, 2011](#); [Claessens et al., 2012](#); [Nguyen and Qian, 2014](#)).

Despite the extensive literature based on this practice, there remains the need to exercise caution, due to the underlying assumption that the pattern of sectoral demand contraction is analogous across countries. This assumption is particularly problematic, given the differences in technological availability, consumer preferences, and the range of substitute products between the two countries. First of all, to rule out the fact that

⁴The earnings forecast are firstly adjusted to account for the fact that a certain fraction of the fiscal year had already been completed before the pandemic.

US firms might adapt better to the Covid shock, we use US firms' annual earnings forecast instead of the real earnings. In addition, we construct an equivalent measure of demand shock using the real change in Tunisian stock prices before and after the lockdown. Tunisia's stock market in 2020 was composed of the 60 largest companies in the country, many of which operate in the financial sector. Thus the demand shock calculated from these data is at best considered as an indicator for a limited part of the economy. We plug the two data sets to the firm data and calculate the correlation coefficient. It varies between 0.29-0.58 depending on the choice of the time window.

Intermediate input shock: While intermediate supply shortage was an aggregate problem due to the interruption of the global value chain, a large part of it is still industry-specific (Balleer and Noeller, 2023). We calculate a survey-based measure of intermediate input shortage from the World Bank's Enterprise Survey Follow-up on Covid-19. These cross-section surveys follow the baseline Enterprise Survey and are designed to provide quick information on the impact and adjustments that Covid-19 has brought about in the private sector. The questionnaire contains a question on firms' production during the last month before the survey. Specifically, firms are asked to compare their supply of inputs, raw materials, or finished goods and materials purchased to resell for the last completed month with the same month in 2019, indicating whether it increased, remained the same, or decreased. If firms answer "decreased", then it is classified as "constrained input". We aggregate the share of firms having a reduced material supply at the 3-digit-*ISIC* industrial level across 33 countries surveyed from 2020 to 2022 around the world. This measure thus captures industry-specific rather than country-specific intermediate constraints. Similar to the demand shock, the intermediate supply shock is also mapped to the 3-digit-*NAT* codes and standardized.

Teleworkability (Telework): To quantify this feature, we use the classification of teleworkable jobs developed by Dingel and Neiman (2020). Their classification covers the questions on work context and generalized work activity in O*NET⁵, a US survey database on the nature of occupations and their task composition. The authors define a list of statements that excludes the possibility of telework. If none of these statements are true, the occupation can be performed from home and takes the value 1, otherwise

⁵US's Occupational Information Network

it takes the value 0. The index is available at the 5-digit SOC⁶ level. We map it to the NNP-14⁷ codes then aggregate it at the 3-digit NAT level.

External finance dependence (EFD): We proxy firm sensitivity to financial shocks by the external finance dependence (Rajan and Zingales, 1998) of US firms over the period 2010-2019 in the Compustat data base. To smooth temporal fluctuations and reduce the effects of outliers, we sum firm use of external finance and investment over 2010–2019 and then take the ratio of these sums. We then take the industry median at the 3-digit SIC code level and map it to the 3-digit NAT level.

RNE panel data

Our main data set comes from the national firm census (RNE) of the Tunisian National Institute of statistics (INS). It covers exhaustively data on all firms registered with the tax authorities. This is an exceptional feature of the RNE, as highlighted by Rijkers et al. (2014). Alongside the ability to track firm entry and exit, these key features enable the tracking of firms over time while controlling for attrition bias.

The RNE provides information on formal firm activity code, characteristics (age, size, ownership and export status) and performance (sales and employment). For this study, we mostly restrict the data set to SMEs in the period 2016-2020, with an extension to 2021 for a part of the analysis . SMEs are defined as firms that have 5 to 200 employees. Table 1.1 describes the descriptive statistics of firm outcomes, shocks and the firm/industrial characteristics of our data set.

COVID-19 survey data and SME adaptation

To investigate SME adaptation, we run a firm survey conducted after the first lockdown in 2020. The survey provides us with firms' and managers' characteristics, including firm age, size, import status, export status (non, partial, total exporter) as well as ownership (local or foreign); manager's experience and education. It also covers strategic management questions containing details about firm performance as well as the strategies adopted for coping with the pandemic. Firm performance during the lockdown is proxied by changes in sales in May 2020 with respect to sales in May 2019.

⁶US's Standard Occupational Classification

⁷Tunisia's 2014 National Occupational Classification

Table 1.1: Summary statistics of RNE firms (2016-2020)

	N	Mean	SD	Min	Max
<i>Panel A: Firm outcomes</i>					
Log of sales	45087	14.065	1.494	-7.212	18.080
Log of employment	45087	2.841	0.858	-1.386	5.234
<i>Panel B: Industrial shocks</i>					
Labor input shock	45087	0.735	0.441	0.000	1.000
Demand shock	45087	0.006	0.874	-1.374	3.754
Intermediate input shock	45087	-0.002	0.985	-4.068	3.813
<i>Panel C: Firm characteristics</i>					
Log of age	45087	2.604	0.761	0.000	4.787
Sq. Log of age	45087	7.358	3.777	0.000	22.920
Medium	45087	0.143	0.350	0.000	1.000
Partial exporter	45087	0.145	0.352	0.000	1.000
Total exporter	45087	0.186	0.389	0.000	1.000
Foreign	45087	0.093	0.291	0.000	1.000
<i>Panel D: Industrial characteristics</i>					
Telework	44401	-0.239	0.832	-0.997	2.522
EFD	44401	0.101	0.964	-8.991	6.223

Table 1.2 describes the data derived from this firm survey and the sectoral variables used in this study. Figure 1.2 and Figure 1.3 compare firm distribution and average sales growth in the RNE panel data set and the survey data set. Manufacturing firms and hotel/restaurants are overrepresented in the survey data set. Furthermore, the average variation in sales in May 2020 (in comparison to May 2019) is much larger than that of the entire year 2020 (with reference to the entire year 2019) due to the fact that most firms were completely shut down during April and the first half of May 2020.

Firm adaptations are constructed as follows. Firms are identified as having implemented a process adaptation if they responded yes to any of the following questions:

1. Did your company start selling online to reduce proximity to clients?
2. Did your company start selling over the phone to reduce proximity to clients?
3. Did your company change your product to reduce proximity to clients?
4. Did your company change its mode of transportation due to mobility restrictions?
5. Did your company change its imported/exported products to cope with the pandemic?

Figure 1.2: Firm distribution across sectors (%)

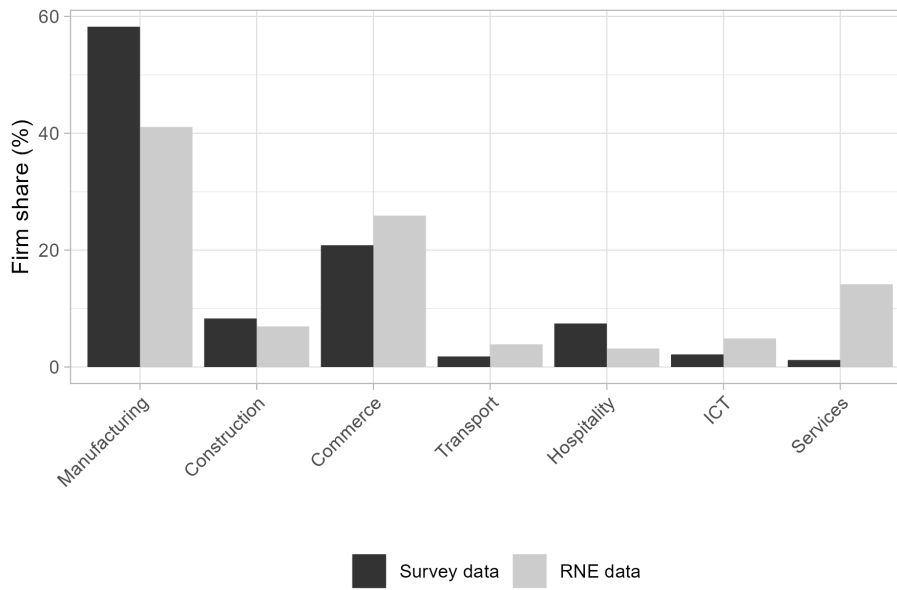
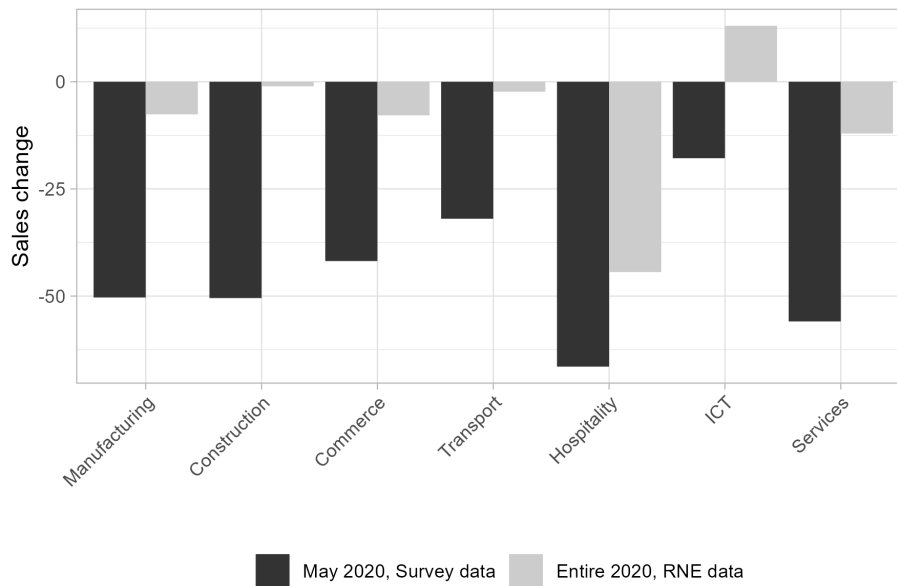


Figure 1.3: Sales change across sectors (%)



Firms are identified as having implemented a workplace adaptation if all or some of their employees were able to work from home. Firms that could sell online or over phone did not necessarily have their employees to work from home. Indeed, among 12% firms that were able to turn their storefront into an online business, only 65% of these firms had their employees work from home.

Table 1.2: Average outcomes and characteristics of firms in control and treatment groups - Survey data

	N	Mean	SD	Min	Max
<i>Panel A: Firm outcomes</i>					
Sales change (%), 05/2019-05/2020	829	-49.397	44.406	-100.000	100.000
<i>Panel B: Firm adaptations</i>					
Use of trade credit	829	0.176	0.381	0.000	1.000
Process adapt.	829	0.188	0.391	0.000	1.000
Workplace adapt.	829	0.227	0.419	0.000	1.000
<i>Panel C: Industrial shocks</i>					
Labor input shock	829	0.768	0.422	0.000	1.000
Demand shock	829	0.044	0.979	-1.603	4.317
Intermediate input shock	829	0.031	0.994	-3.514	3.480
<i>Panel D: Firm characteristics</i>					
Log of age	829	2.409	0.835	0.000	4.477
Sq. Log of age	829	6.499	3.823	0.000	20.047
Medium	829	0.244	0.430	0.000	1.000
Importer	829	0.522	0.500	0.000	1.000
Partial exporter	829	0.112	0.316	0.000	1.000
Total exporter	829	0.186	0.389	0.000	1.000
Foreign	829	0.127	0.333	0.000	1.000
Experience	829	12.241	8.006	1.000	42.000
bachelor's degree	829	0.657	0.475	0.000	1.000
<i>Panel E: Industrial characteristics</i>					
EFD	817	0.030	1.008	-1.428	6.549
Telework	817	-0.182	0.829	-0.853	3.190

1.5 Results

1.5.1 Baseline results

Figure 1.4 plots the mean of the log of sales over time for our control and treatment groups. The treated firms include firms in non-essential industries, industries with demand shocks above the 2020 sample median (high demand shock) and industries with intermediate input shocks above the 2020 sample median (high intermediate input shock). Conversely, the control group include firms in essential industries, industries with demand below the median (low demand shock) and industries with intermediate input shocks below the median (low intermediate input shock). Despite the different levels, the two groups have roughly similar trends in all shocks. Furthermore, there is a clear divergence in firm performance when the Covid-19 pandemic broke out in

2020, due to the labor input and demand shocks.

Figure 1.4: Sales trends (2016-2020)

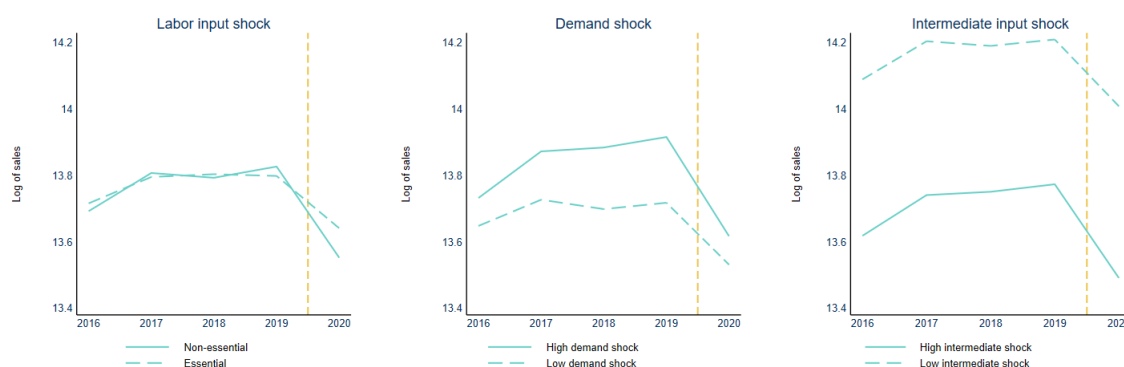


Table 1.3 displays the results of the baseline Equation 1.1 for SME sales. Columns (1)-(3) include one shock at a time. Column (4) includes the three shocks altogether. The effect of the labor input shock on SME sales is significant and negative. Firms in non-essential activities experienced a level of sales 15.6 percent lower than those in essential activities. Column (2) exposes a negative association between the demand shock and SME sales: one standard deviation increase in demand shock is associated with an 11 percent loss in sales. Finally, Column (3) shows that Tunisian SMEs also suffered a negative influence resulting from the intermediate input shock, although the magnitude is lower than that of the demand shock: one additional standard deviation in intermediate input shock is associated with a 7.3 percent loss in firm sales. When we introduce the three shocks at the same time in Column (4), the coefficients associated to the three shocks are lower, but still negative and significant.

Figures 1.5 and 1.6 plot the average changes in the log of sales conditional on the demand and intermediate input shocks. The difference between the average annual sales change of firms whose demand shock is in the 75th percentile and firms whose demand shock is in the 25th percentile is -0.07 log points ($-0.12 - (-0.05)$). For the intermediate input shock, the difference between average annual sales change of firms whose shock is in the 75th percentile and firms whose shock is in the 25th percentile is -0.04 log points ($-0.104 - (-0.06)$).

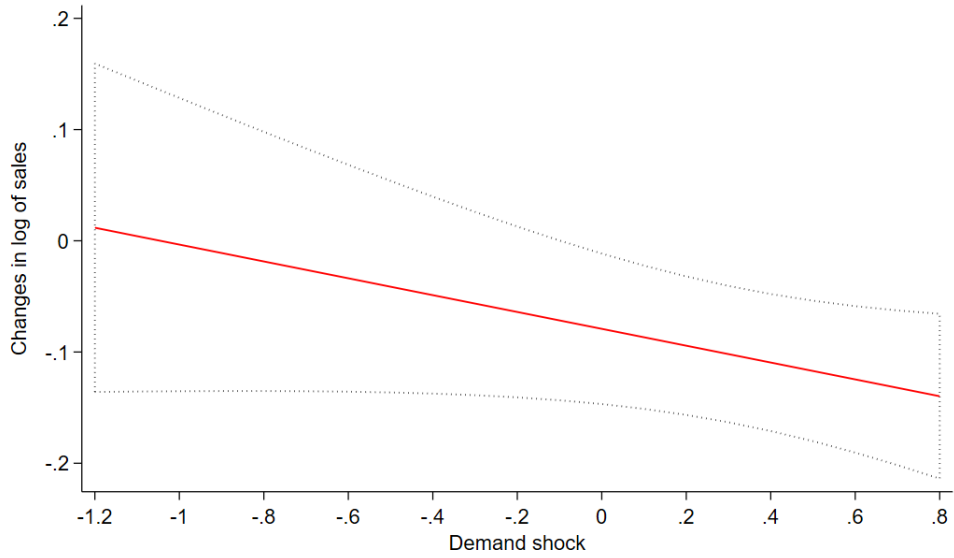
Table 1.3: Effects of the shocks on SME's sales

	(1)	(2)	(3)	(4)
Labor input shock x Post	-0.156*** (0.038)			-0.108** (0.047)
Demand shock x Post		-0.110** (0.044)		-0.076* (0.045)
Intermediate input shock x Post			-0.073** (0.033)	-0.037* (0.019)
Log of age	0.164** (0.070)	0.162** (0.070)	0.162** (0.070)	0.163** (0.070)
Sq. Log of age	-0.027* (0.015)	-0.026* (0.015)	-0.026* (0.015)	-0.026* (0.015)
Medium	1.353*** (0.050)	1.354*** (0.050)	1.353*** (0.050)	1.354*** (0.050)
Partial exporter	0.380** (0.039)	0.381*** (0.039)	0.382*** (0.039)	0.380** (0.039)
Total exporter	0.137** (0.060)	0.137** (0.060)	0.137** (0.060)	0.137** (0.060)
Foreign	0.319*** (0.061)	0.320*** (0.061)	0.320*** (0.061)	0.320*** (0.061)
Year FE	Yes	Yes	Yes	Yes
4-digit Industry FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
N	45,076	45,076	45,076	45,076
R-sq	0.521	0.521	0.521	0.521

Note: All models apply the two-way fixed-effect estimator. Standard errors are clustered at the 4-digit industry level.

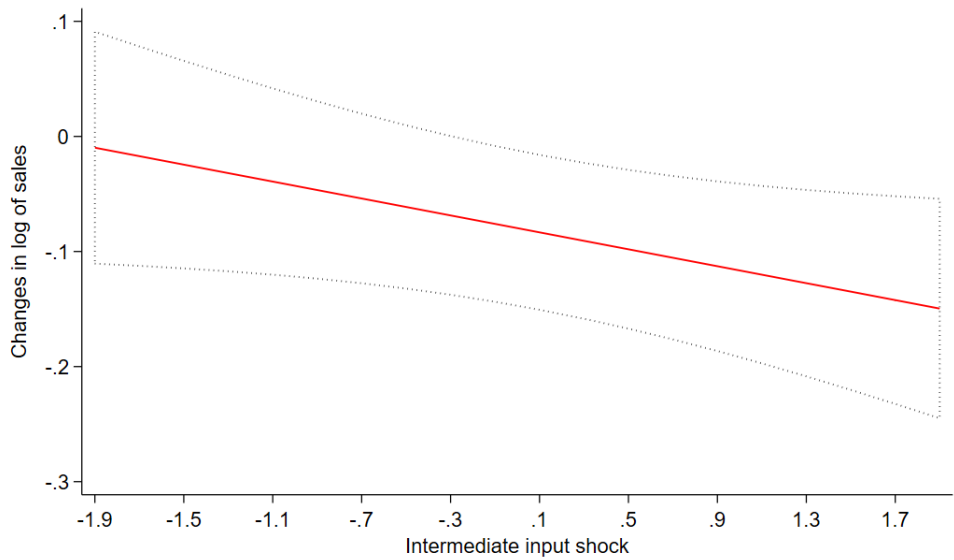
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure 1.5: Average effects of demand shock



Note: This graph is derived from model (4) in Table 1.3.

Figure 1.6: Average effects of intermediate input shock



Note: This graph is derived from model (4) in Table 1.3.

1.5.2 Heterogeneous treatment effects

According to [D’Haultfoeuille et al. \(2023\)](#) and [Callaway et al. \(2024\)](#), using two way fixed effects (TWFE) for continuous treatment can lead to biased estimates in the presence of heterogeneous treatment effects. Units actually receiving a higher dose of treatment might react differently had they received a lower dose of treatment. Given this potential bias of the TWFE, we employ the method proposed by [Callaway and Huang \(2020\)](#) as a robustness check. The main idea is to construct a counterfactual distribution of the potential outcome Y for each value of treatment T by integrating the predicted conditional distribution over the observed covariate X .

For this analysis we use the annual change in log of sales between 2019 and 2020 as the dependent variable. This leaves 10,755 observations. Firm covariates are the same as those used in Equation 1.1. The 3-step procedure estimation of [Callaway and Huang \(2020\)](#) is as follows. First, we estimate the conditional quantiles $\hat{Q}_{Y|T,X}(\tau|t, x)$, then invert them to obtain the conditional distributions $\hat{F}_{Y|T,X}(y|t, x)$. Second, we average \hat{F} over X while fixing $T = t$ to obtain the counterfactual distribution $\hat{F}_{Y|T}^C(y|t)$. Finally, we estimate the average treatment effects using the counterfactual distribution \hat{F}^C .

Figures 1.7 and 1.8 plot the expected changes in log of sales conditional on the demand and intermediate input shock with adjustment for differences in the covariates, respectively. The graphs show that annual sales loss is increasing in level of shocks. To make it comparable to our baseline estimates, we also calculate the p25/p75 gap. The difference between the average annual sales change of firms whose demand shock is in the 75th percentile and firms whose demand shock is in the 25th percentile is -0.11 log points ($-0.32 - (-0.21)$). Similarly, for the intermediate input shock, the corresponding gap between annual sales changes is -0.09 log points ($-0.304 - (-0.215)$). These figures are -0.07 log point and -0.04 log point respectively in our baseline. The inflation of the estimates using this method might be attributed to the lack of pre-trend control, as we use only 2019 in the pre-treatment period.

1.5.3 WBES demand shock

For robustness check, we construct an alternative measure of demand shock based on the World Bank’s Enterprise Survey Follow-up on Covid-19 (WBES). We use the

Figure 1.7: Expected changes in log of sales conditional on demand shock

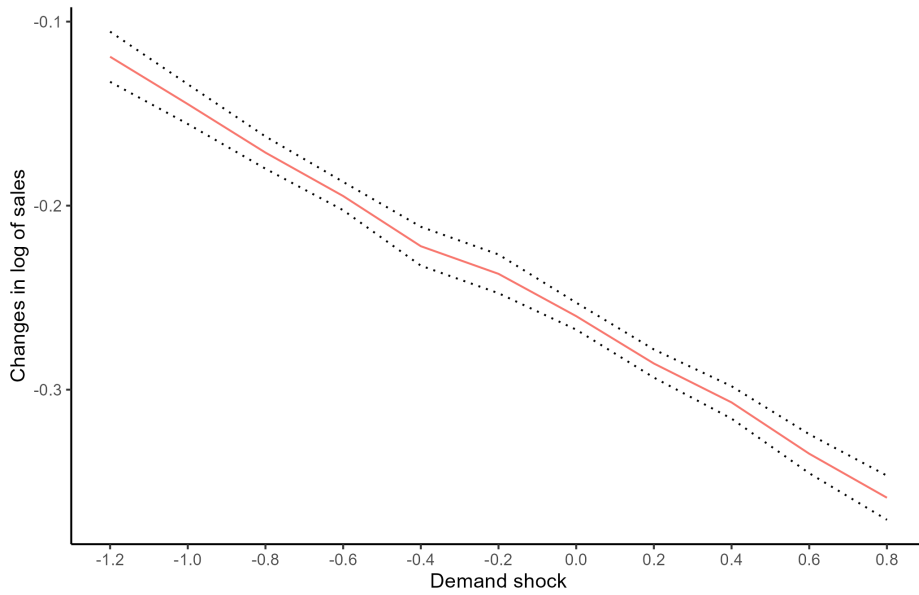
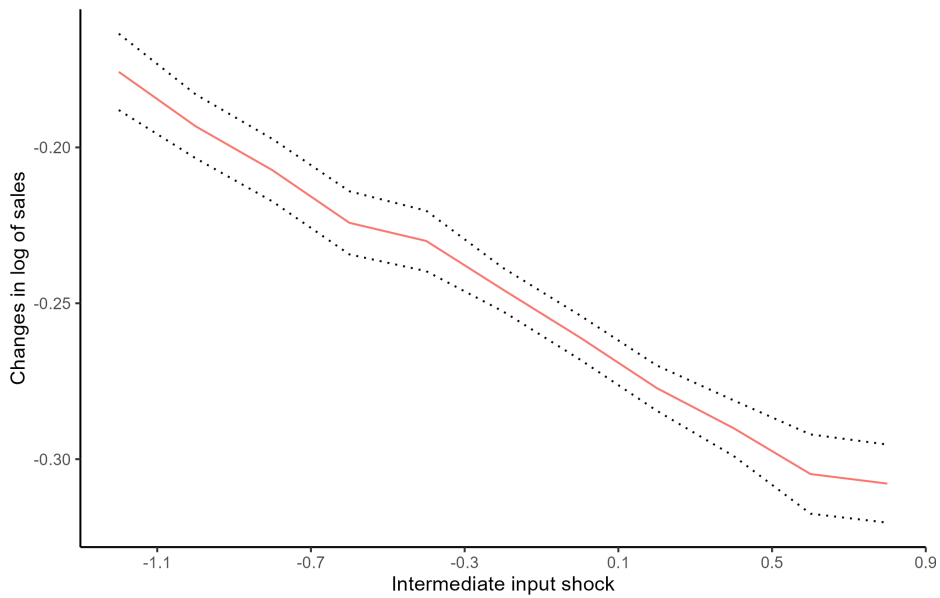


Figure 1.8: Expected changes in log of sales conditional on intermediate input shock



question COVc2b which asks whether the demand for firms' products and services increased, remained the same or decreased comparing to the same month in 2019. We aggregate the share of firms having a decreased demand at the 3-digit-ISIC industry level. This measure, hence, captures industry-specific rather than country-specific negative demand shock. It is then mapped to the 3-digit-NAT codes and standardized.

Table 1.4: Effects of the shocks on SME's sales - WBES demand shock

	(1)	(2)	(3)	(4)
Labor input shock x Post	-0.156** (0.038)			-0.139*** (0.038)
WBES Demand shock x Post		-0.077* (0.040)		-0.047 (0.055)
Intermediate input shock x Post			-0.073** (0.033)	-0.026 (0.030)
Log of age	0.164** (0.070)	0.162** (0.070)	0.162** (0.070)	0.163** (0.070)
Sq. Log of age	-0.027* (0.015)	-0.026* (0.015)	-0.026* (0.015)	-0.026* (0.015)
Medium	1.353*** (0.050)	1.353*** (0.050)	1.353*** (0.050)	1.353*** (0.050)
Partial exporter	0.380*** (0.039)	0.381*** (0.039)	0.382*** (0.039)	0.381*** (0.039)
Total exporter	0.137** (0.060)	0.137** (0.060)	0.137** (0.060)	0.137** (0.060)
Foreign	0.319*** (0.061)	0.320*** (0.061)	0.320*** (0.061)	0.320*** (0.061)
Year FE	Yes	Yes	Yes	Yes
4-digit Industry FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
N	45,076	45,076	45,076	45,076
R-sq	0.521	0.521	0.521	0.521

Note: All models apply the two-way fixed-effect estimator. Standard errors are clustered at the 4-digit industry level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.4 presents the estimates of Equation 1.1 using the WBES measure of demand shocks. The results remain robust when each shock is included separately. However, when all three shocks are introduced simultaneously, the demand and intermediate shocks lose significance. This is likely due to the high correlation (0.7) between these two variables, which are derived from the same survey.

1.5.4 Survival bias

Another issue that might affect our baseline estimate is survival bias. Indeed, if the attrition rate varies across sectors because of the pandemic, this may bias the estimates based solely on the performance of incumbents. Therefore, we run a placebo test to compare the effects of the shocks on pre-treatment outcomes of firms that were missing in 2020 and those that were still observed in 2020. The total attrition rate of the data is about 6.3% in 2020. Table 1.5 shows that there is no significant difference between incumbents and firms that were missing in 2020. This Table also suggests that the pre-treatment difference between the firms exposed to the demand and intermediate input shocks is significant. However, the coefficients of the demand and intermediate input shocks interacted with the 2019 dummy are both positive, suggesting that we may underestimate the negative association of these shocks with firm performance in 2020.

Table 1.5: Effects of the shocks on sales of 2020 missing SME (2018-2019)

	(1)	(2)	(3)
Labor input shock x 2019	0.007 (0.019)		
Labor input shock x 2019 x 2020 missing	0.086 (0.277)		
Demand shock x 2019		0.030*** (0.008)	
Demand shock x 2019 x 2020 missing		0.082 (0.085)	
Intermediate input shock x 2019			0.020** (0.009)
Intermediate input shock x 2019 x 2020 missing			0.175* (0.093)
2020 missing x 2019	-0.445* (0.242)	-0.403*** (0.108)	-0.444*** (0.108)
Year FE	Yes	Yes	Yes
4-digit Industry FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes
N	18,875	18,875	18,875
R-sq	0.530	0.530	0.530

Note: All models apply the two-way fixed-effect estimator. Standard errors are clustered at the 4-digit industry level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

1.5.5 Event study and effects of the shocks in 2021

One pertinent question to ask is whether these effects endure over time. To explore this, we incorporate the recently released 2021 firm census into our analysis. In Table 1.6, we introduce interactions between the shocks and dummy variables for 2020 and 2021 to investigate how their effects evolved. Notably, results in Column (4) suggest that the influence of the labor input and demand shocks dissipated by 2021. However, the influence of the intermediate input shocks endured, possibly attributable to the shutdown of intermediate input suppliers in 2020.

Table 1.6: Effects of the shocks on SME's sales (2016-2021)

	(1)	(2)	(3)	(4)
Labor input shock x 2020	-0.159*** (0.038)			-0.109** (0.048)
Labor input shock x 2021	-0.035 (0.034)			0.000 (0.042)
Demand shock x 2020		-0.113** (0.045)		-0.079* (0.047)
Demand shock x 2021		-0.072** (0.035)		-0.055 (0.037)
Intermediate input shock x 2020			-0.074** (0.034)	-0.036* (0.019)
Intermediate input shock x 2021			-0.055** (0.023)	-0.033** (0.016)
Year FE	Yes	Yes	Yes	Yes
4-digit Industry FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Firm control	Yes	Yes	Yes	Yes
N	55,197	55,197	55,197	55,197
R-sq	0.510	0.511	0.510	0.511

Note: All models apply the two-way fixed-effect estimator and control for firm covariates. Standard errors are clustered at the 4-digit industry level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

We then conduct an event study by interacting each shock with year dummies, incorporating all three shocks into the specification. 2019 serves as the base year. The estimates are illustrated in Figure 1.9. The labor input shock exhibited a pronounced negative effect on firm sales in 2020, while the effects of the demand and intermediate input shocks were comparatively weaker. However, considering the positive pre-trend of firm sales across different demand shock values, it is likely that our estimates of the demand shock effect are underestimated. Firms that suffered from the labor input

and demand shocks in 2020 rebounded quickly in the following year whereas those impacted by higher intermediate input shock had not recovered yet at the end of 2021.

Figure 1.9: Event study: Differences in log of sales (2016-2021)



Note: All graphs are derived from the two-way fixed-effect estimator where all three shocks are included and using the 2016-2021 data set.

1.5.6 Heterogeneous effects of the shocks

The impact of the COVID-19 crisis on SMEs may have varied depending on firm characteristics and activity. To examine this question, we estimate Equation 1.2 on the 2016-2020 SME sample. In this model, we interact each of the three shocks with certain firm/industry-level characteristics. The results are displayed in Table 1.7. If a characteristic (covariate) mitigates the impact of a shock, the coefficient of the triple interaction should have a positive sign. We initially differentiate medium firms from small ones (Column 1). Furthermore, we investigate the impact on outward-looking firms compared to others (Columns 2 and 3). In Column 4, we explore whether foreign firms were more resilient. In Columns 5 and 6, we analyze firms belonging to industries that structurally require more external financing (EFD), making them potentially more vulnerable to shocks, and those in which implementing work-from-home practices is more feasible, hence rendering them less vulnerable to shocks.

Table 1.7 shows that in most of the specifications, all the shocks remain significantly negative and quite similar in terms of magnitude to those displayed in Table 1.3. One common feature is that exporters⁸ were more resilient to all three shocks. Meanwhile foreign firms performed better in response to the labor input and demand shocks only.

⁸This category of firms benefits from a range of tax and administrative incentives in Tunisia.

Table 1.7: Heterogenous effects of the shocks on firm sales (2016-2020)

	(1)	(2)	(3)	(4)	(5)	(6)
	Medium	Partial exporter	Total exporter	Foreign	EFD	Telework
Panel A: Labor input shock						
Shock*Post	-0.133*** (0.049)	-0.131** (0.051)	-0.150*** (0.047)	-0.128*** (0.047)	-0.110*** (0.034)	-0.114** (0.045)
Shock*Covariate*Post	0.164 (0.104)	0.175** (0.079)	0.406** (0.198)	0.440** (0.221)	-0.062* (0.034)	-0.052 (0.058)
Observations	45076	45076	45076	45076	44391	45076
R ²	0.522	0.522	0.522	0.522	0.523	0.521
Panel B: Demand shock						
Shock*Post	-0.078** (0.039)	-0.078* (0.046)	-0.085** (0.039)	-0.080* (0.043)	-0.035 (0.036)	-0.083** (0.040)
Shock*Covariate*Post	-0.033 (0.111)	0.074 (0.076)	0.184*** (0.068)	0.196* (0.107)	-0.133* (0.077)	-0.061 (0.053)
Observations	45076	45076	45076	45076	44391	45076
R ²	0.522	0.522	0.522	0.522	0.523	0.522
Panel C: Intermediate input shock						
Shock*Post	-0.042** (0.019)	-0.042* (0.022)	-0.061** (0.024)	-0.043* (0.022)	-0.047*** (0.016)	-0.042** (0.020)
Shock*Covariate*Post	0.024 (0.046)	0.072* (0.041)	0.063** (0.031)	0.049 (0.035)	-0.025* (0.014)	-0.010 (0.023)
Observations	45076	45076	45076	45076	44391	45076
R ²	0.522	0.522	0.522	0.522	0.523	0.521

Note: All models apply the two-way fixed-effect estimator and control for year fixed-effects, 4-digit industry fixed-effects, district fixed-effects and firm covariates. Standard errors are clustered at the 4-digit industry level.

A potential explanation might be the higher financial and technological capabilities of these firms. Furthermore, during the pandemic, totally exporting firms were granted the right to sell up to 100% of their output on the domestic market for health and food products and up to 50% for the remaining products. This policy helped them compensate their loss of sales due to the contraction of international demand. [Chen et al. \(2023\)](#) find a similar result for the impact of the pandemic on exporting vs non-exporting firms in India. Their explanation is based on a better adaptation of exporting firms through the use of ICT, trade credit and asset selling. The next section dealing with firms' adaptation will enable us to dig deeper with regard to these aspects. Finally, it comes as no surprise that firms in higher EFD sectors, *i.e. sectors that depend more on external financing*, were more affected by the demand shock.

1.5.7 Adaptations and firm resilience

In this section, we use the firm survey conducted after the lockdown to examine firms' coping strategies and the determinants of firm adaptations. Before looking into firm adaptations, we run a regression of firm sales change in May 2020 with respect to May 2019 on firms' characteristics, managers' characteristics and the three shocks, as exposed in Equation 1.3. The model controls for region fixed effects and 2-digit-NAT industry fixed effects. Standard errors are clustered at the 2-digit-NAT industry level. The results of this specification is reported in Table 1.8. Only the coefficient on the labor input shock is significant: firms in non-essential industries experienced approximately 33 percentage points fall in sales in comparison to firms in essential industries during the lockdown.

We employ a linear probability model to evaluate the likelihood of firm adaptation to the three shocks conditionally on their characteristics, as presented in Equation 1.4. Table 1.9 reports the estimates for firms' workplace adaptation, process adaptation and trade credit in Columns (1), (2) and (3) respectively. It turns out that firms in non-essential industries were less able to adapt than firms in essential industries during the first lockdown. The stringent and abrupt nature of the lockdown may have limited the ability of firms to respond effectively. Another hypothesis is that closed firms may have encountered liquidity constraints, hindering their capacity to invest in adaptation strategies. Simultaneously, firms in essential industries, despite being allowed to

operate, also faced difficulties that required them to adjust their activities.

Table 1.8: Effects of the shocks on SME's sales change 5/2019-5/2020

	(1)	(2)	(3)	(4)
Labor input shock	-33.632*** (4.377)			-32.713*** (4.539)
Demand shock		-10.750* (5.873)		-7.680 (5.012)
Intermediate input shock			-1.477 (4.220)	-0.279 (2.680)
Log of age	-3.881 (7.077)	-5.492 (7.474)	-5.375 (7.239)	-4.018 (7.171)
Sq. Log of age	2.281** (1.104)	2.634** (1.228)	2.582** (1.178)	2.335** (1.128)
Medium	4.038 (3.693)	3.243 (3.727)	2.982 (3.715)	4.095 (3.693)
Importer	10.987*** (3.281)	10.323*** (3.563)	10.209*** (3.575)	11.086*** (3.345)
Partial exporter	11.658 (7.778)	13.198* (7.548)	12.574 (7.738)	11.978 (7.764)
Total exporter	8.059 (4.810)	9.603** (4.483)	9.320** (4.349)	8.266* (4.850)
Foreign	-2.273 (4.045)	-1.522 (4.261)	-0.637 (4.626)	-2.942 (4.007)
Experience	-0.575** (0.229)	-0.601** (0.225)	-0.592** (0.233)	-0.582** (0.224)
College degree	2.741 (3.772)	3.185 (3.554)	3.127 (3.548)	2.722 (3.767)
2-digit Industry FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
N	830	830	830	830
R-sq	0.209	0.183	0.180	0.211

Note: All models apply the OLS model. Standard errors are clustered at the 2-digit industry level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Larger (medium) and younger firms were more likely to adopt process adaptation. We also find that exporters were more likely to adopt either workplace or process adaptations and benefited from better access to trade credit. Similarly, foreign firms were more capable of adjusting their sales/production process and obtaining trade credit. This is in line with our findings in Section 1.5.6 that foreign and outward-looking firms were more resilient thanks to their financial and technological capabilities. Interestingly, firm managers who held a university degree were more inclined to engage in teleworking while experienced managers benefited from better access to trade credit.

Table 1.9: Determinants of firm adaptations

	(1) Workplace	(2) Process	(3) Trade credit
Labor input shock	-0.062* (0.034)	0.018 (0.027)	-0.177** (0.066)
Demand shock	-0.061 (0.052)	-0.073 (0.055)	-0.066* (0.038)
Intermediate input shock	-0.009 (0.030)	0.015 (0.026)	-0.024 (0.023)
Log of age	0.072 (0.053)	-0.107* (0.063)	0.078 (0.058)
Sq. Log of age	-0.006 (0.011)	0.027 (0.016)	-0.005 (0.013)
Medium	0.012 (0.027)	0.075** (0.030)	0.011 (0.045)
Importer	0.074** (0.034)	0.031 (0.026)	0.038 (0.041)
Partial exporter	0.115 (0.071)	0.201** (0.066)	0.116** (0.051)
Total exporter	0.111** (0.046)	0.001 (0.046)	0.001 (0.027)
Foreign	0.014 (0.049)	0.260** (0.073)	0.095* (0.056)
Experience	-0.002 (0.003)	-0.003 (0.003)	-0.006** (0.002)
College degree	0.066** (0.029)	0.027 (0.029)	0.034 (0.027)
2-digit Industry FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
N	829	829	829
R-sq	0.232	0.201	0.158

Note: All models apply the linear probability model. Standard errors are clustered at the 2-digit industry level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.10 reports the findings from Equation 1.5, which examines the effectiveness of firm adaptation strategies in mitigating the impacts of Covid-19. Initially, the equation is estimated using the entire sample (Column 1). The results indicate that firm adaptations, particularly process adaptation and trade credit, were generally associated with better performance during the lockdown.

Subsequently, we investigate whether the influence of firm adaptation differs across industries with varying levels of teleworkability (Columns 2 and 3). High (or low) teleworkability industries are defined as those with a teleworkability index above (or below) the median. It is anticipated that workplace adaptation would have a more pronounced effect on firms in industries with high teleworkability prior to the lockdown. Indeed, our analysis suggests that only firms operating in high-teleworkability industries experienced benefits from workplace adaptation. Conversely, firms in industries with low teleworkability (Column 3) were more likely to benefit from process adaptation and trade credit.

Furthermore, we replicate the same regression analysis for high- and low-external-financial-dependence (EFD) sub-samples (Columns 4 and 5) to explore whether the effect of trade credit is more evident in firms with higher dependence on external financing. Our findings indicate that trade credit is significantly positive only for firms in high-EFD industries (Column 4), namely those belonging to industries with greater reliance on external financing. Interestingly, workplace adaptation also emerged as a mitigating factor for firms in high-EFD industries, suggesting that the adoption of remote work was specific to certain industries and not necessarily a costly adaptation.

1.6 Conclusion

In this paper, we assess the impacts of economic shocks as a result of the Covid-19 pandemic on SMEs in Tunisia by employing a Difference-in-Differences framework applied to the national firm census. Furthermore, we analyze the heterogeneous effects of the pandemic on firms based on relevant firm and industry characteristics. Finally, we explore the factors influencing firms' adaptations, *i.e.*, workplace practices, process adjustments, and utilization of trade credit, using our own firm survey.

We find that SME performance in 2020 was heavily affected by a combination of

Table 1.10: Mitigation effect of adaptations on SME's sales change 5/2019-5/2020

	All	High telework	Low telework	High EFD	Low EFD
Workplace adapt.	6.369* (3.215)	11.553* (6.012)	3.113 (3.881)	12.651*** (4.139)	1.218 (4.275)
Process adapt.	11.913** (4.761)	9.283 (7.870)	12.803* (7.264)	9.684 (7.060)	14.456* (7.978)
Trade credit	9.320** (4.457)	9.221 (9.362)	10.805* (5.320)	13.791* (7.524)	4.093 (5.101)
2-digit Industry FE	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
N	829	350	479	379	438
R-sq	0.235	0.260	0.212	0.317	0.189

Note: All models apply OLS estimator and include the three shocks and firm covariates. Standard errors are clustered at the 2-digit industry level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

labor input, demand and intermediate input shocks. Our estimates are robust to the heterogeneous treatment effect and attrition. We also find that exporting firms performed better in facing the three types of shocks, while foreign firms performed better in response to the labor input and demand shocks only. Not surprisingly, firms in higher external financial dependence (EFD) sectors were more affected by the demand shock. In 2021, the effect of the intermediate input shock persisted at a relatively similar negative level, while the impact of the labor input and demand shocks were no longer significant. This is in line with the prediction of the macroeconomic literature. Our results suggest that in the context of a short and strict lockdown, once it is brought to an end, the government should redirect its financial support measures away from firms exposed to the labor input shock and toward firms exposed to the demand and intermediate input shock.

Using our firm survey conducted right after the end of the first lockdown, we find that the impact of the labor input shock was predominant during the lockdown period. It is shown that firms in non-essential industries were less able to adapt than firms in essential industries during the first lockdown. In other words, firm adaptation seems to be driven more by capability than by necessity.

Furthermore, younger and larger firms were more likely to adopt process adaptation, while exporters and foreign-owned firms benefited from better access to trade credit and were more capable of adjusting their sales/production process.

We acknowledge that this work, in spite of our efforts, has certain limitations.

Firstly, we do not account for evolution of the mobility restrictions when they were applied more locally and the enforcement became less strict in the following years. Secondly, a key aspect that is conspicuous by its absence is an analysis of Covid-19's impact on the informal sector. This sector does not only account for a significant part of the private sector⁹ but is also its most vulnerable component. Further research is thus needed to provide more evidence on this sector, depending on data availability.

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⁹Informal employment accounted for 26.8 percent of Tunisia's employment in 2020 according to a report by the [ILO and UNDP \(2022\)](#).

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Chapter 2

Credit Subsidy in Times of Distress: Micro-evidence from Vietnam

Credit subsidy in times of distress: micro-evidence from Vietnam

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Abstract

This study examines the impact of Vietnam's 2009 interest subsidy on small firms. Using the variation in State-Owned Commercial Banks' (SOCBs) employment shares across provinces and Difference-in-Differences method, it demonstrates that the subsidized loans, mainly distributed through the SOCB system, increased employment and investment among firms. Notably, credit-constrained firms, particularly young and small firms in rural areas, experienced more significant enhancements in total outlay, employment, and investment. There was no evidence of a apparent bias favoring local public firms. However, firms in higher SOCB market share provinces also had a significantly higher level of financial revenue following the subsidy, suggesting that a part of the program was channelled into speculative activities.

Keywords: fiscal stimulus, global financial crisis, credit subsidies, state-owned banks

JEL classification: D22, D02, E32, E62

2.1 Introduction

The recent global health and economic crisis has reheated the debate of scholars and practitioners on government support in the context of crises. In response to the Covid crisis, governments around the world have launched unprecedentedly aggressive stimulus packages under various forms - public spending, consumer and corporate tax cuts, credit subsidies and credit guarantee schemes, etc. One of the main topics of this debate is the trade-off between the long-term efficiency and the short-term stability. Accordingly, a pro-allocation government will set a high standard/ default sanction to discourage low-productivity firms while a pro-stabilization government will set a low standard/ default sanction to save as many firms as possible (Goodhart et al., 2023). The latter usually raises several concerns, including the risk of massive defaults, high future inflation and ineffective long-term allocation. One of the underlying reasons is the possibility of loan substitution which can be both firm-driven and bank-driven. More precisely, banks can ask the riskiest clients to repay their existing debts with the guarantee or subsidised loan while firms are also motivated to renegotiate a lower interest rate for their existing loans. The substitution of unsubsidised low-risk loan with the subsidised high-risk loan hence increases the aggregate risk of defaults (Altavilla et al., 2021).

Implementing countercyclical policies poses even more challenges in developing countries. Connected lending, a bias towards State-Owned Enterprises (SOEs), the absence of an efficient evaluation and monitoring system, and disparities in local financial market development are prevalent characteristics in the developing world. These factors tend to exacerbate the misallocation problem of the stimulus packages. Therefore, it necessitates more studies and evidences to contribute to a better policy design in the context of these countries.

Following the global financial crisis of 2008-2009, the Vietnamese Government introduced an unprecedented interest subsidy program aimed at assisting the recovery of domestic firms. However, there is limited evidence regarding the impact of the program. As far as I know, Tuan-Minh et al. (2012) is the only micro-economic paper to evaluate the 2009 interest subsidy. They show that the program equally targeted small and rural firms and had a positive effect on firm performance although there were signs of speculation in the stock market. Nevertheless, their results are potentially

biased due to omitted variables such as firm demand for credit. More importantly, the question on how the program was allocated was left unanswered.

Using the provincial variation in the branch market share of the state-owned commercial banks (SOCB), I investigate whether the subsidised loan allocated through the SOCB system relieved firm credit constraints during the crisis and increased firm employment and investment. Furthermore, young and small firms in higher SOCB market share provinces profited higher increase on total outlay, employment and investment compared with their counterparts in lower SOCB market share provinces. In addition, there was no evidence of a bias toward local public firms. However, firms in higher SOCB market share provinces demonstrated a significantly higher level of financial revenue. The contribution of this paper is twofold. First, it provides micro evidences on the effectiveness of the massive counter-cyclical subsidy in the context of a developing country. By including firm fixed effects and industry-year fixed effect, it allows to control for firm time invariant unobservable and heterogenous demand trends across sectors. Second, this is the only paper that assesses the role of the state-owned banks as an instrument to compensate the spatial disparity in local financial conditions, especially during a crisis.

The results advocate the pro-stabilization government point of view, i.e., the subsidy helped firm to increase its new investment rate and total employment. It also suggests that the local dominance of the SOCB in terms of branch market share helped to channel the subsidised credit to firms, especially firms in the provinces where the banking outreach is limited. In conclusion, if the policy is appropriately designed and the SOCB are well monitored, it can encourage the economy recovery and help mitigating the market failures.

The subsequent sections of the paper are structured as follows: Section 2.2 provides an overview of relevant literature. Section 2.3 describes the Vietnamese Government's 4-percent interest rate subsidy and the 2009 stimulus package. Sections 2.4 and 2.4.2 outline the data and methodology used in the study. The findings are detailed in Section 2.5. Section 2.6 summarizes the conclusions.

2.2 Literature review

Countercyclical support programs in developed countries often showcase a level of effectiveness with limited detrimental impacts. Indeed, [Bach \(2014\)](#) finds a positive effect of the French government's subsidy on debt financing and returns without any subsequent surge in default risk. [Altavilla et al. \(2021\)](#) show that creditworthy firms affected by the pandemic extended their credit thanks to the EU loan guarantees. Concurrently, the program also benefited the balance sheet of banks. The supporting program and credit rating initiative for SMEs in Spain during and after the 2008 crisis produced a positive impact on credit accessibility and improved the capital allocation via the reduction of information asymmetries ([Bonfim et al., 2023](#)). [Harasztosi et al. \(2022\)](#) add further evidence advocating the credit subsidies by the EU governments during the Covid-19: the allotment was unrelated to pre-crisis weakness and the support fastened digitization and enabled financial expansion. Their findings show that the program substantially increased debt financing without substitution between subsidised and unsubsidised finance, as the targeted firms were truly credit constrained. [Horvath and Lang \(2021\)](#) suggest that the Hungarian credit subsidy with a good policy design promoted investment and job creation among small firms and enhanced the productivity overtime. [Huneus et al. \(2022\)](#) tackle this question from the risk perspective using the Covid-19 credit subsidies provided by the Chile's government. They find that even there was a credit shift toward riskier firms and riskier loans, the macro risk remained small thanks to policy designs such as loan cap, firm selection, etc. and the equilibrium behavior. However, some authors, such as [Mian and Sufi \(2012\)](#) and [Bachas et al. \(2021\)](#), find the subsidies to be short-lived. Leveraging the disparities across U.S. cities prior to the "Cash for Clunkers" program, [Mian and Sufi \(2012\)](#) discovered an extra 360,000 cars were bought in July and August of 2009 due to the stimulus, but this effect was significantly short-lived and almost completely reversed seven months after the program ended. Similarly, [Bachas et al. \(2021\)](#) shows that the excess mass of SME loan increase with the guarantee generosity disappeared as soon as the guarantee rate schedule for Small Business Administration (SBA) loans ended.

Meanwhile, many developing countries struggle against the misallocation effect of these programs. [Johansson and Feng \(2015\)](#) estimate the firm effects of China's 2008 stimulus program in two aspects: changes in total factor productivity and in capital

structure. The Difference-in-Differences results show that the stimulus program led to greater lending to firms controlled by state although private firms with access to preferential lending outperformed SOE with access to preferential lending. This implies that the subsidy amplified the misallocation of capital in the Chinese economy. [Deng et al. \(2017\)](#) gauge the impact of Chinese Government's intervention during the 2008 global crisis on firms' investment and investment efficiency. Their analysis indicates a positive effect of the intervention and this even constituted the main source of funding for investment. In contrast, the post-investment performance was poor, which suggests that government intervention could play a negative role in the firms involved in the program. Using firm-level data, the paper of [Liu et al. \(2018\)](#) examines the effectiveness of bank lending through the Chinese government-owned banking system in the 2008 economic meltdown. The stimulus package benefited both SOEs and non-SOEs, helped them get better access to bank loan and encouraged their investment. However, the political bias of the program is clear. The increased bank loan supply and the government lending were mainly channelled to the SOEs rather than the non-SOEs. Furthermore, these granted loans for SOEs were less associated with firm profitability. [Chari et al. \(2021\)](#) reveal that troubled banks in India took advantage of the forbearance measures enacted during the global financial crisis and reallocated credit to the weakest firms while rejected credit to healthy firms. Finally, exploiting the survey data of 7,787 firms and Propensity Score Matching method, [Tuan-Minh et al. \(2012\)](#) show that the loan subsidy helped firms to increase working capital, to keep their businesses in operation and to hire additional labor. Each firm that received a loan subsidy hired, on average 4 more workers. However, a further examination into the sample of 165 firms selected from 490 firms listed on the two Stock Exchanges in Ha Noi and Ho Chi Minh indicates a tendency of firms to restrict their investments in productive activities while extending their investments in speculative activities. The authors suggest that loan subsidy during the economic recession should be limited to short-term period and need to be well monitored to avoid the vulnerability in the macroeconomic environment.

My paper also concerns the literature on firm access to credit and the local financial market development and structure. Due to the information asymmetry and transaction costs, the physical proximity between lender and borrower tends to affect the

access to credit (Fafchamps and Schündeln, 2013). Recent evidences have shown that credit markets are (still) local for small and medium firms (SMEs), regardless of the progress in lending technology (Alessandrini et al., 2009; Nguyen, 2019; Bragoli et al., 2022). While the positive link between financial sector growth and economic growth is well-documented through both cross-country and within-country evidences (King and Levine, 1993; Levine et al., 2000; Guiso et al., 2009; Fafchamps and Schündeln, 2013; Tran et al., 2022), the effect of banking market structure on firm performance remains relatively less evident. The market power hypothesis argues that high level of competition reduces the transaction cost while improving the credit supply (Claessens and Laeven, 2005; Beck et al., 2013; Love and Martínez Pería, 2015; Chauvet and Jacolin, 2017). In contrast, the information hypothesis posits that competition reduces the incentive of bank to invest in lending relationship, therefore reduce credit supply for opaque clients (Hauswald and Marquez, 2006; Beck et al., 2013). Duqi et al. (2021) highlights the role of concentration in abnormal market condition. They show that following a natural disaster, economic growth recovers faster in U.S. counties with less competitive banking sectors, especially, profitable and better-capitalized banks used their normal-time profit to support the recovery of local economy.

Last but not least, this work is close to the literature on the role of the state-owned banking system during the times of economic downturn. The social welfare approach suggests that government bank has an important role in correcting market failures and assure social welfare (Stiglitz and Weiss, 1981; Greenwald and Stiglitz, 1986). Meanwhile the efficiency point of view criticizes the government bank to be less efficient than private bank, since the former is more easily influenced by connections and corruption. Empirical evidences are mixed. On the one hand, Chen et al. (2016), Sapienza (2004) and Tong and Wei (2020) point to a positive effect of the capital injected directly by the government on the economy, firms located in depressed areas and firm stock prices. On the other hand, many studies have shown that government-owned banks are less responsive to firm profitability (Liu et al., 2018; Iannotta et al., 2007) and tend to favor politicians and connected firms (Khwaja and Mian, 2005; Micco et al., 2007).

2.3 The 2009 economic stimulus package

The 2008-2009 global financial crisis had substantially slowed down the growth of Vietnam's economy from 7.4 percent in the first quarter of 2008 to 3.1 percent in the early 2009, at the peak of the crisis (Report of the Economic Committee of the National Assembly, 2011). According to [Thurlow et al. \(2010\)](#), manufacturing and agriculture were the two sectors that suffered the most from the contraction in global demand. The largest declines in production were for textiles and clothing, followed by machinery and construction. Declining world prices and weaker consumer demand also reversed the gain of agriculture during the commodity crisis in 2008. The financial crisis therefore caused a drop of 1.1 percent in employment relative to the level obtained in the course of the food and oil crisis.

As many other countries in the world, in December 2008, the Vietnamese Government released an exceptional stimulus package worth US\$8.6 billion: The Resolution 30/2008/NQ-CP included a set of urgent measures to stop the economic downturn, promote production, business and exports, stimulate investment and consumption and guarantee social stability. The stimulus package components are specified in table 2.1.

Table 2.1: Components of Vietnam's Stimulus Package in 2009 (US\$ billion)

	Announced	Disbursed
Total proposed cost	8.6	7.2
(Percentage of 2008 GDP)	(10.2%)	(8.2%)
Interest support	1.0	1.1
Delayed payback for construction capital in 2009	0.2	0.2
Advanced capital investment (from 2009/10)	2.2	1.2
Transfer planned investment capital (2008-09)	1.8	1.7
Additional government bonds	1.2	1.2
Tax reduction	1.6	1.2
Other expenditures (including social safety)	0.6	0.6

Source: Report of the Economic Committee of Vietnam National Assembly, 2011

The 4-percent interest rate subsidy which constituted an important part of the stimulus package was announced in the Decision No.131/QDTTg in January 2009. Short-term loan contracts signed and disbursed from February 1, 2009 to December 31, 2009 would receive an interest rate assistance of 4% per annum within 8 months. All firms, especially small and medium firms (SMEs), were eligible for the grant if they were operating in targeted industries, more precisely, those industries with high

labor absorption capacity such as manufacturing, agriculture, forestry and aquaculture, science and technology. The ineligible industries were mining, finance, real estate, health and education, and consumer good imports. This subsidy program, together with the cut in policy interest rate from 8.5 percent to 7 percent of the State Bank, was expected to increase firms' access to credit, create new jobs, and stimulate the aggregate demand of the whole economy. The total lending generated by this program was estimated at US\$24.1 billion of which about 68 percent went to private businesses and 17 percent to households (Thurlow et al., 2010). By 24 December 2009, 97 percent of the planned subsidy for enterprise had been granted mostly to privately-owned domestic firms (about 70 percent of recipient firms).

Although the economic growth of Vietnam was slowed down in the first months of 2009, the economy continued to expand and manifested clear signs of recovery during the second half of the year. These results suggest that, from a macroeconomic perspective, the stimulus package has yielded a positive impact on the performance of the economy. The dynamic computable general equilibrium model developed by Thurlow et al. (2010) demonstrates that the package prevented around two-fifths of the decline in total GDP caused by the financial crisis, in other words, the GDP growth rate would have been 2.3 percentage points lower without the implementation of the stimulus package. This study also concludes that agricultural GDP growth accelerated, and the overall decline of industrial GDP was lessened under simulated stimulus while it was argued that manufacturing, due to its external dependence, was unaffected by the stimulus package, thus, its growth remained unchanged.

2.4 Methodology and data

2.4.1 Empirical strategy

An important feature of the interest subsidy is that the subsidised loans were mainly allocated through the state owned commercial banks (SOCBs). According to Giang and Le (2010), the SOCBs alone provided about 69% of the subsidised loan in 2009, meanwhile the 2009 market share of SOCBs in total outstanding loan was about 62% (Stewart et al., 2016). This fact is in line with the observation of Dufhues (2007) and Malesky and Taussig (2009) that there is a spatial divergence between bank credit and

private sector growth. The credit flow has been designed to be balanced across the country via the SOCBs as a strategy to equalize incomes. This lays the groundwork for me to use the local market share of the SOCBs as a predictor of the credit subsidy allocation. More precisely, it is expected that firms in provinces with higher market share of the SOCBs will benefit more the credit subsidy.

I study firm activities during the period 2007-2010, 2 years before and 2 years after the interest subsidies. Given that the local banking structure mainly affect the access to credit of small firms (Fafchamps and Schündeln, 2013; Hasan et al., 2017), I only focus on small firms in this analysis. Small firms defined by the Decision 56/2009/ND-CP are those who have less than or equal to 200 employees. Therefore I restrict the data set to firms with less than or equal to 200 employees at the beginning of the period under examination.

As the increase of credit for firms is itself just a means to an end, the ultimate goal of this paper is to assess whether the credit subsidy relieved the firm credit constraints during the crisis and increased firm employment and investment. If it did, one should finally observe a higher employment and investment growth of firms in in provinces with higher market share of the SOCBs. The test strategy is mathematically formulated as follows:

$$y_{ijpt} = \beta_0 + \beta_1 2007SOCBshare_p \times Post_t + \lambda X_{pt} + \alpha_i + \lambda_{jt} + \epsilon_{ijpt} \quad (2.1)$$

where y_{ijpt} can be total credit (including bank credit, trade credit and other liabilities), net investment rate (change in fixed assets scaled by lagged fixed assets), new investment rate (new investment scaled by lagged fixed assets), log of total employment, log of long-term employment. $SOCBshare_p$ captures the market share in term of employment of SOCB at the provincial level at the beginning of the examined period (2007). The dummy variable $Post$ indicates the post-treatment year (2009 and 2010). α_i controls for firm-specific effects and λ_{jt} captures time-varying industry-specific effects. I choose not to include lagged values of firm revenue, assets or employment to avoid the endogeneity problem. The coefficient of interest β_1 is expected to be positive if the interest subsidy increases the differential firm growth in ex-ante higher SOCB market share localities.

Although controlling for firm fixed-effects rules out the time-invariant heterogene-

ity across province, unobserved time-varying provincial factors that affect firm growth can still alter the estimates. Therefore, I introduce lagged values of time-varying provincial controls from [Malesky et al. \(2015\)](#). The lagged values of provincial population (log), GDP per capita (log), the share of asphalted roads and the number of telephones per capita, the bank density (number of banking employees per 1000 citizens) are included to capture the provincial demand size and infrastructures. To control for the quality of local government, I use the composite Provincial Competitiveness Index (PCI). Initiated in 2005 by the Vietnam Chamber of Commerce and Industry (VCCI) and the Vietnam Competitiveness Initiative (VNCI), the PCI Survey is a repeated cross-section survey with the purpose of measuring and ranking the economic governance quality of provincial authorities in term of business environment for the development of the private sector. The composite PCI is calculated from this survey and composed of 10 dimensions of the local governance which affects the provincial competitiveness. These are entry cost, land access and security of tenure, transparency and access to information, time costs of regulatory compliance, informal charges, competition environment and SOE bias, proactivity of provincial leadership, business development services, labour and training and confidence in legal institutions.

2.4.2 Data

Firm level data

My firm data are drawn from the Enterprise Census of the Vietnam General Statistics Office (GSO census). This annual census covers all firms with 30 or more employees and a random sample of smaller firms. The questionnaire captures firm activities, location, legal type and owner's characteristics. More importantly, it provides a range of information from firm financial statements, including employees, assets, total liabilities, equity, profit and investment. My data covers an unbalanced panel of firms from 2007 to 2010. I restrict the data set to domestic private firms and remove firms in sectors that are not eligible to receive the interest subsidy, including finance, real estate, education, public administration, healthcare and cultural activities. I also remove observations with recording errors (e.g., negative value of assets), duplicate observations, the 1 percent tails of the distribution of firm profitability, investment and employment.

I finally end up with 144,988 observations over 36,247 firms. The firm-level outcomes are presented in table 2.2 below.

Table 2.2: Summary statistics of firm data

	Count	Mean	SD	Min	Max
Total credit (log)	130780	6.936	2.170	-1.650	11.13
Net investment rate	121751	0.762	3.375	-1.000	42.82
New investment rate	124626	1.507	5.084	0	63.88
Total employment (log)	144403	2.949	1.057	0	5.714
Long-term employment (log)	68097	2.388	1.279	0	5.565
Age	143984	5.659	4.555	0	64

Measures of SOCB market share

In addition to general information, the Enterprise Census also ask firms to list all of its branches together with branches' location, employment and revenue. I use this data base to construct the indicators of SOCB market share. I firstly identify the major commercial banking institutions in the data set and their branches. I exclude the Vietnam Bank for Social Policies (VSBP) for its social purposes. I also exclude non-bank financial institution, because the interest subsidy was mainly distributed through the banking system. Finally, branches of foreign banks are also removed, since they have restricted activities and mainly serve foreign firms and expatriates. The cleaning process leaves 29 banks, of which five banks are state owned commercial banks (SOCB), one is joint venture commercial bank (JVCB) and the rest is joint stock commercial banks (JSCB). The banks covered by this sample account for the majority of loans to the economy from the banking system.

Another problem of the data set is the difference in branch definition across banks. The largest SOCB - Agribank owned a network distribution of 1,468 branches and sub-branches in 2007 (Thanh and Quang, 2008). However, only 179 branches are recorded in the data set. Meanwhile, all 118 branches of Techcombank (Vietnam Technological and Commercial Joint-stock Bank) are recorded. Moreover, the branches of the JSCBs only qualify as sub-branches of the SOCBs in terms of size (Thanh and Quang, 2008). Therefore, using the number of bank branches/sub-branches from this database is misleading. As an alternative, I define the local market share of the SOCBs as the share of the SOCB employment in the local banking employment.

Table 2.3: Summary statistics of provincial data

	Count	Mean	SD	Min	Max
2007 SOCB employment share	63	0.929	0.108	0.495	1
2008 SOCB employment share	63	0.897	0.134	0.449	1
2008 SOCB credit share	63	0.717	0.164	0.304	0.971
L.Log population	252	7.012	0.578	5.691	8.797
L.GDP per capita	252	-1.762	0.542	-3.851	0.692
L.Share of asphalted roads	252	0.565	0.240	0.0198	1
L.Telephones per capita	251	0.173	0.116	0.0142	1.169
PCI index	252	48.93	4.918	36.62	61.56

The identification strategy of this paper depends much on the relevance of the treatment and its proxy - the SOCB employment share. I use the PCI Survey to get the information on actually treated firms. Conducted annually, the PCI survey provides basic information on firm and manager's characteristics, firm access to credit as well as other local business-support services. I have access to five waves of surveys from 2007 to 2011. Since 2008, in addition to the question on the credit access, the survey also asks about the bank from which firm borrowed. This question allows me to construct a second measure of the SOCB provincial market share : the share of firms having credit from the SOCBs in each province. More importantly, the 2009 survey wave asked whether firm received the 2009 credit subsidy. Therefore, I am able to compute the share of treated firms at the province level.

Figures 2.1 and 2.2 plot the share of treated firms and the share of firms having SOCB credit against the SOCB employment share. It is shown that the SOCB employment share is highly correlated with the SOCB market share measured by the share of credit number and the treatment. Provinces with a high SOCB employment share are mainly rural and less attractive to private banks due to their remote locations and inadequate infrastructure. Table 2.3 presents some descriptive statistics of the province-level variables used in model 2.1.

Figure 2.1: Correlation between provincial SOCB employment share and the share of subsidized firms

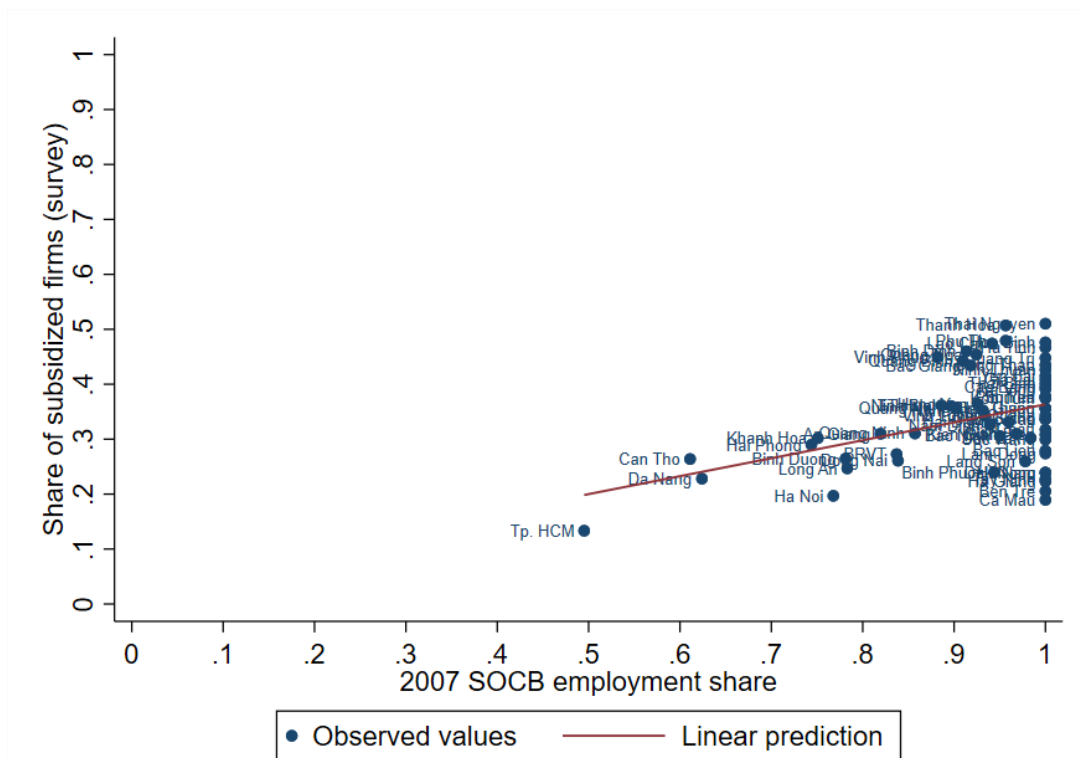
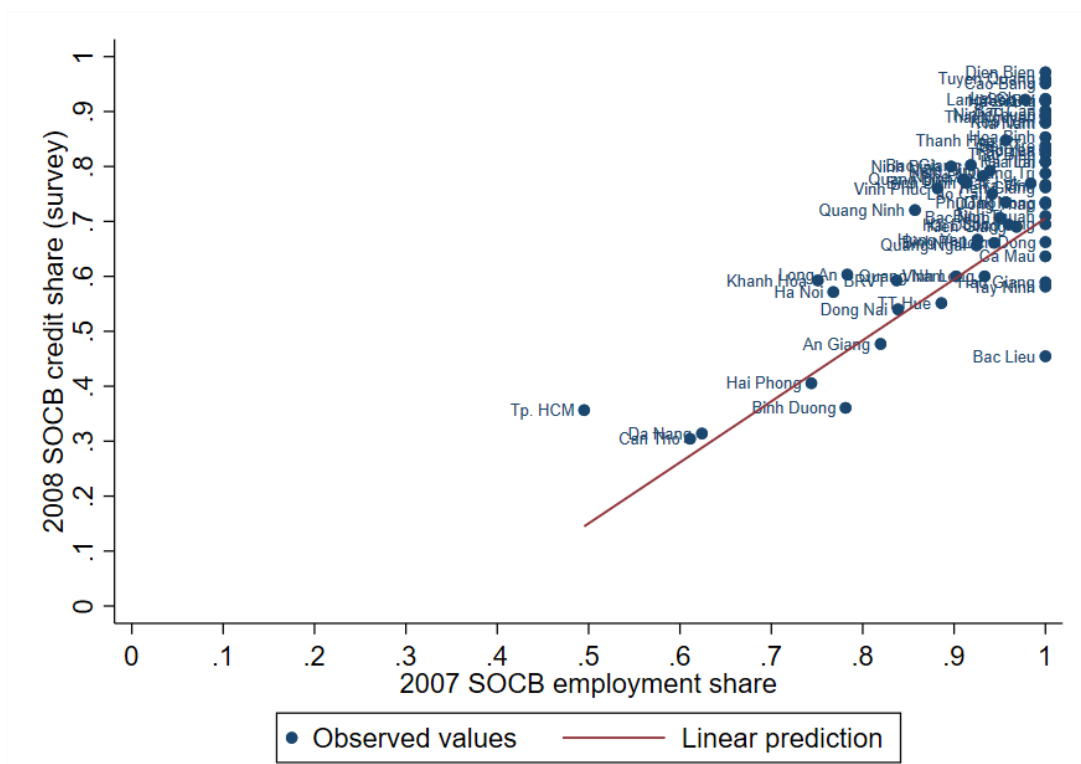


Figure 2.2: Correlation between provincial SOCB employment share and SOCB credit share



Note: SOCB credit share = No. of firms having SOCB credit/ No. of firms having credit)

2.5 Results

2.5.1 The overall effect of the credit subsidy on investment

Tables 2.4-2.8 report the estimates of the subsidy effect on firm outcomes. Column (1) presents the estimates of the baseline model 2.1 with the main treatment variable: 2007 SOCB employment share. Column (2) replaces the interaction term $SOCBshare_p \times Post_t$ with $SOCBshare_p \times y2009_t$ and $SOCBshare_p \times y2010_t$ to examine the effect of the program over time. Column (3) and (4) rerun the models of the first two columns with the 2008 SOCB employment. Column (5) and (6) estimate the models of the first two columns with the 2008 SOCB credit share drawn from the PCI survey. As a result, the first two columns include all 4 years 2007-2010 and the last four columns include only 3 years 2008-2010. I also produce an event-study plot over 4 years for each outcome (figure 2.3). The reference year is 2008.

Table 2.4 reports the estimates for firm total credit. The coefficient on the interaction term is positive but not significant. The event-study plot unveils a more intricate pattern. First, firms in high SOCB concentration provinces appear to have benefited from more credit prior to the 2008 crisis compared to those in low SOCB concentration provinces. This aligns with the findings of Malesky and Taussig (2009) that policy goals of increasing credit in rural provinces were the main driver of firm credit access. While these provinces were hit harder by the crisis - their total credit dropped more following the Central Bank's contractionary monetary policy, their firm credit level swiftly rebounded to pre-crisis levels thanks to the credit subsidy. The pre-existing trend plot suggests that the estimates on debt level could be downwardly biased, hence the true effect might be significantly much higher.

While the effect of the credit subsidy on firm total credit isn't significant due to the pre-existing trend, its positive impact on firm employment and investment is undeniably clear. Table 2.5 shows that firms in high SOCB concentration provinces had a significantly higher level of total employment. This effect persisted at least until 2010. The estimates remain consistent across various measures of SOCB concentration. The event-study plot for total employment shows no pre-existing trend. Firms in these provinces sustained not just higher total employment but also higher long-term employment (table 2.6).

Moving to firm investment in tables 2.7 and 2.8, I again find that a strong position of the SOCBs in the local market is associated to an increase in firm new investment rate after the credit subsidy. The coefficients on net investment rate are mostly not significant. Figure 2.3 indicates no pre-treatment difference in investment as measured by both methods. Nonetheless, the impact of the credit subsidy on firm investment was solely apparent for the same year. This may stem from the nature of investment flows, often marked by lumpiness and a connection to activities in the preceding year (O'Toole and Newman, 2016). The lumpiness is especially pronounced for small firms for small firms, as they often lack the capital to smooth out their investment patterns.

Table 2.4: Bank market structure and the effect of the 2009 interest subsidy on Total credit (log)

	(1)	(2)	(3)	(4)	(5)	(6)
2007 SOCB employment share × Post	0.136 (0.116)					
2007 SOCB employment share × 2009		0.201* (0.111)				
2007 SOCB employment share × 2010		0.019 (0.137)				
2008 SOCB employment share × Post			0.161 (0.123)			
2008 SOCB employment share × 2009				0.194 (0.120)		
2008 SOCB employment share × 2010				0.025 (0.135)		
2008 SOCB credit share × Post					0.026 (0.111)	
2008 SOCB credit share × 2009						0.070 (0.108)
2008 SOCB credit share × 2010						-0.129 (0.129)
Constant	7.698*** (0.998)	7.721*** (0.987)	16.484*** (3.618)	17.407*** (3.623)	18.878*** (3.421)	19.572*** (3.453)
Observations	128,227	128,227	96,688	96,688	96,688	96,688
R2	0.808	0.809	0.842	0.842	0.842	0.842

Note: This table estimates of the baseline model 2.1 for Total credit (log). Column (1)-(2) include all 4 years 2007-2010. Column (3)-(6) include 3 years 2008-2010. All models include the lagged values of provincial controls: population (log), GDP per capita (log), share of asphalted road, telephones per capita and the composite PCI. All models control for firm fixed-effects and industry-year fixed-effects. Standard errors are adjusted for industry-province clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.5: Bank market structure and the effect of the 2009 interest subsidy on Total employment (log)

	(1)	(2)	(3)	(4)	(5)	(6)
2007 SOCB employment share × Post	0.190*** (0.048)					
2007 SOCB employment share × 2009		0.156*** (0.038)				
2007 SOCB employment share × 2010		0.249*** (0.069)				
2008 SOCB employment share × Post			0.136*** (0.041)			
2008 SOCB employment share × 2009				0.123*** (0.037)		
2008 SOCB employment share × 2010				0.189*** (0.061)		
2008 SOCB credit share × Post					0.127*** (0.033)	
2008 SOCB credit share × 2009						0.114*** (0.031)
2008 SOCB credit share × 2010						0.172*** (0.046)
Constant	2.877*** (0.268)	2.868*** (0.268)	4.187*** (1.414)	3.819*** (1.370)	4.668*** (1.450)	4.471*** (1.419)
Observations	142,767	142,767	107,064	107,064	107,064	107,064
R2	0.867	0.867	0.892	0.892	0.892	0.892

Note: This table estimates of the baseline model 2.1 for Total employment (log). Column (1)-(2) include all 4 years 2007-2010. Column (3)-(6) include 3 years 2008-2010. All models include the lagged values of provincial controls: population (log), GDP per capita (log), share of asphalted road, telephones per capita and the composite PCI. All models control for firm fixed-effects and industry-year fixed-effects. Standard errors are adjusted for industry-province clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.6: Bank market structure and the effect of the 2009 interest subsidy on Long-term employment (log)

	(1)	(2)	(3)	(4)	(5)	(6)
2007 SOCB employment share × Post	0.074* (0.043)					
2007 SOCB employment share × 2009		0.098 (0.063)				
2007 SOCB employment share × 2010		0.021 (0.068)				
2008 SOCB employment share × Post			0.175** (0.085)			
2008 SOCB employment share × 2009				0.177* (0.091)		
2008 SOCB employment share × 2010				0.164** (0.076)		
2008 SOCB credit share × Post					0.223*** (0.070)	
2008 SOCB credit share × 2009						0.211*** (0.081)
2008 SOCB credit share × 2010						0.286*** (0.065)
Constant	2.246*** (0.559)	2.264*** (0.543)	-2.197 (3.304)	-2.097 (3.006)	-2.485 (2.812)	-2.838 (2.662)
Observations	61,747	61,747	47,422	47,422	47,422	47,422
R2	0.899	0.899	0.913	0.913	0.913	0.913

Note: This table estimates of the baseline model 2.1 for Long-term employment (log). Column (1)-(2) include all 4 years 2007-2010. Column (3)-(6) include 3 years 2008-2010. All models include the lagged values of provincial controls: population (log), GDP per capita (log), share of asphalted road, telephones per capita and the composite PCI. All models control for firm fixed-effects and industry-year fixed-effects. Standard errors are adjusted for industry-province clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.7: Bank market structure and the effect of the 2009 interest subsidy on Net investment rate

	(1)	(2)	(3)	(4)	(5)	(6)
2007 SOCB employment share × Post	0.031 (0.234)					
2007 SOCB employment share × 2009		0.382 (0.297)				
2007 SOCB employment share × 2010		-0.612* (0.357)				
2008 SOCB employment share × Post			0.199 (0.270)			
2008 SOCB employment share × 2009				0.427 (0.318)		
2008 SOCB employment share × 2010				-0.699** (0.321)		
2008 SOCB credit share × Post					0.254 (0.227)	
2008 SOCB credit share × 2009						0.507** (0.252)
2008 SOCB credit share × 2010						-0.596** (0.288)
Constant	4.444* (2.502)	4.554* (2.428)	12.884 (10.775)	18.766** (9.482)	12.485 (10.595)	16.256* (9.492)
Observations	119,343	119,343	94,196	94,196	94,196	94,196
R2	0.285	0.285	0.339	0.340	0.340	0.340

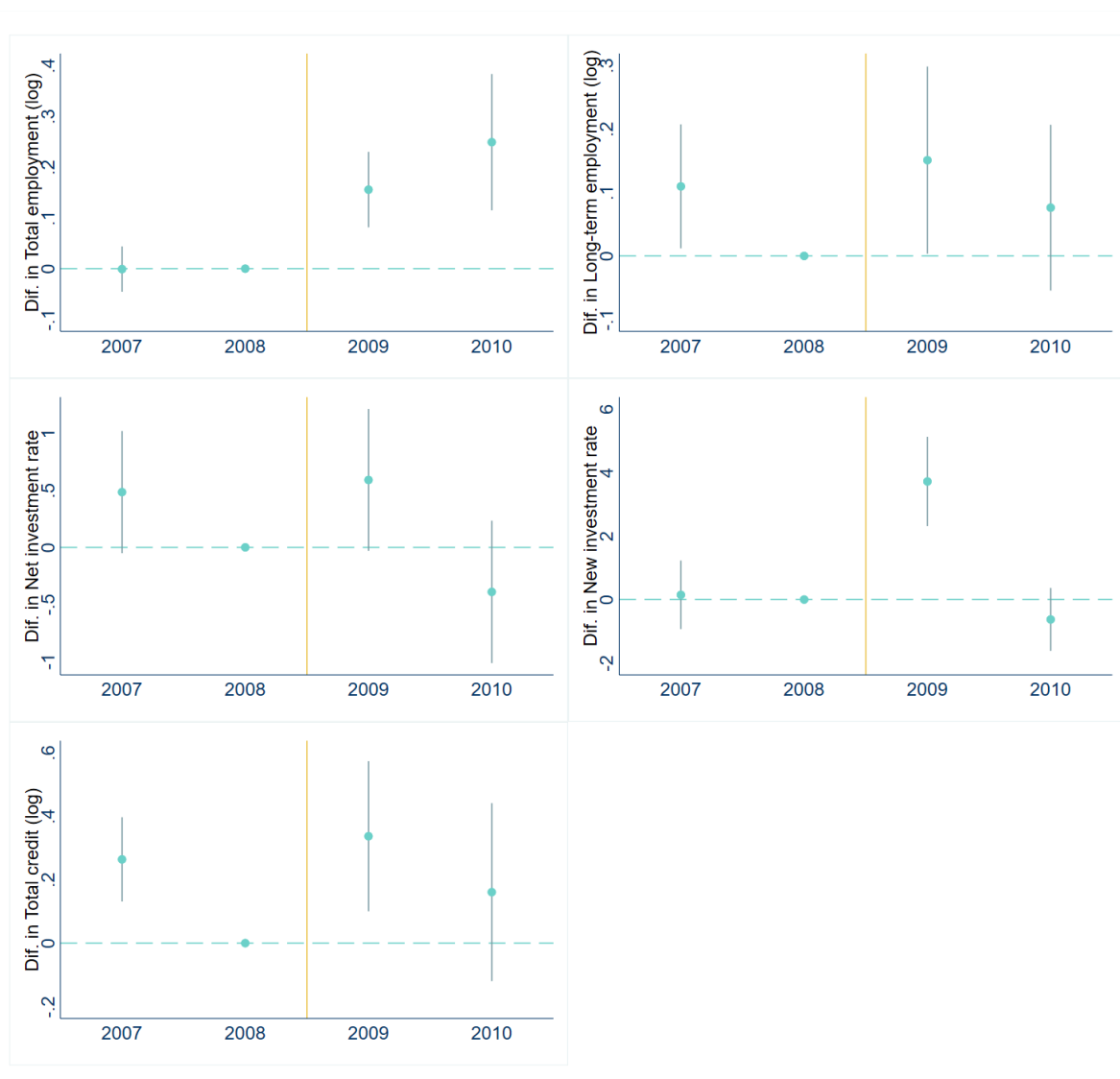
Note: This table estimates of the baseline model 2.1 for Net investment rate. Column (1)-(2) include all 4 years 2007-2010. Column (3)-(6) include 3 years 2008-2010. All models include the lagged values of provincial controls: population (log), GDP per capita (log), share of asphalted road, telephones per capita and the composite PCI. All models control for firm fixed-effects and industry-year fixed-effects. Standard errors are adjusted for industry-province clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.8: Bank market structure and the effect of the 2009 interest subsidy on New investment rate

	(1)	(2)	(3)	(4)	(5)	(6)
2007 SOCB employment share × Post	2.126*** (0.595)					
2007 SOCB employment share × 2009		3.653*** (0.672)				
2007 SOCB employment share × 2010		-0.694 (0.599)				
2008 SOCB employment share × Post			1.699** (0.837)			
2008 SOCB employment share × 2009				2.536*** (0.765)		
2008 SOCB employment share × 2010				-1.607*** (0.555)		
2008 SOCB credit share × Post					0.609 (0.711)	
2008 SOCB credit share × 2009						1.511** (0.697)
2008 SOCB credit share × 2010						-2.398*** (0.499)
Constant	14.155*** (4.952)	14.687*** (4.250)	52.672* (28.322)	74.779*** (22.281)	73.082*** (25.361)	86.607*** (20.658)
Observations	122,375	122,375	96,810	96,810	96,810	96,810
R2	0.351	0.354	0.401	0.404	0.400	0.403

Note: This table estimates of the baseline model 2.1 for New investment rate. Column (1)-(2) include all 4 years 2007-2010. Column (3)-(6) include 3 years 2008-2010. All models include the lagged values of provincial controls: population (log), GDP per capita (log), share of asphalted road, telephones per capita and the composite PCI. All models control for firm fixed-effects and industry-year fixed-effects. Standard errors are adjusted for industry-province clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure 2.3: Parallel trends



As a robustness check, I generate a binary variable derived from the continuous treatment variable. This binary treatment takes a value of 1 for firms located in provinces with an SOCB employment share is equal to or exceeding the median. As reported in table 2.9, the estimates of the baseline model are consistent with the binary treatment.

In overall, the SOCB system did channel the subsidised loan into productive activities like investment in new fixed assets and employment expansion. The remaining question is whether the loan fell into the right hand, i.e., those who really needed it. To address this, the subsequent sections will investigate the program's impact across firm size, age, and ownership.

Table 2.9: Bank market structure (binary) and the effect of the 2009 interest subsidy

	Total credit (log)	Net investment rate	New investment rate	Total employment (log)	Longterm employment (log)
2007 SOCB employment share x Post	-0.021 (0.078)	0.156* (0.083)	0.487* (0.258)	0.046** (0.017)	0.027 (0.017)
Constant	8.273** (1.614)	3.510 (3.436)	17.685** (5.560)	3.180** (0.399)	2.348** (0.463)
Observations	128,227	119,343	122,375	142,767	61,747
R2	0.808	0.285	0.351	0.867	0.899

Note: This table estimates of the baseline model 2.1. The independent variables are dichotomized and equal to 1 if firm belongs to a province with the above-median SOCB market share. All models include the lagged values of provincial controls: population (log), GDP per capita (log), share of asphalted road, telephones per capita and the composite PCI. All models control for firm fixed-effects and industry-year fixed-effects. Standard errors are adjusted for industry-province clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

2.5.2 Effect of the credit subsidy across firm size and age

In the an influential paper that aims to identify firm credit constraints using a directed lending program in India, [Banerjee and Duflo \(2014\)](#) hypothesize that although both credit constrained and unconstrained firms will absorb any cheaper credit they can have, only constrained firms use it to expand their production while unconstrained firms will substitute it for other credits. Similarly, if the Vietnam's 2009 credit subsidy relieved firm credit constraint, constrained firms will expand more than unconstrained firms. Therefore, I expect the effect of the credit subsidy to be larger for small and young firms. To verify this hypothesis, I add a triple interactions of SOCB employment share, post-treatment dummy and firm size/age to the baseline equation.

The estimates for firm size in table 2.10 confirms [Banerjee and Duflo's](#) hypothesis (2014). Small firms (1-20 employees) demonstrated significantly higher investment levels compared to larger firms. Although no difference is observed in total employment, larger firms were more likely to retain long-term employees in comparison to smaller firms.

Table 2.11 reports the estimates for young firms (less than 5 years old). The results are almost similar to those for small firms. Moreover, young firms exhibited a significantly higher debt level following the credit subsidy. These findings confirm that young and small firms in rural provinces are substantially credit-constrained, especially long-terms credit for investment.

Table 2.10: Bank market structure and the effect of the 2009 interest subsidy by size

	Total credit (log)	Net investment rate	New investment rate	Total employment (log)	Longterm employment (log)
1-20 employees x 2007 SOCB employment share x Post	0.088 (0.104)	0.960*** (0.279)	5.363*** (1.074)	-0.036 (0.060)	-0.328*** (0.045)
2007 SOCB employment share x Post	0.029 (0.205)	-0.491** (0.224)	-0.625 (0.548)	0.157*** (0.048)	0.218*** (0.040)
1-20 employees x Post	0.245*** (0.087)	-0.690** (0.276)	-4.687*** (1.072)	0.256*** (0.049)	0.314*** (0.038)
Constant	7.618*** (1.522)	4.799 (3.409)	16.285** (6.335)	2.809*** (0.348)	2.175*** (0.565)
Observations	128,227	119,343	122,375	142,767	61,747
R2	0.810	0.285	0.353	0.869	0.899

Note: This table estimates an augmented model of the baseline model 2.1 which adds a triple interaction terms $Size \times SOCBshare \times Post$. The reference is the group of firms with 21-200 employees. All models include the lagged values of provincial controls: population (log), GDP per capita (log), share of asphalted road, telephones per capita and the composite PCI. All models control for firm fixed-effects and industry-year fixed-effects. Standard errors are adjusted for industry-province clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.11: Bank market structure and the effect of the 2009 interest subsidy by age

	Total credit (log)	Net investment rate	New investment rate	Total employment (log)	Longterm employment (log)
Young x 2007 SOCB employment share x Post	0.216** (0.091)	0.669*** (0.241)	2.656*** (0.354)	-0.003 (0.024)	-0.231*** (0.038)
2007 SOCB employment share x Post	-0.017 (0.199)	-0.248 (0.202)	1.175 (0.781)	0.175*** (0.029)	0.171*** (0.042)
Young x Post	0.132* (0.079)	-0.861*** (0.221)	-2.845*** (0.335)	0.062** (0.017)	0.276*** (0.025)
Constant	7.848*** (1.556)	4.535 (3.330)	13.979** (6.374)	2.878*** (0.342)	2.166*** (0.590)
Observations	129,318	120,057	123,112	143,945	62,528
R2	0.808	0.284	0.355	0.867	0.900

Note: This table estimates an augmented model of the baseline model 2.1 which adds a triple interaction terms $Young \times SOCBshare \times Post$. The reference is the group of firms with more than 5 years old. All models include the lagged values of provincial controls: population (log), GDP per capita (log), share of asphalted road, telephones per capita and the composite PCI. All models control for firm fixed-effects and industry-year fixed-effects. Standard errors are adjusted for industry-province clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

2.5.3 Did the SOCBs favor the local SOEs?

Next, I explore whether the credit subsidy was channeled more towards the SOEs. Given that local banking market structure only affects small and local firms, I include in the primary dataset the subset of local public firms with less than 200 employees. Table 2.12 reports the estimates of the baseline model model incorporating triple interaction terms $Public \times SOCBshare \times Post$. The estimates indicate no evidence of discrimination toward local public firms. In fact, public firms even exhibited lower levels of total outlay and new investment rates compared to private firms in higher SOCB concentration provinces.

Table 2.12: Public versus private sector

	Total credit (log)	Net investment rate	New investment rate	Total employment (log)	Longterm employment (log)
Public x 2007 SOCB employment share x Post	-0.453* (0.260)	0.254 (0.514)	-1.811*** (0.538)	-0.058 (0.091)	-0.054 (0.052)
2007 SOCB employment share x Post	0.118 (0.205)	0.046 (0.225)	1.827*** (0.592)	0.195*** (0.030)	0.066* (0.037)
Post x Public	0.144 (0.252)	-0.027 (0.444)	1.877*** (0.504)	-0.011 (0.085)	-0.003 (0.045)
Constant	7.649*** (1.536)	4.853 (3.286)	14.114** (5.521)	2.819*** (0.340)	2.388*** (0.500)
Observations	136,908	127,556	130,816	152,626	66,992
R2	0.815	0.285	0.348	0.869	0.906

Note: This table estimates an augmented model of the baseline model 2.1 which adds a triple interaction terms $Public \times SOCBshare \times Post$. All models include the lagged values of provincial controls: population (log), GDP per capita (log), share of asphalted road, telephones per capita, bank density (measured by number of banking employees per 1000 citizens) and the composite PCI. All models control for firm fixed-effects and industry-year fixed-effects. Standard errors are adjusted for industry-province clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

2.5.4 Firm speculation

In this section, I examines the possibility of speculation among the subsidy beneficiaries. To answer this question, I run the baseline model with firm financial revenue. As this study focuses on small non-financial establishment and a majority of these firms exhibit zero or very small financial revenues, I use directly the variable financial revenue in Vietnam Dong instead of its log. The findings are presented in table 2.13. Firms located in provinces with a high concentration of SOCBs showed a notably

higher financial revenue following the credit subsidy. This result is in line with Tuan-Minh et al. (2012) who observed a significant increase in trading volume in the stock market coinciding with the implementation of the credit subsidy. While speculation in the stock market may not have been universally accessible for all firms, using firm financial revenue allows me to take into account more popular forms of speculation, especially re-lending.

Table 2.13: The interest subsidies and firm speculation

	(1)	(2)
2007 SOCB employment share x Post	16.796*** (5.297)	
2007 SOCB employment share x 2009		13.552*** (4.761)
2007 SOCB employment share x 2010		22.469*** (6.968)
Constant	50.194 (39.276)	49.329 (38.988)
Observations	141,201	141,201
R2	0.573	0.573

Note: This table estimates of the baseline model 2.1 for firm financial revenue. All models include the lagged values of provincial controls: population (log), GDP per capita (log), share of asphalted road, telephones per capita and the composite PCI. All models control for firm fixed-effects and industry-year fixed-effects. Standard errors are adjusted for industry-province clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

2.6 Conclusion

This paper examines the effect of the Vietnamese government's interest subsidy in 2009 on small firm performance. Using the provincial variation in the employment share of the SOCBs, I find that the subsidised loan allocated through the SOCB system increased firm employment and investment. More precisely, a strong position of the SOCB in the local market is associated to an increase in firm new investment rate and employment after the credit subsidy. Jobs created through the subsidy were also long-term.

In terms of allocation efficiency, I find that typical credit constrained firms were

among the main beneficiaries of the credit subsidy. More precisely, young and small firms in higher SOCB market share provinces profited higher increase on total outlay, employment and investment compared with their counterparts in lower SOCB market share provinces. These are consistent with the results of [Tuan-Minh et al. \(2012\)](#) who finds that the credit subsidy was allocated unbiasedly throughout regions, sectors and firm sizes. In addition, there was no evidence of a bias toward local public firms.

Finally, I also find some evidence of firm speculation: firms in higher SOCB market share provinces demonstrated a significantly higher level of financial revenue.

This study differs from the previous works on the same program not only by its identification strategy but also from its original perspective. Indeed, the findings underscore the role of state-owned banks in addressing market failures, particularly during periods of crisis. It is suggested that a well-crafted policy, coupled with effective oversight of state-owned banks, can effectively support constrained and vulnerable firms, ultimately aiding in economic recovery.

This study encounters two primary limitations. Firstly, it may be affected by the selection bias of surviving firms. As the census encompasses only approximately 10 percent of firms with less than 30 employees, many firms exited and re-entered the panel multiple times. Consequently, it becomes challenging to identify precisely which firms exited the market. Secondly, due to the absence of data on the subsidized loan, I could not perform a cost-benefit analysis of the loan. Further data is crucial for conducting these in-depth analyses.

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Chapter 3

The Role of Public Employment and Wage Policy in the Dynamic of Earnings Inequality: The Tunisian perspective

The Dynamics of Earnings Inequality in Revolution Times

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Abstract

In this paper, we analyze the impact of education, technology, structural change and public employment and wage policies on Tunisia' earnings inequality before and after the revolution breakpoint. Based on labor force surveys from the last two decades, a recentered-influence function (RIF) decomposition is performed to assess the contribution of relevant determinants of inequality change. We find that earnings inequality decreased significantly during the period of investigation in Tunisia, mainly due to the decrease in the public-private wage gap and in the sector wage gaps on the demand side, and the decreasing education premia on the supply side. After the Revolution, the closing process of private-public wage gap halted as the public sector turns to the pro-poor wage policy, and the routinization began to impact the Tunisian earnings distribution in the same way as observed in developed countries.

Keywords: public wage policy, wage inequality, occupational change, education premium

JEL classification: D31, J23, J24

3.1 Introduction

The relationship between political change and inequality is not easy to apprehend as causality can go both ways (Thorbecke and Charumilind, 2002). As shown by Alesina and Perotti (1996), inequality is a source of social tensions that lead to political instability. This cross-country analysis has however been recently challenged by the Arab Spring. Devarajan and Ianchovichina (2018) show that inequality did not fuel the uprisings as it was decreasing in countries where it started. People were dissatisfied because the Government was not able anymore to provide jobs and good quality public services. This is in line with Thorbecke and Charumilind (2002) who consider that what really matters is the gap between expectations and achievements. The importance of perceptions is confirmed by Gimpelson and Treisman (2018) who show that there is a strong correlation between conflict and perceived inequality, while there are none with actual income distribution outcomes. More recently, using an absolute measure of inequality, Clementi et al. (2023), show that polarization is significantly correlated to perception in Morocco.

Our objective in this paper is to empirically investigate the evolution of inequality before and after the political transition to democracy in Tunisia. Adopting a labor market lens, we focus on the evolution of earnings' distribution and its determinants. We test the contribution of different factors highlighted in the literature on developed and developing countries and add the role of the public sector, given its importance in the MENA social contract. Our aim is to identify regularities explained by structural factors, and highlight changes that may have occurred due to increasing social pressures, resulting from regime change.

Tunisia is a lower middle-income country structurally characterized by high unemployment rates despite a sustained average growth rate from the mid-1990s to the global financial crisis of 5%. In the last 20 years, youth unemployment has been severe, particularly for graduates.¹ Coupled with a widely shared sentiment of political discontent and rising cronyism among the population (Rijkers et al., 2017), the labor market outcomes fuelled the Revolution of 2011, with a long-lasting impact for the whole Middle East and North Africa (MENA) region. MENA is however, not an exception. In many places in the world, the combination of a youth bulge and low de-

¹Between 30 and 40 per cent according to Asik et al. (2020).

mand for skills have induced unemployment, overeducation, frustration, and rebellion (Urdal, 2006; Nordås and Davenport, 2013).

Much of the academic literature on employment and wage distribution focused on levels of education, suggesting that the increasing gap between two distinct skill groups is the strongest determinant of earnings inequality. The canonical model formalizes the two forces of “Tinbergen’s race” between technology and skills’ supply, by considering high and low skill workers as imperfect substitutes. With the dramatic increase of education in the 20th century, if technology remained constant, education premia would have fallen significantly (Acemoglu and Autor, 2011). While education premia have generally increased in developed countries and particularly in the US (Autor, 2014), Ferreira et al. (2021) show that lower education premia are among the significant driving forces of falling earnings inequality in Brazil between 1995 and 2012. However, they also show that a reduction of returns to labor market experience played a much bigger role in reducing pay inequality.

An influential and growing literature (Autor et al., 2003; Acemoglu and Autor, 2011; Autor and Dorn, 2013) has shown that a significant share of inequality in developed countries is also explained by inequality within skill groups, namely due to occupational change and the tasks associated with occupations. This literature highlighted the role of the evolution of occupations and tasks over time as a key determinant in understanding jobs and wage polarization (Autor and Dorn, 2013). According to studies that use US task databases—the Dictionary of Occupational Titles (DOT) (Autor et al., 2003) and its successor, the Occupational Information Network (O*NET) (Acemoglu and Autor, 2011)—routine tasks are mainly concentrated in average-wage occupations, while low-wage and high-wage occupations are characterized respectively by high intensity of manual and cognitive tasks, respectively. While this work was ground-breaking, it remains biased towards the task-based structure of occupations in the most developed countries. Indeed, as shown by Lewandowski et al. (2020), occupations in developing countries are more intensive in routine tasks than similar occupations in developed countries.

Studying the case of Portugal, a country with slow adoption of automation, Fonseca et al. (2018) show that the decline of routine manual task jobs is the main determinant of job and wage polarization, while routine cognitive task jobs do not witness a similar

outcome. [Lewandowski et al. \(2019\)](#) test the routinization hypothesis in a broader context, including in developing countries, using survey-based and regression corrected estimations of routine-task intensity (RTI) in occupations on a country basis. Using global census data, [Maloney and Molina \(2019\)](#) also investigate polarization and automation links in developing countries, and find little evidences. Using Chinese data, [Fleisher et al. \(2018\)](#) highlight a redistribution of jobs from middle-income skills to low-income categories, but they do not find any evidence of polarization at the upper end of the skill spectrum, despite the development of routine tasks.

[Bárány and Siegel \(2018\)](#) propose a structural change-driven explanation of job polarization. One of their main arguments is that polarization started in the 1950s in the USA, long before the information and communication technologies (ICT) revolution. Their analysis is based on the complementarity between consumption goods in manufacturing (intensive in medium-skilled workers) and low-skill and high-skill services, and the increase of relative labor productivity in manufacturing, which pushes labor in the two other sectors. This is in line with the work of [Kupets \(2016\)](#), who shows that job polarization in Ukraine is due to a structural change biased towards subsistence agriculture and low value-added services, rather than routine-based technological change.

Last but not least, studying the evolution of earnings inequality in the MENA region necessitates to take into account the role of public sector employment and wage policy, as an oversized public sector has been always a well-established fact on the MENA labor market ([Assaad, 2014](#)). Furthermore, given that public wages are generally less dispersed than private ones, the size of the public sector can affect wage inequality ([Wallerstein, 1999](#)).

Based on labor force surveys from the last two decades, a recentered-influence function (RIF) decomposition is performed to assess the contribution of the main determinants of inequality change. By identifying the important determinants of earnings dynamics and examining their changes following the revolution, this chapter lays the groundwork for further rigorous analysis on the causal effect of the revolution on inequality and the impact channels.

The main result is that earnings inequality decreases significantly during the period of investigation in Tunisia, mainly due to decreases in the public–private wage gap

and the sector wage gap on the demand side and the decreasing education premia on the supply side. The increase in marginal returns to low-wage but average-RTI jobs, the falling return to experience, and the decreasing regional wage gap are also found to have contributed to the decline in overall earnings inequality. When comparing between the two periods, the private-public wage gap converged strongly before the Revolution but halted as the public sector turns to the pro-poor wage policy after that. Meanwhile, the contribution of routinization to the wage structure effect reversed during the transition-to-democracy period and began to impact the Tunisian earnings distribution in the same way as observed in developed countries.

The structure for the remainder of the paper is as follows. Section 3.2 presents the data used in this study. Section 3.3 describes general trends of earnings inequality and the underlying factors of these dynamics. Section 3.4 details our decomposition method. Results are reported in Section 3.5. Finally, Section 3.6 presents the concluding remarks.

3.2 Data

The data used for this paper are cross-sectional data from the National Population and Employment Survey (Enquête Nationale sur la Population et l'Emploi, ENPE). Through an agreement with the Tunisian National Statistics Institute (INS), we were able to gain access to three waves of data on the labor market and household conditions from 2000, 2010, and 2017. In addition to labor market conditions, we have obtained access to data on wages and benefits.

The annual ENPE survey was first conducted in 2000 to provide information on the labor market, household composition, and employment policy. For these purposes, the survey is divided into two main modules. The first module provides demographic information on all members of the household, including gender, age, relationship with the householder, marital position, education, working status, and employment sector. The second module provides the occupational code (Nomenclature Nationale des Professions, NNP), the working conditions, and, exceptionally for paid workers, the remuneration (including net salary, assurance, allowance, and other benefits). Therefore, our analysis will mainly use the data set of employees.

In order to estimate the contribution of the Routine-biased technical change to the earnings inequality changes, we use the task-content measure proposed by [Autor et al. \(2003\)](#), based on the US Department of Labor's DOT, and then its successor, O*NET. [Autor et al.'s index \(2003\)](#) was aggregated from five sub-indices measuring the intensity of five different types of tasks: non-routine cognitive, non-routine interactive, non-routine manual, routine cognitive, and routine manual. The O*NET RTI has been widely used in studying the relationship between technical changes and employment in developed countries (see [Goos and Manning, 2007](#); [Autor et al., 2008](#); [Acemoglu and Autor, 2011](#); [Jaimovich and Siu, 2012](#); [Foote and Ryan, 2015](#); [Graetz and Michaels, 2017](#)).

Merging the two data sets requires us to map the two occupational code systems O*NET-SOC and NNP into the four-digit ISCO-88 occupations². Among the three waves of the survey to which we have access, two waves (2000 and 2010) use NNP-97 (1997 NNP), corresponding to ISCO-88; the third wave, in 2017, uses NNP-14 (2014 NNP), corresponding to ISCO-08. Therefore, we first mapped the NNP to the corresponding ISCO, then ISCO-08 to ISCO-88. The NNP is highly compliant with ISCO, except that it does not further divide the agricultural and fishery occupational group into skilled and subsistence workers. All agricultural and fishery workers (NNP) were classified as skilled workers (group 61, ISCO). This classification is acceptable in our case because the survey only covers employees' earnings, while subsistence workers tend to be self-employed. Our second remark relates to the conversion from ISCO-08 to ISCO-88. For some ISCO-08 occupations that have various ISCO88 equivalents, we chose the ISCO-88 equivalent that has the highest number of employees recorded in 2010. We observed that all ISCO-08 agricultural workers (occupations 6111–6223) were classified as ISCO-88 general managers in agriculture (occupations 1311–1312). To convert these occupations, we use the earnings distribution and other workers' features relating to the position, such as workplace, contract types, and payment methods. As occupations were precisely recorded at the four- or five-digit level, eventually we were able to merge the survey data with task measures at the four-digit ISCO-88 level.

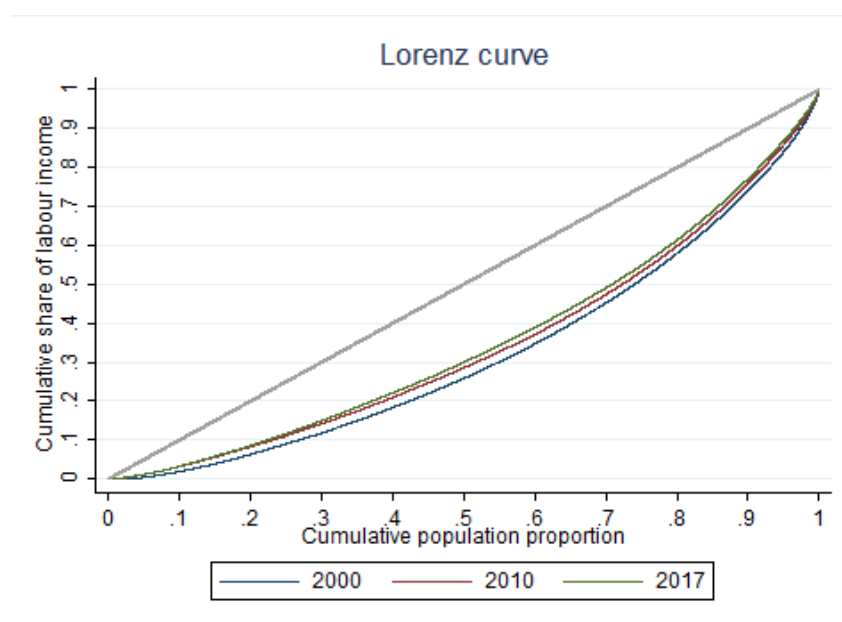
²ISCO, International Standard Classification of Occupations.

3.3 Inequality in Tunisia over the period 2000-2017

3.3.1 General trends

Labor income inequality in Tunisia has decreased significantly over the past two decades, from 0.353 in 2000 to 0.294 in 2017. The trends in earnings inequality reflect two episodes: before and after the Revolution. The first sub-period witnessed a rapid fall in earnings inequality, with the Gini index dropping by 4 percentage points over 10 years. This reduction halved to around 2 percentage points in the second sub-period. The Lorenz curves in Figure 3.1 provide an illustration of these trends.

Figure 3.1: Lorenz curves showing trends in labor income inequality



While the reduction is clear at the aggregate level, the evidence also suggests that the reduction in inequality did not affect all workers in the same way. On a macro level, we see that the variance in earnings may have fallen considerably from 2000 to 2010, but this improvement was followed by an increase in 2017 as compared to 2010. In fact, the difference between earnings in the bottom 50th (median) to 10th percentile decreased more than those in the top 90th to 50th percentile (Table 3.1). The earnings gap between the 90th and 50th percentile narrowed mostly during the post-Revolution period, whereas the earnings gap between the 90th and 10th percentile contracted more in the pre-Revolution period. As we will argue in later sections, this decrease of inequality mainly came from the relative improvement of wages for low-wage workers

and, to a lower extent, medium-wage workers.

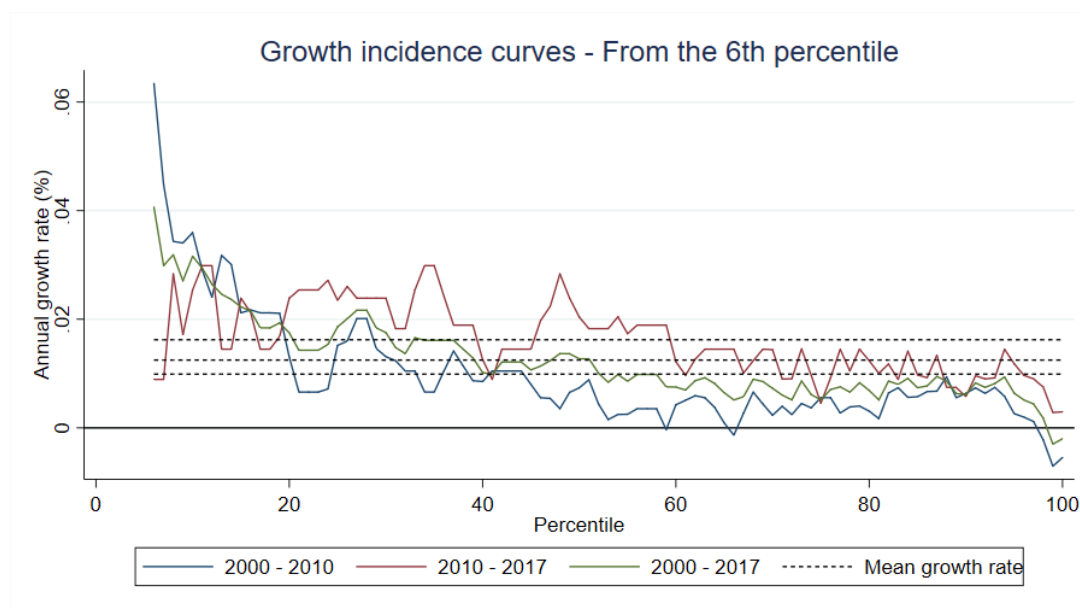
Table 3.1: Summary inequality indices and interquartile ratios

	Summary indices				Interquartile ratios		
	2000	2010	2017		2000	2010	2017
Var	0.645	0.384	0.429	$\log(p90/p10)$	1.636	1.422	1.283
Gini (log)	0.098	0.074	0.069	$\log(p90/p50)$	0.847	0.832	0.772
Gini	0.355	0.315	0.295	$\log(p50/p10)$	0.788	0.590	0.511

Source: authors' calculation based on ENPE data.

Examining the earnings growth by percentile (Figure 3.2), we see a high growth in low wages from 2000 to 2010 (particularly for the lowest decile), but a lower increase of earnings in low-wage jobs in the 2010–17 period. We also see opposite patterns for medium-income earners, whose earnings growth was relatively flat in the pre-Revolution period, and increased, particularly for the second to the sixth decile. Higher wages also improved but to a much lesser extent.

Figure 3.2: Growth incidence curves of the wage distribution



3.3.2 Underlying factors of the inequality trend

In this paper, we focus on four potential determinants of the inequality changes that have recently drawn much attention of scholars and policymakers: education, technological change, structural change and public wage and employment policy.

The high pace of education expansion and the fall of education premium

Tunisia experienced a high pace of education expansion over the pre-revolution period. The gross tertiary enrollment ratio of Tunisia increased on average 1.4 percentage point per year from 2000 to 2011, whereas, the average of the world and the MENA region was about 1.1 percentage point ³. While the supply of highly educated workers was and remained high, the demand for jobs in more productive and high-earning sectors stagnated (Marouani and Mouelhi, 2016). This relative increase of skill supply drove down the market return to skill, or education premium. In 2000, men and women educated at tertiary levels gained, respectively, 27 and 24 percentage points of a premium above those who had a secondary level of education. These differences had shrunk to 19 percentage points for both men and women by 2010. The trends slowed down for men and slightly reversed for women after the Revolution⁴.

The unclear role of technical change

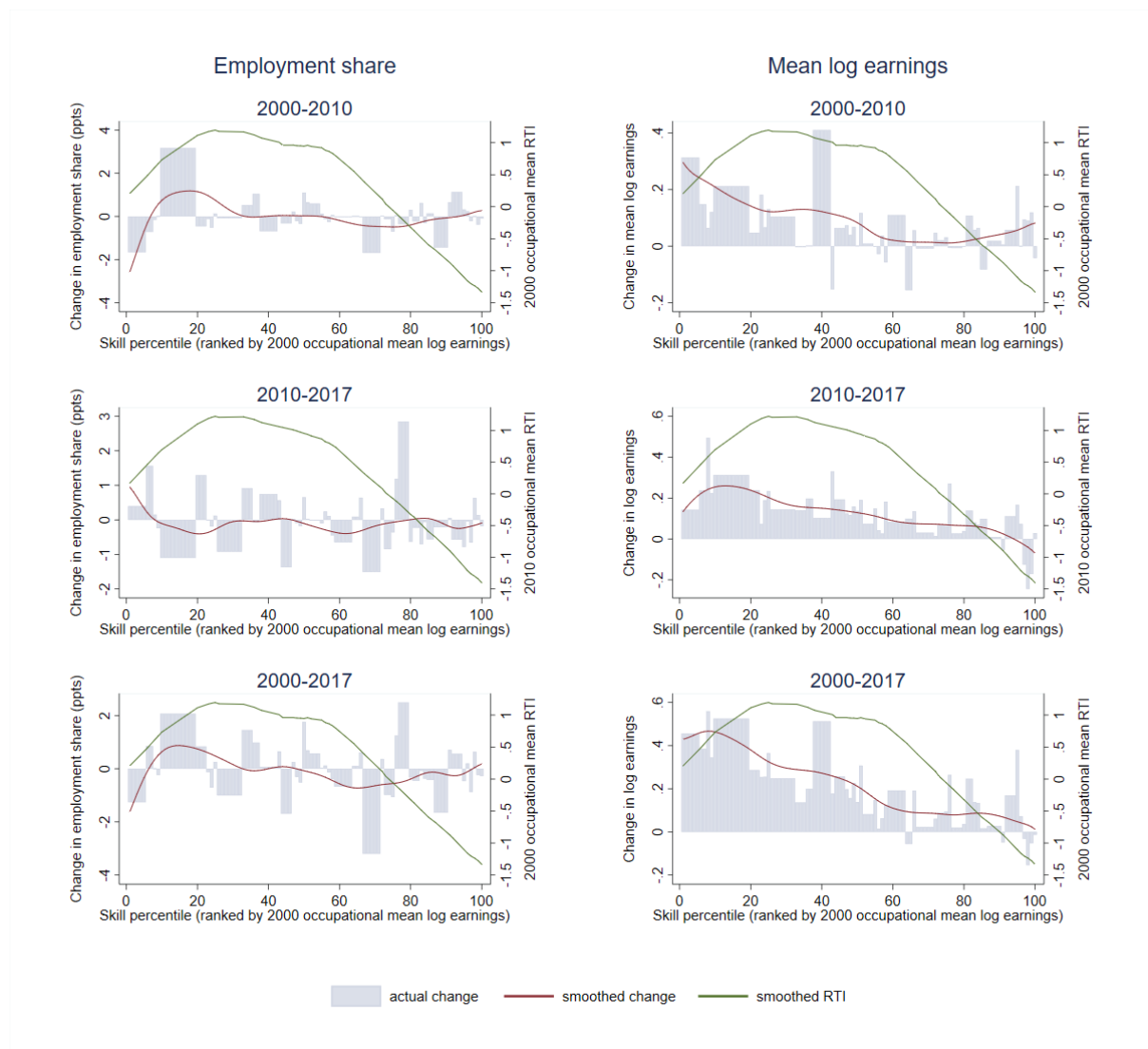
Although the expansion of education may be a crucial factor, it does not alone determine the changes in education premium and ultimately earnings inequality. The education premium results from the interplay between the supply and demand of skills. As a result, it does not decline as long as the skill demand increases at an equivalent or higher pace than the skill supply. According to Autor et al. (2008), technical change, in one hand, replaces the repetitive tasks (routine-intensive tasks) performed by low- and middle-skilled workers, and in the other hand, creates new tasks that require an input combination of technologies and high-skilled workers performing abstract tasks. This mechanism is called the "Routine bias technical change" (RBTC) and has been widely accepted as the main economic culprit of the famous vanishing of the middle class in many developed countries (see Levy and Murnane (1992), Acemoglu (2002), Autor and Dorn (2013) for the U.S.; Goos and Manning (2007) for the UK and Goos et al. (2014) for Europe). The role of technical change in developing countries' labor market is, however, still far from clear. In Figure 3.3, we plot the changes in log earnings, employment share and the average Routine-task intensity (RTI) over skill

³Authors' calculation from World Bank's data. Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Source: <https://data.worldbank.org/indicator>.

⁴Authors' calculation from ENPE's data.

percentiles. The earnings evolution follows an L-shaped pattern with the increase of earnings at the lower end of the distribution and the stagnancy of earnings at the upper end of the distribution before the Revolution. The rising jobs were not only low-paid but also had an average RTI, contrasting with the declining trend of RTI in advanced countries. Although the same trends continued after the Revolution, they were much flatter. The share of high-RTI jobs continued to decrease, but so did the share of low- (negative-) RTI jobs. The winners in terms of earnings were still the same, but their earnings improved less. Technical changes may play a certain role in shaping the demand in Tunisia's labor market, but this role seems to be very small in comparison to other factors.

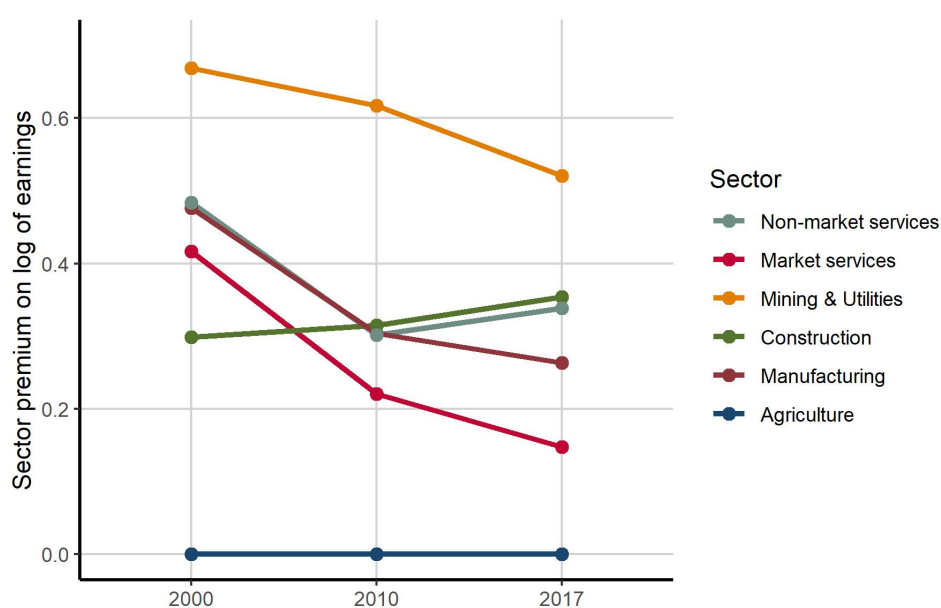
Figure 3.3: Change in mean log earnings and employment share by skill percentiles



A sluggish structural transformation

The sectoral distribution of employment helps understand some of the previous dynamics. The share of agriculture in employment increased for the first time in 2017 after a decline in 2010 which started a few decades ago (Marouani and Mouelhi, 2016). Moreover, the share of manufacturing in 2017 is back to its level of 2000 after an increase in the first decade of the new millenium. This movement of deindustrialization is in favour of services of which share continuously increased between 2000 and 2017. Because of this service-led deindustrialization, the process of wage gap closing with agriculture was slower in manufacturing than in services. Comparing the two sub-periods (Figure 3.4), we see that the sector premium reduced more strongly before the Revolution, which is congruent with the sharp decline of inequality during this sub-period.

Figure 3.4: Change in the sector premium on log earnings



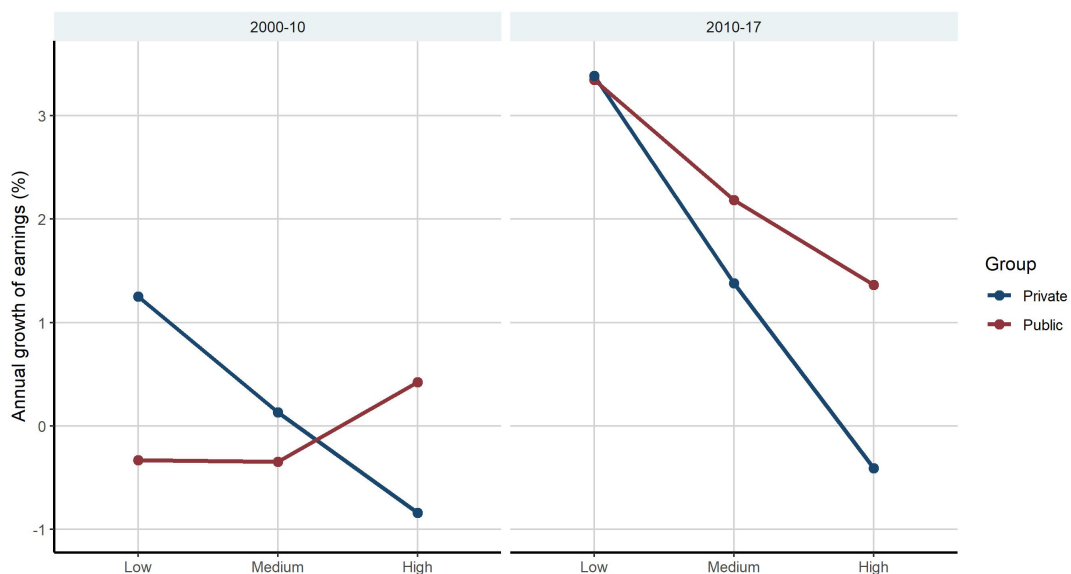
Public wage and employment policies as a redistribution tool

The earnings dynamics illustrated in Figure 3.5 reveal a substantial change in public wage policy in the decade following the Revolution. Indeed, before the 2010 uprisings, the earnings evolution of public sector was characterized by a disequalizing change across occupations. Public high-skilled workers benefited an average annual earnings

growth of 0.4%, while the other skill groups had their earnings reduced on average by 0.3% per year. On the contrary, the between-skill-groups earnings difference decreased significantly in the private sector. Private high-skilled workers saw their earnings falling considerably, from above to below the earnings level of their public counterparts. This highlights an additional source of the decline in earnings inequality observed in this sub-period.

The 2011 Revolution reversed the public wage policy. Thenceforth, the public sector joined the private sector in the wage-equalizing tendency. Although the earnings growth rate of public qualified workers still increased, it was far below the earnings growth rate of public low-skilled workers. This change came as no surprise, given the urgency to attenuate social tensions. As public and private earnings followed the same trends across skill groups, we expect that the change in public-private earnings gap would be smaller and have a lower effect on the overall change of earnings inequality.

Figure 3.5: Change in earnings by skill level in public and private sector



3.4 Methodology

How much do these factors contribute to the decline of earnings inequality over the last decades? To answer this question, we use [Firpo et al.'s \(2018\)](#) reweighted recentered-influence function decomposition, an extended version of Oaxaca-Blinder (OB) decomposition to other distributional statistics besides the mean, including the Gini index,

quantiles, interquantile ranges, etc. The identification strategy and econometric issues of the RIF decomposition method are detailed below.

3.4.1 Identification strategy

The overall wage inequality can change in two ways. First, it is altered when the relative return to an individual characteristic changes, for example, an increase in the education premium results in a disequalizing effect. This is called the wage structure effect. Second, it can be affected by changes in employment share of this characteristic, for example, it increases when the share of high qualified workers increases. This is called the composition effect. The decomposition of the overall wage inequality into these two components, following the OB framework, is formalized as follows.

OB-based decomposition

Let $Y_t = g_t(X, \varepsilon)$ be wage function of workers' observable (X) and unobservable (ε) characteristics in period t , $t = 0, 1$. $Y_t|T = t$ represents the observed wages. $Y_t^C|T = (1-t)$ represents the counterfactual wage of workers in period $(1-t)$ had they been paid like those in period t . For instance, $Y_0^C|T = 1$ is the counterfactual wages of period 1 workers that would have prevail when they were paid like period 0 workers. The counterfactual distribution $F_{Y_0^C|T=1}$ is created, hence, by replacing the conditional distribution of period 1 by the conditional distribution of period 0. Under the assumptions of overlapping support and ignorability (Fortin et al., 2011), one can decompose the overall change in the distributional statistic $\nu(F)$ as:

$$\Delta_O^v = \nu(F_{Y_1|T=1}) - \nu(F_{Y_0|T=0}) = \underbrace{\nu(F_{Y_1|T=1}) - \nu(F_{Y_0^C|T=1})}_{\text{wage structure effect } (\Delta_S^v + \Delta_\varepsilon^v)} + \underbrace{\nu(F_{Y_0^C|T=1}) - \nu(F_{Y_0|T=0})}_{\text{composition effect } \Delta_X^v} \quad (3.1)$$

where:

$$F_{Y_t|T=t}(y) = \int F_{Y_t|X,T=t}(y|X = x) \cdot dF_{X|T=t}(x), \quad t = 0, 1 \quad (3.2)$$

$$F_{Y_0^C|T=1}(y) = \int F_{Y_0|X,T=0}(y|X = x) \cdot dF_{X|T=1}(x). \quad (3.3)$$

The wage structure effect ($\Delta_S^v + \Delta_\varepsilon^v$) contains the differences associated with the return to observable characteristics X and the return to unobservable characteristics ε ; the composition effect contains only the differences associated with the distribution of observable characteristics X , as the differences in the distribution of unobservable characteristics ε do not contribute to the composition effect under the ignorability assumption.

Since we are not only interested in the aggregate decomposition but also in the detailed decomposition, more precisely, the individual contribution of each covariate in X , more assumptions are needed to isolate the return to unobservable characteristics ε from the wage structure effect Δ_S^v . In the case of mean decomposition, the additive linearity and zero conditional mean assumptions implicit in the OB method allow us to drop the error terms:

$$\begin{aligned}\Delta_S^\mu &= E[X|T = 1](\beta_1 - \beta_0) \\ \Delta_X^\mu &= (E[X|T = 1] - E[X|T = 0])\beta_0\end{aligned}\tag{3.4}$$

given $Y_t = g_t(X, \varepsilon) = X\beta_t + h_t(\varepsilon)$, $t = 0, 1$.

For more general distributional statistics, such as gini index, we need to add the assumption of conditional rank preservation. Under this assumption, an individual would have the same rank in the counterfactual as in the observed conditional distribution of regression errors (Fortin et al., 2011). However, this assumption can be relaxed using the RIF-regression method.

RIF-regression

RIF-regression is a linear regression with the recentered influence function (RIF) of the dependent variable. The recentered influence function (RIF) of an outcome variable allow to evaluate the impact of changes in the distribution of the predictors on quantiles of the unconditional distribution of the outcome variable (Firpo et al., 2009). The influence function $IF(y; \nu, F)$ of a distributional statistic $\nu(F)$ tells us how much an individual observation affects that distributional statistic (Firpo et al., 2009). The $RIF(y; \nu, F)$ is created by adding the statistic $\nu(F)$ to $IF(y; \nu, F)$ so that its expectation is equal to the statistic $\nu(F)$. The conditional expectation of the $RIF(y; \nu, F)$ then can be modeled as a linear function of the covariates $E[RIF(y; \nu, F)|X] = X\gamma$ and estimated by

OLS.

In this paper, we are interested in decomposing the change of three distributional statistics: the Gini index, quantiles and interquantile ranges. They have the following RIF ([Firpo et al., 2018](#)):

Gini index v^G :

$$RIF(y; v^G, F_Y) = 1 + \frac{2}{\mu_Y^2} R(F_Y) - \frac{2}{\mu_Y} [y(1 - F_Y(y))]$$

where $R(F_Y) = \int_0^1 GL(p; F_Y) dp$, with $p(y) = F_Y(y)$ and $GL(p; F_Y) = \int_{-\infty}^{F^{-1}(p)} z dF_Y(z)$.

Quantile $q_Y(p)$:

$$RIF(y; q_Y(p), F_Y) = q_Y(p) + \frac{p - 1(y \leq q_Y(p))}{f(q_Y(p))}$$

Interquantile $iqr_Y(p_1, p_2)$:

$$RIF(y; iqr_Y(p_1, p_2), F_Y) = RIF(y; q_Y(p_1), F_Y) - RIF(y; q_Y(p_2), F_Y)$$

Other distributional statistics and the corresponding RIF are listed in [Rios Avila \(2019\)](#), together with the related literature for reference.

3.4.2 Econometric issues

The standard OB method has two main caveats. First, as [Barsky et al. \(2002\)](#) point out, if the linearity assumption does not hold, the OB decomposition may yield inconsistent estimates of both composition and wage structure effects. Second, the contribution of each covariate to the total wage structure effect varies according to the choice of the omitted based category ([Jann, 2008](#); [Firpo et al., 2011](#)). We will subsequently address these issues in the following sections.

Counterfactual construction

As shown in equation 3.1, the decomposition of a distributional statistics into the wage structure and the composition effects necessitates a meaningful counterfactual. In the standard OB framework, the mean counterfactual wage $\mu(F_{Y_0^c|T=1})$ is equal to $E[X|T = 1]\beta_0$ (equation 3.4). If the relationship between earnings and the covariates is non linear, the estimate of the mean counterfactual wage will differ from $E[X|T = 1]\beta_0$ ([Fortin et al., 2011](#)).

One solution is to use the reweighting procedure proposed by [DiNardo et al. \(1996\)](#) to construct an alternative counterfactual. The idea is to create a counterfactual using a reweighting function to make the characteristics of period 0 workers similar to those of period 1 workers. The reweighting factor is the ratio of two marginal multivariate distributions and can be estimated as follows:

$$\begin{aligned}\Psi(X) &= \frac{dF_{X_1}(X)}{dF_{X_0}(X)} = \frac{\Pr(X|T=1)}{\Pr(X|T=0)} \\ &= \frac{\Pr(T=1|X)/\Pr(T=1)}{\Pr(T=0|X)/\Pr(T=0)}, t = 0, 1\end{aligned}\quad (3.5)$$

The "reweighted-regression" decomposition, as called by [Firpo et al. \(2011\)](#), then has the following form:

$$\Delta_O^v = \underbrace{(\bar{X}_1\hat{\beta}_1^v - \bar{X}_0^C\hat{\beta}_0^{vC})}_{\Delta_S^v} + \underbrace{(\bar{X}_0^C\hat{\beta}_0^{vC} - \bar{X}_0\hat{\beta}_0^v)}_{\Delta_X^v}\quad (3.6)$$

where superscript C denote the counterfactual. The wage structure effect can be divided into a pure wage structure component and a reweighting error component which would be close to zero if the estimate of $\Psi(X)$ is consistent:

$$\underbrace{(\bar{X}_1\hat{\beta}_1^v - \bar{X}_0^C\hat{\beta}_0^{vC})}_{\Delta_S^v} = \underbrace{\bar{X}_1(\hat{\beta}_1^v - \hat{\beta}_0^{vC})}_{\Delta_{S,p}^v} + \underbrace{(\bar{X}_1 - \bar{X}_0^C)\hat{\beta}_0^{vC}}_{\Delta_{S,e}^v}\quad (3.7)$$

The composition effect can be divided into a pure composition component and a specification error component which would be close to zero if the model is linear:

$$\underbrace{(\bar{X}_0^C\hat{\beta}_0^{vC} - \bar{X}_0\hat{\beta}_0^v)}_{\Delta_X^v} = \underbrace{(\bar{X}_0^C - \bar{X}_0)\hat{\beta}_0^v}_{\Delta_{X,p}^v} + \underbrace{\bar{X}_0^C(\hat{\beta}_0^{vC} - \hat{\beta}_0^v)}_{\Delta_{X,e}^v}\quad (3.8)$$

Choice of the omitted group

At the first stage, we run a logit regression of membership status on the following vector of covariates:

$$X = \{\text{Education, RTI, Age, Gender, Public/Private, Coastal region, Industry}\}$$

and estimate the reweighting factor in Equation 3.5 to construct to counterfactual.

At the second stage, we regress the RIFs of our inequality measures on the vector of covariates of the three groups: group 0 (period 0), group 1 (period 1) and the counterfactual group C.

Finally, we decompose the changes in overall indices into total composition and total wage structure effect as in Equation 3.6, then further into detailed composition and detailed earnings structures effect as in Equation 3.8 and 3.7.

Among our covariates, only RTI and age are continuous, the others are categorical. The difference will be transferred into the intercept (unobserved characteristics). Although some methods have been proposed to make the wage structure effects of a categorical variable invariant, they are still somewhat arbitrary or make it difficult to interpret the size of the effects. Since the earnings inequality in Tunisia declines over-time, we choose to omit the most favoured category, so that any increase in its returns, which increases earnings inequality, is interpreted as the result of individual's unobserved characteristics. More precisely, we take Male, Public, Coastal region and Hotels & Restaurant as based category. In the case of education, we take the secondary level as based category according to the common practice in the literature. The descriptive statistics of the covariates are presented in Table 3.2.

3.5 Results

3.5.1 RIF regressions

Table 3.3 presents the OLS regressions of RIF of the Gini index on the covariates. The RTI level is negatively correlated with inequality. This is consistent with the logic of the routinization hypothesis and its consequent polarization: the more the RTI level reduces, the more polarized the wage distribution will be. As for education, an increase in employment share of no schooling, primary- or tertiary-educated workers all contributes to increases in the overall inequality but in the different ways: the expansion of the first two worker categories brings down the lower half of the earnings distribution, while the expansion of tertiary-educated workers' share elevates the upper half of the earnings distribution. For other factors, an increase in the employment share of private sector, female workers or workers in coastal areas are related to increases in the Gini coefficient.

Table 3.2: Descriptive statistics of covariates

	2000	2010	2017
RTI	0.52	0.55	0.50
Age	35.23	36.46	37.95
Male=0 (Female)	60	56	51
Public=0 (Private)	70.98	73.33	74.75
Coast=0 (Inland)	33.16	34.74	33.34
Education			
No schooling	11.22	6.66	6.72
Primary	38.88	33.45	33.16
Secondary	37.28	39.81	38.79
Tertiary	12.62	20.08	21.33
Industry			
Agriculture	9.92	6.21	8.36
Mining	1.05	0.74	0.64
Manufacturing	21.84	23.23	21.79
Utilities	1.03	0.78	0.8
Construction	16.55	18.69	17.08
Wholesale & Retail	7.17	7.18	9.35
Hotels & Restaurant	4.24	4.82	4.24
Transport & ICT	5.22	5.66	4.71
Finance	1.56	1.23	1.36
Real estate	1.53	2.41	3.04
Public administration	12.74	10.94	11.15
Education	10.28	10.58	9.92
Healthcare	3.46	3.80	4.22
Other services	2.31	2.61	2.08
Private households	1.02	1.05	1.19
NGOs	0.10	0.07	0.08
Observations	20,046	100,909	89,159

3.5.2 RIF decomposition

The results of the Gini's RIF decomposition are presented in Tables 3.4. Although more than half of the specification errors, which measure the importance of departures from the linearity assumption (Firpo et al., 2018), are significant, they are relatively small when compared to the total changes of the distribution. Furthermore, the reweighting errors are trivial which means that the estimate of the reweighting factor is consistent. So it can be said that the reweighting RIF decomposition model performs relatively well at estimating the composition and discrimination effects.

Table 3.3: RIF regression with Gini index

	Gini					
	2000		2010		2017	
RTI	-0.031***	(0.005)	-0.059***	(0.002)	-0.053***	(0.003)
Age	0.000	(0.000)	0.000	(0.000)	0.000**	(0.000)
Male=0	0.02***	(0.006)	0.02***	(0.002)	0.031***	(0.004)
Public=0	0.088***	(0.012)	0.025***	(0.006)	0.025***	(0.009)
Coast=0	0.051***	(0.005)	0.029***	(0.002)	0.008***	(0.002)
Education (Secondary = 0)						
No schooling	0.082***	(0.009)	0.054***	(0.003)	0.042***	(0.004)
Primary	0.047***	(0.005)	0.02***	(0.002)	0.009***	(0.002)
Tertiary	0.23***	(0.014)	0.133***	(0.004)	0.098***	(0.006)
Industry (Hotel & Restaurant = 0)						
Agriculture	0.233***	(0.011)	0.152***	(0.005)	0.093***	(0.005)
Mining	0.167***	(0.05)	0.258***	(0.022)	0.126***	(0.023)
Manufacturing	0.073***	(0.011)	0.078***	(0.005)	0.063***	(0.007)
Utilities	0.052***	(0.019)	0.13***	(0.014)	0.161***	(0.05)
Construction	0.107***	(0.011)	0.079***	(0.004)	0.027***	(0.005)
Wholesale & Retail	0.082***	(0.012)	0.048***	(0.005)	0.042***	(0.006)
Transport & ICT	0.076***	(0.013)	0.072***	(0.006)	0.062***	(0.008)
Finance	0.157***	(0.035)	0.295***	(0.025)	0.367***	(0.04)
Real estate	0.084***	(0.023)	0.041***	(0.008)	0.019*	(0.01)
Public administration	0.097***	(0.015)	0.047***	(0.007)	0.072***	(0.01)
Education	-0.008	(0.016)	-0.007	(0.009)	0.074***	(0.011)
Healthcare	0.044**	(0.018)	0.011	(0.007)	0.018*	(0.009)
Other services	0.157***	(0.028)	0.125***	(0.009)	0.114***	(0.034)
Private households	0.219***	(0.018)	0.169***	(0.007)	0.103***	(0.009)
NGOs	0.569**	(0.284)	0.083	(0.088)	0.476	(0.335)
Constant	0.134***	(0.018)	0.216***	(0.008)	0.221***	(0.01)
Observations	19,642		92,612		60,152	
F(23, 19618)	99.890		449.210		277.310	
Prob >F	0.000		0.000		0.000	
R-squared	0.119		0.138		0.175	
Root MSE	0.285		0.233		0.209	

Note: Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

In general, the total composition effect contributed to increases in Gini coefficient during the first sub-period. However, the disequalising composition effect was entirely counteracted by the equalising wage structure effect. The two effects also had contrary trend: total composition effect tended to rise while the wage structure effect tended to

fall overtime.

The composition effects were mostly induced by the change in education composition of the labor force. The increase in education attainment had a disequalising effect (positive coefficient). This is similar to the finding of [Ferreira et al. \(2021\)](#) in Brazil's labor market and again confirms [Bourguignon and Ferreira's](#) "paradox of progress" ([2005](#)) where the convexity of education premium widened the earnings gap between college graduates and the rest. During the first sub-period, the increase of the private sector's share in the labor market also positively contributed to the overall inequality, since wages were more equally paid in the public sector.

Moving to the detailed wage structure effects, we unexpectedly find that the most important factors are not skill supply but two demand-side factors: the public-private wage gap and the sector wage gap. The reduction in wage gap between public and private high-skilled workers was the largest contributor to the decline in earnings inequality over the last two decades. While the public sector initially had a more equal wage distribution, it was the "small and anemic formal private sector" ([Assaad et al., 2019](#)) who equalized the wage distribution during the first period. The Revolution reversed the disequalizing trend of the public wage policy and made it similar to the equalizing trend of the market wage. The closing wage gap halted as both sector move in the same direction.

The return-to-education decline, despite not being the most important, still contributed largely to the decrease of the Gini index. The smaller contribution of education to decreases in the Gini index after the Revolution corresponds to the smaller slope of education premium during this period.

Among the covariates, only RTI had the contrary contributions over the two sub-periods. During the 2000–2010 period, the increase in marginal returns to low-wage but average-RTI jobs enhanced the equality. Only during the transition-to-democracy period that the routinization began to impact the Tunisian earnings distribution in the same way as observed in developed countries.

The decomposition of change in the Gini index provides a big picture of the total contribution of each factor to the total change of the distribution. However, it is silent about how these factors affected the earnings distribution, for example, which factor levelled up the lower end of the distribution, which factor pulled down the

Table 3.4: RIF decomposition of changes in Gini index

	Gini					
	2000-2010		2010-2017		2000-2017	
Overall						
Final (F)	0.315***	(0.001)	0.295***	(0.001)	0.295***	(0.002)
Counterfactual (C)	0.359***	(0.003)	0.323***	(0.001)	0.37***	(0.003)
Initial (I)	0.355***	(0.003)	0.315***	(0.001)	0.355***	(0.002)
Total change (F-I)	-0.041***	(0.003)	-0.02***	(0.002)	-0.06***	(0.003)
Total composition (C-I)	0.004*	(0.002)	0.008***	(0.001)	0.014***	(0.002)
Total earnings structure (F-C)	-0.044***	(0.003)	-0.028***	(0.002)	-0.075***	(0.003)
RIF aggregate decomposition						
RIF composition	0.005***	(0.002)	0.007***	(0.001)	0.016***	(0.002)
RIF specification error	-0.002**	(0.001)	0.000***	(0.000)	-0.002**	(0.001)
RIF earnings structure	-0.044***	(0.003)	-0.028***	(0.002)	-0.076***	(0.003)
RIF reweighting errors	0.000	(0.000)	0.000	(0.000)	0.001**	(0.000)
RIF detailed decomposition						
RIF composition						
RTI	-0.002***	(0.000)	0.002***	(0.000)	-0.001	(0.000)
Age	0.000	(0.000)	0.000	(0.000)	0.000	(0.001)
Male=0	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)
Public=0	0.003***	(0.001)	0.000***	(0.000)	0.004***	(0.001)
Coast=0	0.001**	(0.000)	0.001***	(0.000)	0.002***	(0.000)
Education	0.009***	(0.001)	0.001***	(0.000)	0.009***	(0.001)
Industry	-0.006***	(0.001)	0.003***	(0.000)	0.000	(0.001)
RIF earnings structure						
RTI	-0.017***	(0.004)	0.005***	(0.002)	-0.013***	(0.003)
Age	-0.014	(0.012)	-0.018***	(0.006)	-0.024*	(0.012)
Male=0	0.004*	(0.002)	0.003**	(0.001)	0.008***	(0.003)
Public=0	-0.052***	(0.016)	-0.002	(0.008)	-0.054***	(0.015)
Coast=0	-0.004*	(0.003)	-0.008***	(0.001)	-0.014***	(0.002)
Education	-0.021***	(0.003)	-0.013***	(0.002)	-0.035***	(0.004)
Industry	-0.028**	(0.011)	-0.011*	(0.006)	-0.04***	(0.01)
Intercept	0.089***	(0.027)	0.017	(0.012)	0.096***	(0.026)

Note: Bootstrapped standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

upper end of the distribution, etc. Therefore, we also look at the impact of each factor at the percentile level. The results are shown in Figure 3.6 and Figure 3.7. The total decomposition results in Figure 3.6 are consistent to the Gini decomposition. The changes in log earnings were mostly explained by the changes in the earnings structure of the percentiles. The adverse composition effects were completely counterbalanced by the wage structure effects in both sub-periods.

In terms of composition effects, we can see that those who benefited the most from education expansion were the employees in high-paid jobs, especially during the first

sub-period. Other factors had relatively small composition effect in comparison to the effects of education.

In terms of structural effects, the reduction in wage gap between private and public sector was mostly driven by the reduction in the upper half of the distribution. Meanwhile, the structural changes reduced the overall inequality by upgrading the industrial premium of the low-skilled jobs during the first sub-period and the industrial premium of the middle-skilled jobs during the second sub-period. The downward-sloping curve of education's wage structure effects is also in line with the decline in education premium of all schooling levels comparing to the no-schooling level.

For a robustness check, we run the same decomposition with the p90/p50 and p50/p10 ranges, as well as with different data sets, including a data set with imputed earnings for missing observations and the subset of male workers. The results (presented in the Appendix) are consistent with the above results of Gini and percentile decomposition using the original data set.

Figure 3.6: RIF decomposition of total earnings change into wage structure and composition effects

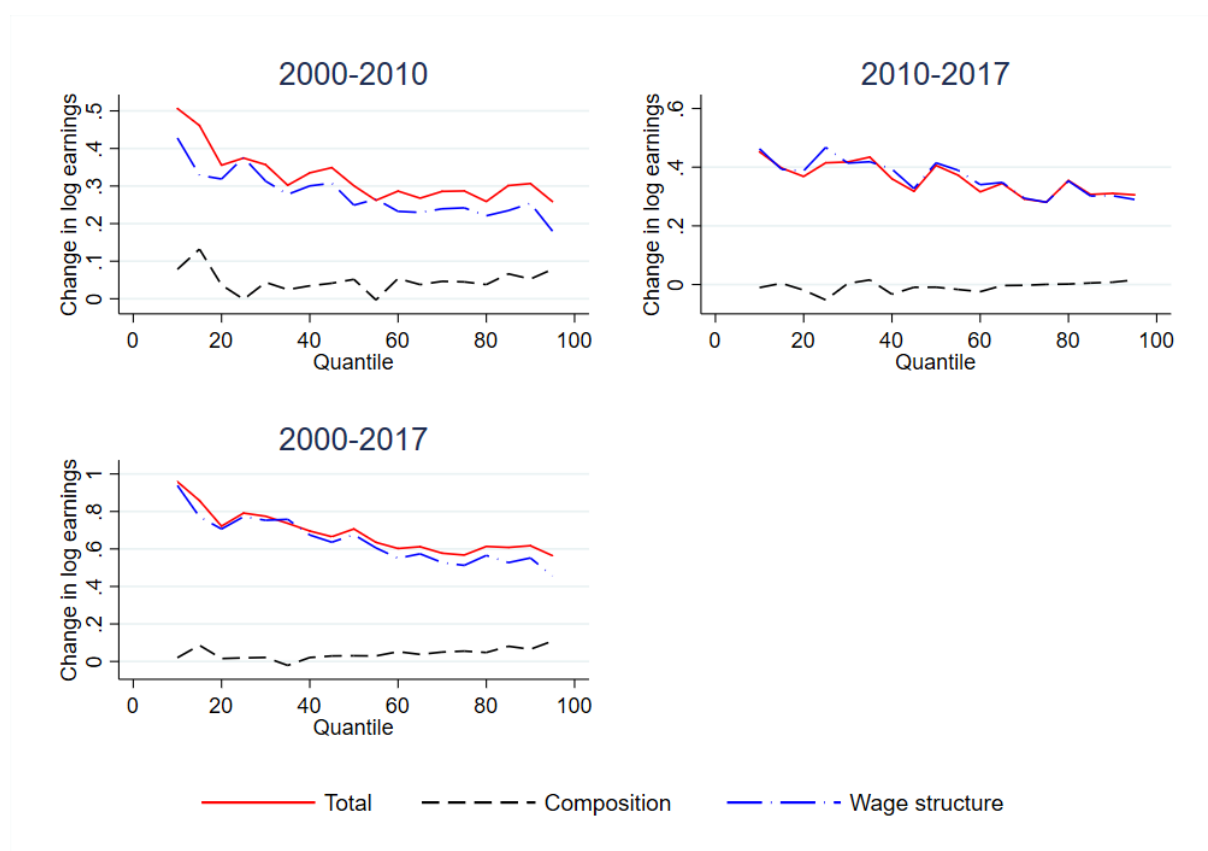
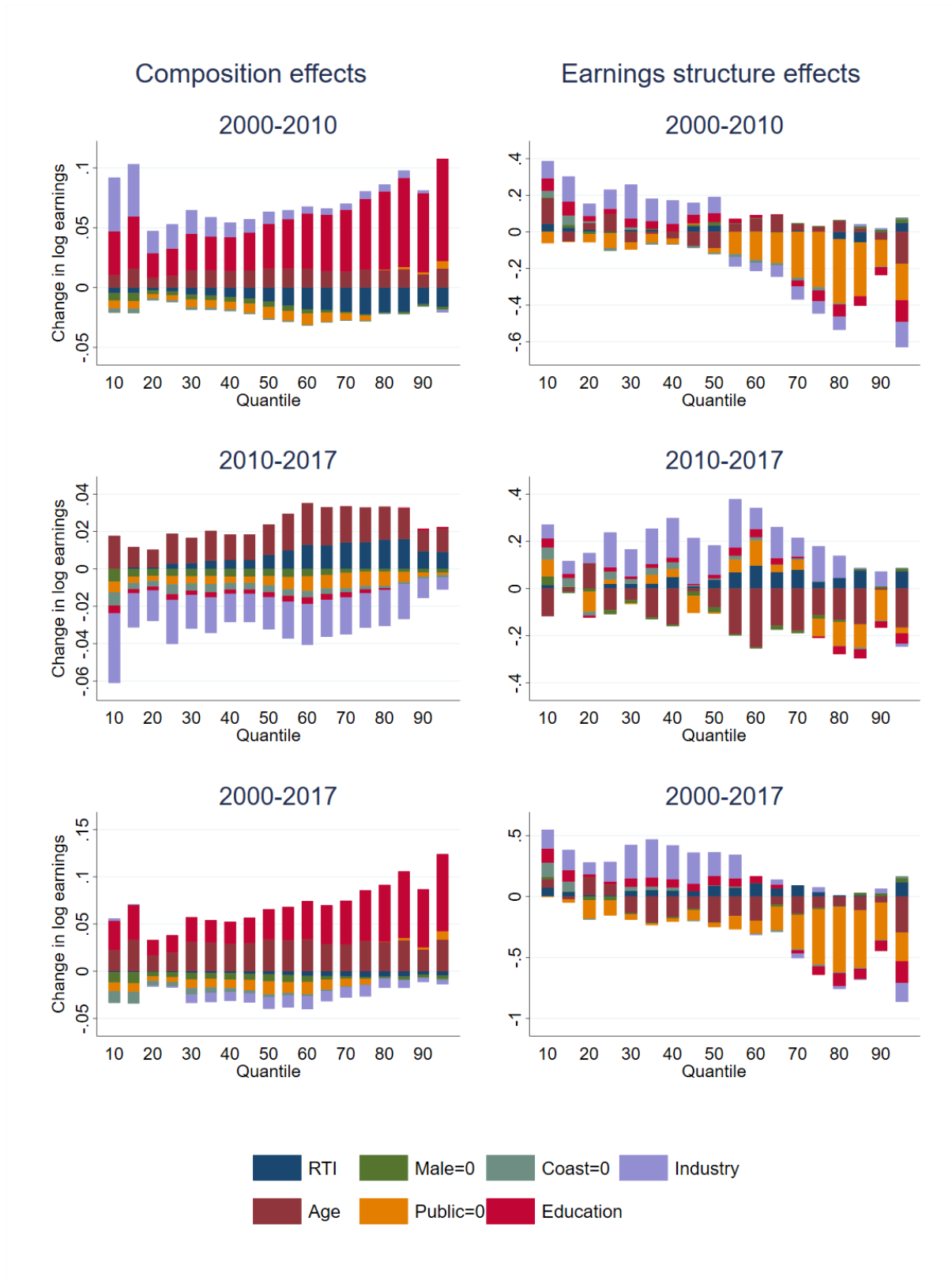


Figure 3.7: Detailed RIF decomposition of determinants of earnings changes



3.6 Conclusion

Over the last two decades, Tunisia's labor market experienced a strong decline in earnings inequality. The dynamic of earnings followed an L-shape polarization with higher earnings growth concentrated at the lower end of the distribution, a pattern that has been also observed in China. Four main factors of the inequality variations were identified: skill supply, technological changes, structural changes, and public wage and employment policies.

Similar to other MENA countries, Tunisia witnessed a downward trend of skill premia due to the excess supply of tertiary-educated job seekers. On the demand side, we find ambiguous evidence of routine-biased technical changes. On the contrary, we observed strong declining trends of sector premia and the public-private wage gap, which are congruent with the change in overall earnings inequality. The outflow of labor from agriculture and manufacturing due to service-led deindustrialization resulted in favorable earnings changes to agricultural and manufacturing jobs, especially elementary jobs in these sectors. Whereas the wage gap between private and public sectors fell sharply during the pre-Revolution period, it hardly changed after that since the public wage dynamic became similar to the private wage dynamic.

Our RIF decomposition of earnings inequality changes showed that the overall change was mostly driven by the wage structure effects. In terms of composition effects, the effect of education is dominant and disequalizing. In terms of wage structure effects, the main contributors are decreases in the public-private wage gap and sector wage gap on the demand side and the decreasing education premia on the supply side. The increase in marginal returns to low-wage but average-RTI jobs, the falling return to experience, and the decreasing regional wage gap are also found to have contributed to the decline in overall earnings inequality.

Breaking down the overall trend into pre- and post-revolution period revealing more interesting changes. The contribution of education premia and structural change to the overall inequality were still disequalizing after the Revolution, but this not the case for the public-private wage gap and RTI. The closing process of private-public wage gap halted after the Revolution as the public sector turns to the pro-poor wage policy. Meanwhile, the return to low-RTI job slightly increased more than the return to high-RTI the during the transition-to-democracy. In other word, the routinization

began to impact the Tunisian earnings distribution in the same way as observed in developed countries.

Despite our efforts to construct a meaningful counterfactual, the decomposition method employed in this chapter neither provides grounds for asserting a causal effect nor accounts for the general-equilibrium effect. However, by identifying the important determinants of earnings dynamics and examining their changes following the revolution, this chapter lays the groundwork for further rigorous analysis on the causal effect of the revolution on inequality.

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Conclusion

This thesis contributes to the long-lasting debate on the socio-economic impact of crises, especially on small businesses and workers in developing countries. In addition, it also provides evidences on how these economic agents respond to crises and how the government can act effectively to assist vulnerable actors of the economy.

The first chapter contributes to the literature on the impacts of "negative shocks" on SMEs in three ways. Firstly, it is among a small number of papers that look at these impacts at the firm level in developing countries. The uniqueness of our data set makes it possible to estimate the effects of the Covid crisis on the entire Tunisian SME population and control for time-invariant unobservable heterogeneity. Moreover, working on two years of observations allows us to study firms' behavior in the midst of crisis and recovery, whereas most papers have solely focused on the first months of the crisis. Furthermore, this paper quantifies the impact of various simultaneous shocks induced by the pandemic. From the technical point of view, we provide a comprehensive set of measures of shocks at the industry level. These measures neither limit themselves to the Tunisian context nor to the Covid context. Other measures of economic shocks can be constructed in the same manner for other countries and crises. From the practical point of view, being informed about which firms are more sensitive to certain shocks than others is important in order to enable better timing and targeting of public support. Finally, with our own survey on SMEs carried out after the first lockdown, we are able to provide evidence on the determinants of firm adaptation.

The contribution of the second chapter is twofold. First, it provides micro evidences on the effectiveness of the massive counter-cyclical subsidy in the context of a developing country. Using the Vietnam enterprise survey, this chapter demonstrates that the subsidized loans, mainly distributed through the SOCB system, increased employment and investment among firms. Notably, credit-constrained firms, particularly

young and small firms in rural areas, experienced more significant enhancements in total outlay, employment, and investment. There was no evidence of an apparent bias favoring local public firms. However, there are some indications of speculative activities emerging with the subsidy. The study highlights the spontaneity and the inclusion of government supports during the time of crises. Second, using different measures of states-owned bank local market share, the chapter confirms the role of the SOCB as an instrument to timely allocate the subsidy and compensate the spatial disparity in local financial conditions.

In the last chapter, by using the RIF decomposition and Tunisian labor force surveys, we demonstrate that the decline in earnings inequality over the last two decades was mostly driven by the wage structure effects. The main contributors are decreases in the public–private wage gap and sector wage gap on the demand side and the decreasing education premia on the supply side. The increase in marginal returns to low-wage but average-RTI jobs, the falling return to experience, and the decreasing regional wage gap are also found to have contributed to the decline in overall earnings inequality. After the Revolution, the closing process of private-public wage gap halted as the public sector turns to the pro-poor wage policy, and the routinization began to impact the Tunisian earnings distribution in the same way as observed in developed countries. By identifying the important determinants of earnings dynamics and examining their changes following the revolution, this chapter lays the groundwork for further rigorous analysis on the causal effect of the revolution on inequality.

Appendix A

Appendix Chapter 1

A.4 Descriptive statistics

Table A.1: Definition and measurement of variables

Firm-level variable	Definition and measure
<i>National firm census (RNE)</i>	
Log of sales	Unit: Thousands of Tunisian Dinar
Medium	Dummy, capturing whether a firm has a medium size (50-200 employees)
Partial exporter	Dummy, capturing whether a firm exports a part of its output, as defined by Article 21, Code d'Incitation aux Investissements.
Total exporter	Dummy, capturing whether a firm exports all its output, as defined by Article 10 and 11, Code d'Incitation aux Investissements.
Foreign	Dummy which is equal to 1 if a firm is owned by foreigner.
<i>Firm survey</i>	
Change in sales	Change in firm sales in May 2020 compared to firm sales in May 2019, measured in percent.
Medium	idem.
Partial exporter	idem.
Total exporter	idem.
Foreign	idem.
Import	Dummy, capturing whether a firm imports its input.
Experience	Continuous variable proxied by the age of the owner/manager, measured in years
Bachelor's degree	Dummy, capturing whether the owner/manager has a bachelor's degree

A.5 Results

A.5.1 Baseline results

Figure A.1: Employment trends (2016-2021)

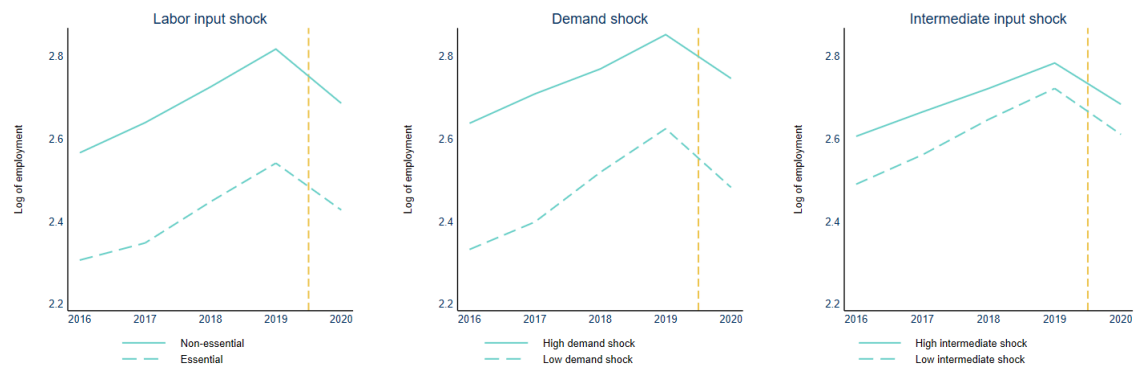


Table A.2: Effects of the shocks on SME's employment

	(1)	(2)	(3)	(4)
Labor input shock x Post	-0.034 (0.024)			-0.037 (0.026)
Demand shock x Post		0.002 (0.017)		0.002 (0.016)
Intermediate input shock x Post			0.009 (0.014)	0.009 (0.011)
Log of age	-0.110*** (0.027)	-0.111*** (0.027)	-0.111*** (0.027)	-0.110*** (0.027)
Sq. Log of age	0.035*** (0.006)	0.035*** (0.006)	0.035*** (0.006)	0.035*** (0.006)
Medium	1.475*** (0.025)	1.475*** (0.025)	1.475*** (0.025)	1.475*** (0.025)
Partial exporter	0.142*** (0.015)	0.142*** (0.015)	0.142*** (0.015)	0.142*** (0.016)
Total exporter	0.247*** (0.041)	0.247*** (0.041)	0.247*** (0.041)	0.247*** (0.041)
Foreign	0.081*** (0.019)	0.081*** (0.019)	0.081*** (0.019)	0.081*** (0.019)
Year FE	Yes	Yes	Yes	Yes
4-digit Industry FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
N	45,076	45,076	45,076	45,076
R-sq	0.614	0.614	0.614	0.614

Note: All models apply the two-way fixed-effect estimator. Standard errors are clustered at the 4-digit industry level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.5.4 Survival bias

Table A.3: Differences between missing and non-missing SMEs

	Diff. between	Diff. between	
	2019 and 2020 missing SMEs	missing and nonmissing SMEs	
	2019-2020	2019	2020
Log of sales	-0.375* (-2.50)	1.213*** (10.88)	0.843*** (8.52)
Log of employment	0.0107 (0.22)	0.102* (2.39)	0.166*** (5.09)
Log of age	-0.127* (-2.51)	0.0963* (2.51)	0.0521 (1.78)
Partial exporter	-0.0123 (-1.57)	0.111*** (7.39)	0.0929*** (7.64)
Total exporter	-0.0125 (-0.51)	-0.0347 (-1.95)	-0.0463** (-3.11)
Foreign	-0.00171 (-0.10)	-0.00604 (-0.46)	-0.00642 (-0.58)
Observations	1204	12193	12605

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A.5.5 Event study and effects of the shocks in 2021



Note: All graphs are produced by the two-way fixed-effect estimator where the interaction term is "Year dummy * Shock" and using the 2016-2021 data set.

Figure A.2: Event study: Differences in log of employment (2016-2021)

A.5.6 Heterogeneous effects of the shocks

Table A.4: Heterogenous effects of the shocks on firm sales (2016-2021)

	(1)	(2)	(3)	(4)	(5)	(6)
	Medium	Partial exporter	Total exporter	Foreign	EFD	Telework
Panel A: Labor input shock						
Shock*2021	0.005 (0.041)	-0.013 (0.043)	0.005 (0.041)	0.004 (0.041)	0.000 (0.035)	-0.004 (0.040)
Shock*Covariate*2021	-0.039 (0.080)	0.100 (0.078)	0.340 (0.314)	0.070 (0.180)	-0.007 (0.019)	-0.068 (0.043)
Observations	53472	53472	53472	53472	52660	53472
R ²	0.514	0.514	0.514	0.514	0.516	0.514
Panel B: Demand shock						
Shock*2021	-0.051 (0.035)	-0.052 (0.036)	-0.059* (0.035)	-0.053 (0.035)	-0.021 (0.034)	-0.055 (0.035)
Shock*Covariate*2021	-0.031 (0.049)	0.059 (0.043)	0.139** (0.063)	0.034 (0.050)	-0.017 (0.036)	-0.012 (0.034)
Observations	53472	53472	53472	53472	52660	53472
R ²	0.514	0.515	0.514	0.515	0.516	0.514
Panel C: Intermediate input shock						
Shock*2021	-0.032* (0.017)	-0.025 (0.018)	-0.046** (0.021)	-0.038** (0.018)	-0.038** (0.016)	-0.035** (0.017)
Shock*Covariate*2021	-0.011 (0.027)	-0.020 (0.028)	0.035 (0.025)	0.023 (0.030)	0.002 (0.007)	0.002 (0.014)
Observations	53472	53472	53472	53472	52660	53472
R ²	0.514	0.514	0.514	0.515	0.516	0.514

Note: All models apply the two-way fixed-effect estimator and control for year fixed-effects, 4-digit industry fixed-effects, district fixed-effects and firm covariates. Standard errors are clustered at the 4-digit industry level.

Table A.5: Heterogenous effects of the shocks on firm employment (2016-2020)

	(1)	(2)	(3)	(4)	(5)	(6)
	Medium	Partial exporter	Total exporter	Foreign	EFD	Telework
Panel A: Labor input shock						
Shock*Post	-0.046* (0.027)	-0.052* (0.028)	-0.051* (0.029)	-0.045 (0.028)	-0.027* (0.015)	-0.033 (0.023)
Shock*Covariate*Post	0.027 (0.031)	0.112** (0.049)	0.150*** (0.054)	0.268*** (0.095)	-0.063*** (0.022)	0.028 (0.031)
Observations	45076	45076	45076	45076	44391	45076
R ²	0.615	0.614	0.614	0.614	0.615	0.614
Panel B: Demand shock						
Shock*Post	0.006 (0.013)	-0.003 (0.016)	-0.005 (0.014)	0.000 (0.015)	0.006 (0.018)	0.002 (0.014)
Shock*Covariate*Post	-0.067** (0.026)	0.055* (0.033)	0.141*** (0.033)	0.086 (0.053)	-0.004 (0.037)	-0.004 (0.021)
Observations	45076	45076	45076	45076	44391	45076
R ²	0.614	0.614	0.614	0.614	0.615	0.614
Panel C: Intermediate input shock						
Shock*Post	0.012 (0.012)	0.007 (0.013)	0.008 (0.015)	0.012 (0.014)	0.003 (0.008)	0.013 (0.013)
Shock*Covariate*Post	-0.016 (0.023)	0.035* (0.019)	0.002 (0.019)	-0.008 (0.019)	0.005 (0.007)	0.009 (0.010)
Observations	45076	45076	45076	45076	44391	45076
R ²	0.614	0.614	0.615	0.614	0.615	0.614

Note: All models apply the two-way fixed-effect estimator and control for year fixed-effects, 4-digit industry fixed-effects, district fixed-effects and firm covariates. Standard errors are clustered at the 4-digit industry level.

Table A.6: Heterogenous effects of the shocks on firm employment (2016-2021)

	(1)	(2)	(3)	(4)	(5)	(6)
	Medium	Partial exporter	Total exporter	Foreign	EFD	Telework
Panel A: Labor input shock						
Shock*2021	-0.003 (0.019)	-0.005 (0.019)	-0.008 (0.018)	-0.005 (0.018)	0.000 (0.016)	-0.003 (0.018)
Shock*Covariate*2021	-0.010 (0.025)	0.007 (0.044)	0.197** (0.091)	0.111 (0.117)	-0.013 (0.012)	-0.000 (0.019)
Observations	53472	53472	53472	53472	52660	53472
R ²	0.611	0.611	0.611	0.611	0.612	0.611
Panel B: Demand shock						
Shock*2021	-0.013 (0.009)	-0.014 (0.011)	-0.014 (0.010)	-0.012 (0.011)	-0.009 (0.012)	-0.011 (0.011)
Shock*Covariate*2021	-0.010 (0.029)	0.036 (0.024)	0.036 (0.032)	-0.008 (0.041)	-0.012 (0.016)	-0.011 (0.010)
Observations	53472	53472	53472	53472	52660	53472
R ²	0.611	0.611	0.612	0.611	0.612	0.611
Panel C: Intermediate input shock						
Shock*2021	0.008 (0.009)	0.012 (0.009)	0.009 (0.009)	0.009 (0.008)	0.006 (0.008)	0.011 (0.008)
Shock*Covariate*2021	0.001 (0.012)	-0.008 (0.019)	-0.000 (0.014)	-0.001 (0.020)	-0.002 (0.003)	-0.008 (0.007)
Observations	53472	53472	53472	53472	52660	53472
R ²	0.611	0.611	0.612	0.611	0.612	0.611

Note: All models apply the two-way fixed-effect estimator and control for year fixed-effects, 4-digit industry fixed-effects, district fixed-effects and firm covariates. Standard errors are clustered at the 4-digit industry level.

Appendix B

Appendix Chapter 3

B.3 Inequality in Tunisia over the period 2000-2017

B.3.1 General trends

Figure A.1: Adaptive kernel densities

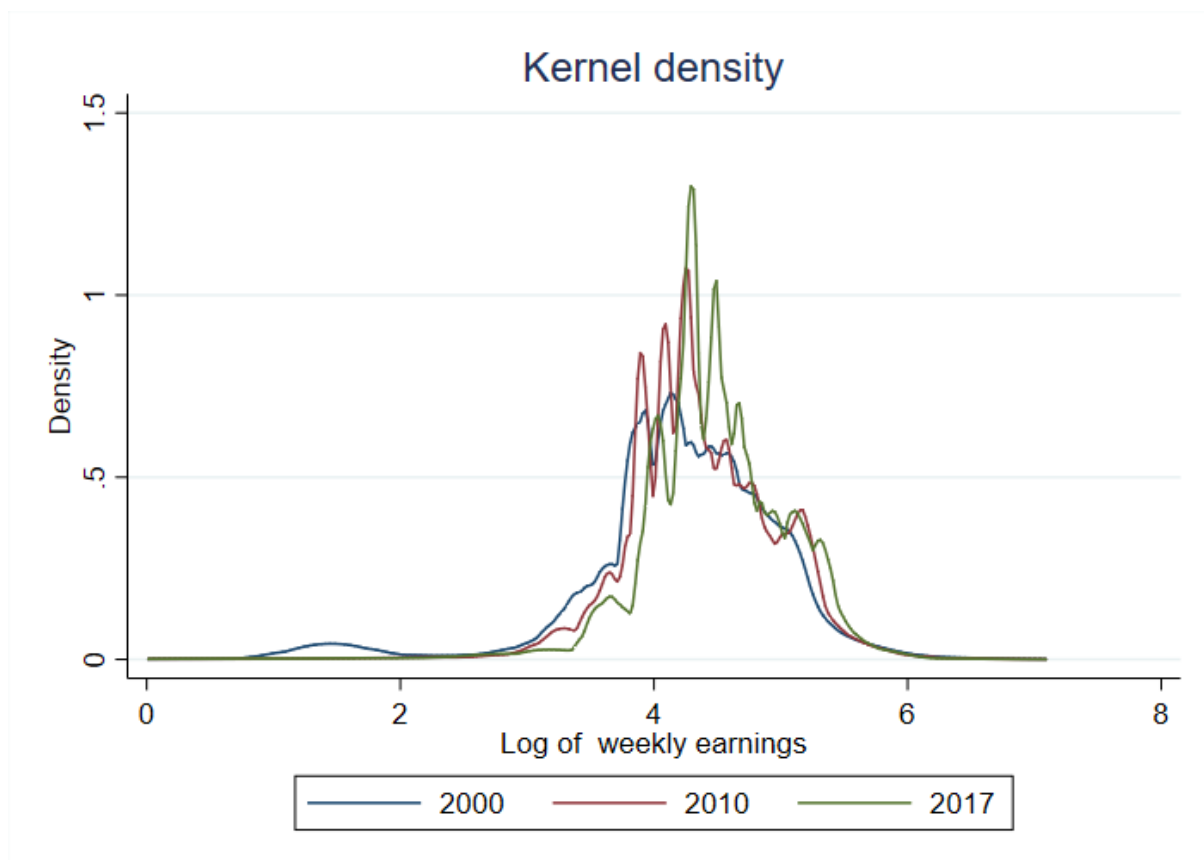


Figure A.2: Employment share by occupational group

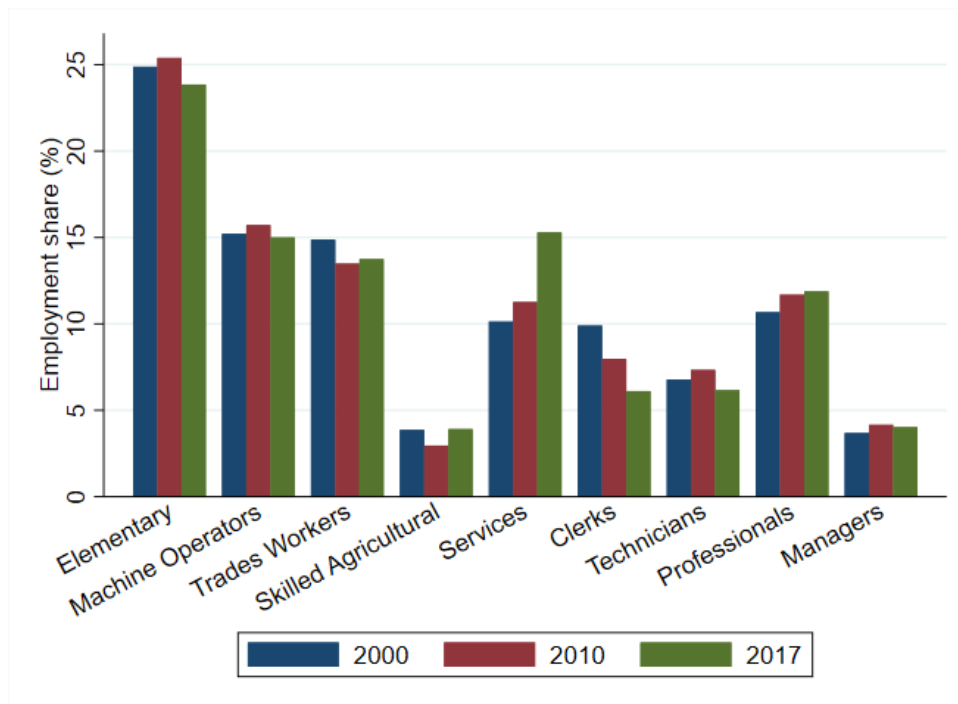


Figure A.3: Change in employment share by occupational group

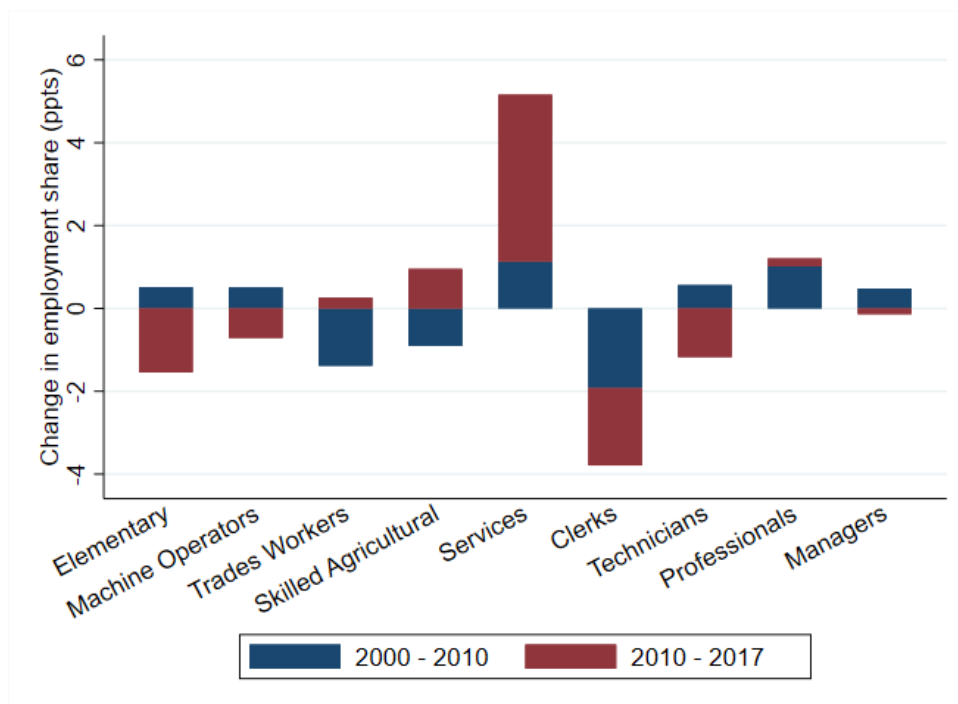
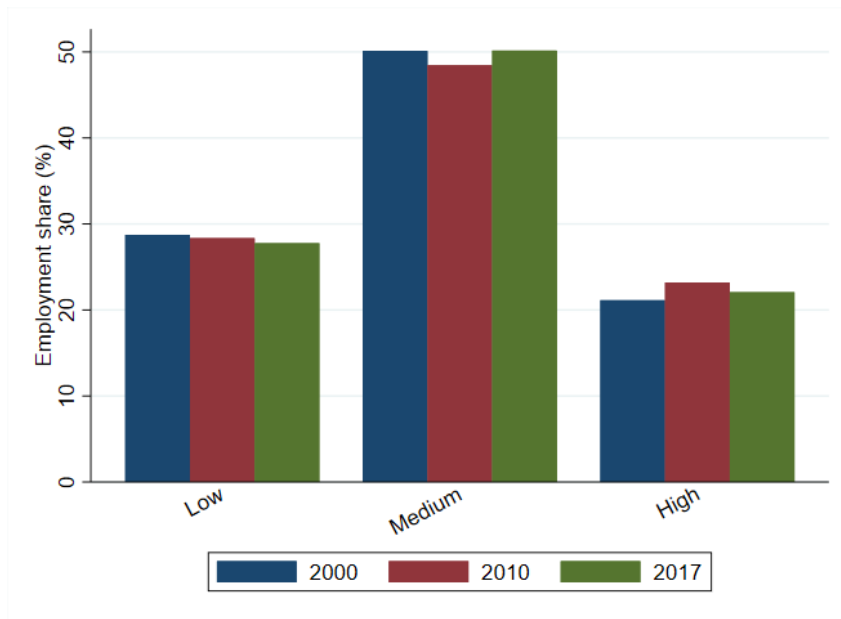


Table A.1: Employment shares by 3-digit occupational categories for ISCO-88 categories 3, 4 and 5 (per cent)

Occupation	2000	2010	2017
311 Physical and engineering science technicians	1.22	1.09	0.78
312 Computer associate professionals	0.10	0.25	0.14
313 Optical and electronic equipment operators	0.25	0.18	0.18
314 Ship and aircraft controllers and technicians	0.18	0.04	0.02
315 Safety and quality inspectors	0.14	0.19	0.57
321 Life science technicians and related associate professional	0.31	0.14	0.22
322 Health associate professionals (except nursing)	0.30	0.55	0.42
323 Nursing and midwifery associate professionals	1.56	1.32	1.09
333 Special education teaching associate professionals		0.05	0.06
334 Other teaching associate professionals	0.55	0.86	0.22
341 Finance and sales associate professionals	0.35	0.33	0.44
342 Business services agents and trade brokers	0.25	0.10	0.10
343 Administrative associate professionals	0.77	1.26	0.80
344 Customs, tax and related government associate professionals	0.25	0.10	0.07
346 Social work associate professionals	0.16	0.06	0.03
347 Artistic, entertainment and sports associate professionals	0.30	0.36	0.22
411 Secretaries and keyboard-operating clerks	4.89	3.24	1.90
412 Numerical clerks	1.17	0.50	0.17
413 Material-recording and transport clerks	1.68	1.62	0.76
414 Library, mail and related clerk	0.58	0.26	0.28
419 Other office clerks	0.16	0.10	0.69
421 Cashiers, tellers and related clerks	0.57	0.70	0.45
422 Client information clerks	0.76	1.09	1.13
511 Travel attendants and related workers	0.25	0.23	0.15
512 Housekeeping and restaurant services workers	2.62	3.20	3.18
513 Personal care and related workers	0.22	0.36	0.22
514 Other personal services workers	0.60	0.70	0.56
516 Protective services workers	3.64	3.34	6.19
522 Shop salespersons and demonstrators	2.31	2.84	3.75
523 Stall and market salespersons	0.46	0.23	0.30

Source: authors' calculation based on ENPE data.

Figure A.4: Employment share by skill level



B.3.2 Underlying factors of the inequality trend

Figure A.5: Supply and employment of college graduates, 2000-2017

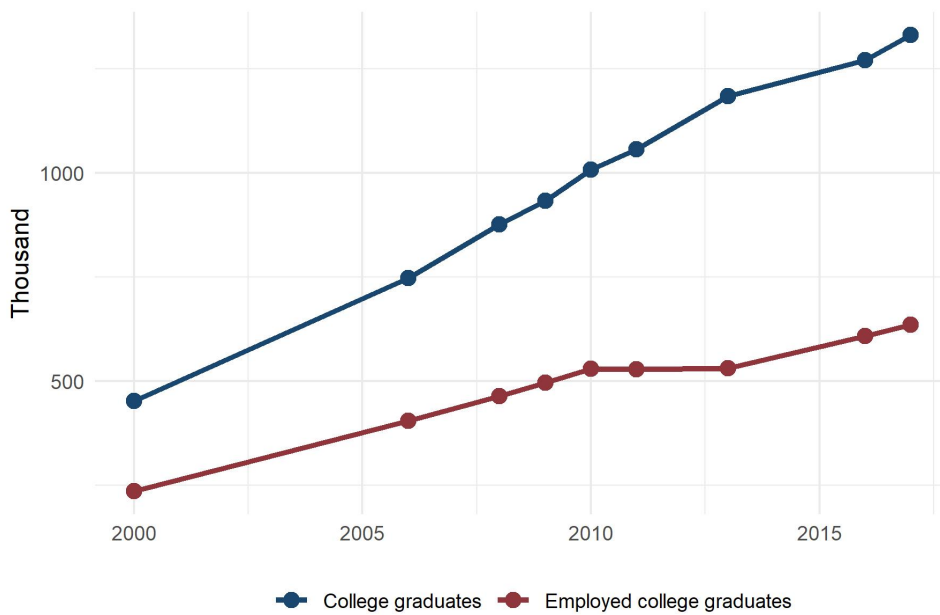


Figure A.6: Change in the education premium on log earnings by gender

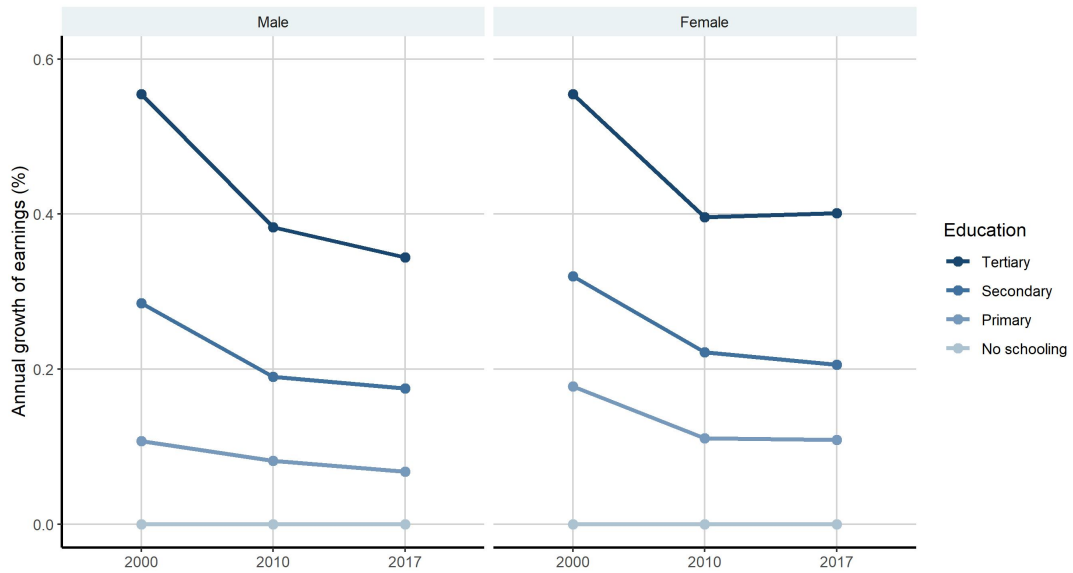


Figure A.7: Employment distribution by sector 2000-2017

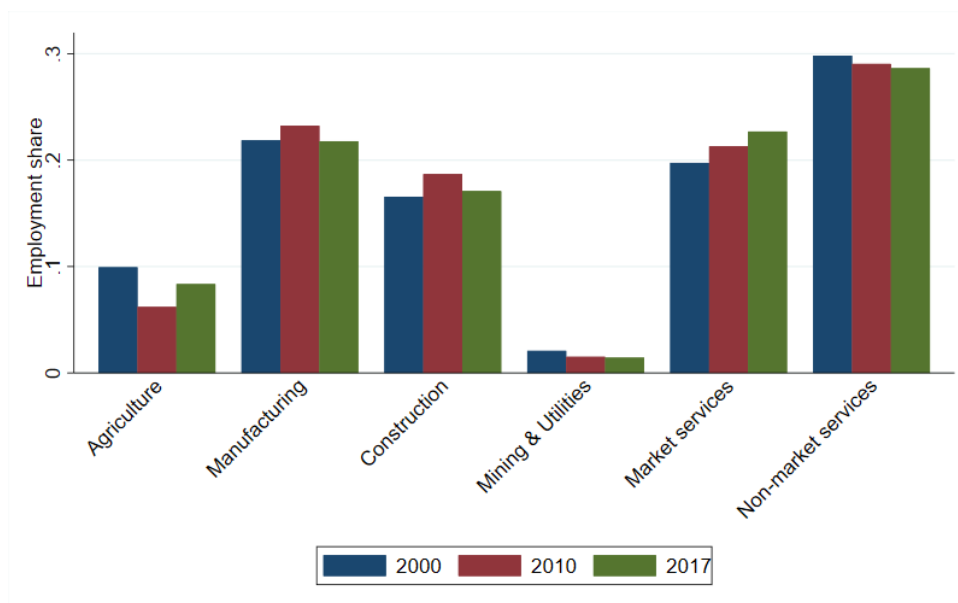
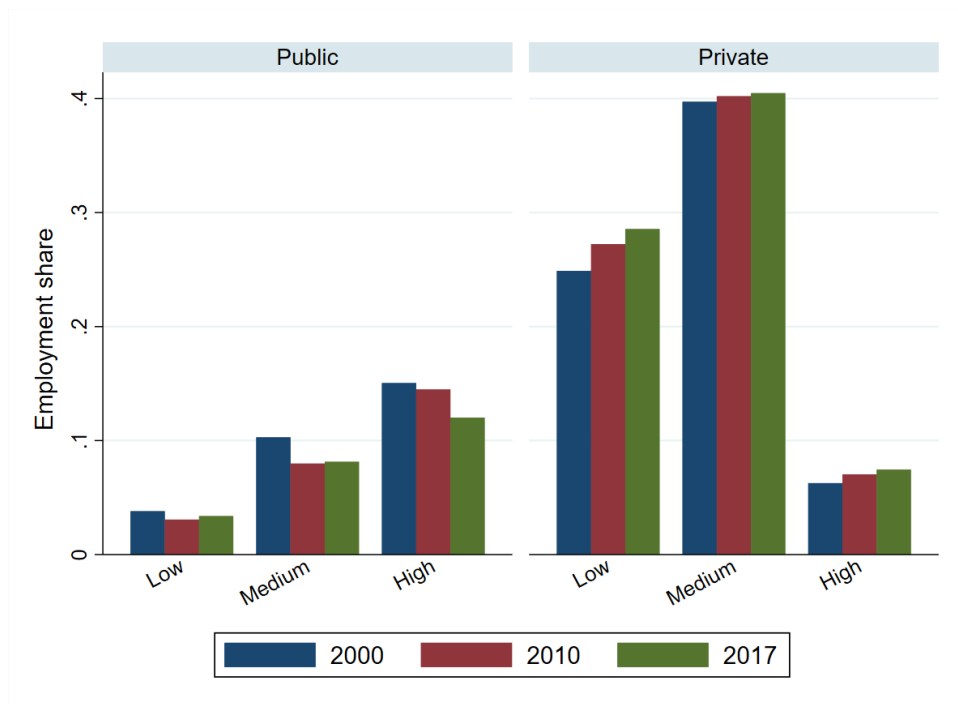


Figure A.8: Employment shares in public and private sector by skill levels



B.5 Results

B.5.1 RIF regressions

Table A.2: RIF regression with p50/p10 ratio

	p50/p10					
	2000		2010		2017	
RTI	-0.12***	(0.016)	-0.197***	(0.006)	-0.149***	(0.005)
Age	0.005***	(0.001)	-0.001***	(0.000)	0.002***	(0.000)
Male=0	0.072***	(0.027)	0.104***	(0.009)	-0.023**	(0.009)
Public=0	-0.086*	(0.046)	0.049**	(0.019)	-0.086***	(0.016)
Coast=0	0.257***	(0.025)	0.129***	(0.007)	-0.043***	(0.007)
Education (Secondary=0)						
No schooling	0.085	(0.054)	0.18***	(0.019)	0.037**	(0.018)
Primary	-0.028	(0.028)	0.044***	(0.01)	-0.063***	(0.009)
Tertiary	0.048***	(0.019)	-0.049***	(0.009)	0.078***	(0.01)
Industry (Hotel & Restaurant=0)						
Agriculture	0.701***	(0.073)	0.765***	(0.027)	0.234***	(0.023)
Mining	0.145*	(0.076)	0.336***	(0.032)	0.44***	(0.031)
Manufacturing	-0.062	(0.05)	0.037**	(0.018)	0.169***	(0.02)
Utilities	0.125*	(0.073)	0.356***	(0.031)	0.467***	(0.028)
Construction	-0.202***	(0.056)	0.047***	(0.018)	0.273***	(0.02)
Wholesale & Retail	-0.001	(0.061)	0.159***	(0.022)	0.165***	(0.023)
Transport & ICT	0.239***	(0.061)	0.309***	(0.019)	0.283***	(0.023)
Finance	0.219***	(0.055)	0.292***	(0.024)	0.309***	(0.034)
Real estate	-0.231***	(0.077)	0.094***	(0.03)	0.219***	(0.028)
Public administration	0.182***	(0.065)	0.437***	(0.026)	0.27***	(0.024)
Education	-0.005	(0.065)	0.148***	(0.026)	0.137***	(0.025)
Healthcare	0.08	(0.071)	0.268***	(0.029)	0.224***	(0.03)
Other services	0.3***	(0.108)	0.493***	(0.036)	0.218***	(0.033)
Private households	0.556***	(0.197)	0.517***	(0.058)	0.08	(0.052)
NGOs	0.178	(0.163)	0.238**	(0.094)	0.069	(0.103)
Constant	0.577***	(0.078)	0.422***	(0.029)	0.437***	(0.028)
Number of obs	19,642		92,612		60,152	
F(23, 19618)	62.430		494.350		301.170	
Prob >F	0.000		0.000		0.000	
R-squared	0.066		0.102		0.092	
Root MSE	1.407		0.993		0.671	

Note: Bootstrapped standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

B.5.2 RIF decomposition

Table A.3: RIF regression with p90/p50 ratio

	p90/p50					
	2000		2010		2017	
RTI	-0.054***	(0.016)	-0.053***	(0.006)	-0.136***	(0.008)
Age	-0.003***	(0.001)	-0.004***	(0.000)	-0.001**	(0.000)
Male=0	0.1***	(0.021)	0.071***	(0.008)	0.161***	(0.012)
Public=0	0.316***	(0.042)	0.146***	(0.017)	-0.006	(0.026)
Coast=0	0.08***	(0.015)	0.097***	(0.006)	0.067***	(0.008)
Education (Secondary=0)						
No schooling	0.356***	(0.024)	0.213***	(0.009)	0.113***	(0.014)
Primary	0.256***	(0.017)	0.111***	(0.006)	0.055***	(0.009)
Tertiary	0.979***	(0.043)	0.463***	(0.014)	0.415***	(0.02)
Industry (Hotel & Restaurant=0)						
Agriculture	0.676***	(0.036)	0.365***	(0.013)	0.252***	(0.019)
Mining	0.274***	(0.092)	0.608***	(0.049)	0.128*	(0.075)
Manufacturing	0.323***	(0.041)	0.194***	(0.015)	0.174***	(0.022)
Utilities	0.197**	(0.092)	0.222***	(0.048)	0.108	(0.081)
Construction	0.522***	(0.04)	0.136***	(0.015)	0.017	(0.02)
Wholesale & Retail	0.332***	(0.043)	0.119***	(0.015)	0.058***	(0.022)
Transport & ICT	0.197***	(0.051)	0.011	(0.02)	0.068**	(0.032)
Finance	0.479***	(0.104)	0.679***	(0.049)	0.702***	(0.093)
Real estate	0.434***	(0.079)	0.083***	(0.025)	-0.074*	(0.042)
Public administration	0.24***	(0.055)	-0.025	(0.022)	-0.022	(0.032)
Education	0.205***	(0.063)	0.314***	(0.025)	0.499***	(0.037)
Healthcare	0.024	(0.064)	-0.154***	(0.023)	-0.25***	(0.034)
Other services	0.406***	(0.066)	0.28***	(0.02)	0.098**	(0.044)
Private households	0.614***	(0.053)	0.38***	(0.018)	0.342***	(0.028)
NGOs	1.169**	(0.466)	-0.095	(0.183)	0.563*	(0.336)
Constant	0.085	(0.06)	0.533***	(0.023)	0.539***	(0.034)
Number of obs	19,642		92,612		60,152	
F(23, 19618)	150.510		389.100		224.660	
Prob >F	0.000		0.000		0.000	
R-squared	0.150		0.104		0.160	
Root MSE	0.907		0.780		0.857	

Note: Bootstrapped standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.4: RIF decomposition of changes in the p50/p10 and p90/p50 ratios

	p50/p10				p90/p50			
	2000-2010		2010-2017		2000-2010		2010-2017	
Overall								
Final (F)	0.589***	(0.003)	0.542***	(0.003)	0.825***	(0.005)	0.73***	(0.009)
Counterfactual (C)	0.768***	(0.015)	0.589***	(0.004)	0.82***	(0.01)	0.842***	(0.005)
Initial (I)	0.794***	(0.018)	0.589***	(0.009)	0.82***	(0.009)	0.825***	(0.005)
Total change (F-I)	-0.205***	(0.018)	-0.046***	(0.009)	0.005	(0.011)	-0.095***	(0.01)
Total composition (C-I)	-0.026	(0.016)	0.000	(0.009)	0.001	(0.012)	0.017***	(0.004)
Total earnings structure (F-C)	-0.179***	(0.016)	-0.047***	(0.005)	0.005	(0.012)	-0.112***	(0.009)
RIF aggregate decomposition								
RIF composition	-0.034***	(0.006)	0.035***	(0.003)	0.034***	(0.006)	0.014***	(0.002)
RIF specification error	0.008	(0.014)	-0.035***	(0.011)	-0.033***	(0.012)	0.003	(0.004)
RIF earnings structure	-0.174***	(0.016)	-0.046***	(0.005)	0.003	(0.012)	-0.114***	(0.009)
RIF reweighting errors	-0.005***	(0.001)	-0.001***	(0.000)	0.002**	(0.001)	0.002***	(0.000)
RIF detailed decomposition								
RIF composition								
RTI	-0.007***	(0.002)	0.008***	(0.001)	-0.003**	(0.001)	0.002***	(0.000)
Age	0.005***	(0.002)	-0.001**	(0.001)	-0.004***	(0.001)	-0.005***	(0.001)
Male=0	0.002**	(0.001)	0.003***	(0.001)	0.003***	(0.001)	0.002***	(0.000)
Public=0	-0.003	(0.002)	0.001*	(0.000)	0.011***	(0.002)	0.003***	(0.000)
Coast=0	0.003**	(0.001)	0.003***	(0.001)	0.001**	(0.000)	0.003***	(0.000)
Education	0.001	(0.004)	0.002***	(0.000)	0.034***	(0.005)	0.004***	(0.001)
Industry	-0.035***	(0.003)	0.02***	(0.003)	-0.008***	(0.003)	0.007***	(0.001)
RIF earnings structure								
RTI	-0.017	(0.013)	0.022***	(0.006)	-0.023*	(0.013)	-0.034***	(0.008)
Age	-0.209***	(0.061)	0.05**	(0.02)	0.006	(0.037)	0.073***	(0.021)
Male=0	0.012	(0.009)	-0.062***	(0.004)	-0.002	(0.007)	0.031***	(0.004)
Public=0	0.032	(0.041)	-0.084***	(0.022)	-0.116**	(0.049)	-0.126***	(0.025)
Coast=0	-0.043***	(0.01)	-0.047***	(0.004)	0.007	(0.007)	-0.01**	(0.004)
Education	-0.02	(0.018)	-0.024***	(0.006)	-0.097***	(0.013)	-0.044***	(0.008)
Industry	-0.006	(0.053)	0.06**	(0.025)	-0.089*	(0.046)	-0.063***	(0.023)
Intercept	0.077	(0.091)	0.04	(0.042)	0.316***	(0.091)	0.06	(0.039)

Note: Bootstrapped standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.5: RIF decomposition of changes in Gini index - Male employees

	Gini					
	2000-2010		2010-2017		2000-2017	
Overall						
Final (F)	0.306***	(0.001)	0.275***	(0.002)	0.275***	(0.002)
Counterfactual (C)	0.356***	(0.004)	0.311***	(0.001)	0.366***	(0.004)
Initial (I)	0.356***	(0.003)	0.306***	(0.001)	0.356***	(0.003)
Total change (F-I)	-0.051***	(0.003)	-0.031***	(0.002)	-0.082***	(0.003)
Total composition (C-I)	0.000	(0.003)	0.005***	(0.001)	0.009***	(0.003)
Total earnings structure (F-C)	-0.051***	(0.004)	-0.036***	(0.002)	-0.091***	(0.004)
RIF aggregate decomposition						
RIF composition	0.000	(0.002)	0.005***	(0.001)	0.009***	(0.002)
RIF specification error	0.000	(0.001)	0.000	(0.000)	0.000	(0.001)
RIF earnings structure	-0.051***	(0.003)	-0.036***	(0.002)	-0.092***	(0.004)
RIF reweighting errors	0.000	(0.000)	0.000	(0.000)	0.001**	(0.000)
RIF detailed decomposition						
RIF composition						
RTI	-0.004***	(0.001)	0.003***	(0.000)	-0.002***	(0.001)
Age	0.001*	(0.000)	0.000	(0.000)	0.001	(0.001)
Public=0	0.003***	(0.001)	0.000**	(0.000)	0.005***	(0.001)
Coast=0	0.000	(0.000)	0.001***	(0.000)	0.002***	(0.000)
Education	0.007***	(0.001)	-0.002***	(0.000)	0.003**	(0.001)
Industry	-0.007***	(0.001)	0.003***	(0.000)	0.000	(0.001)
RIF earnings structure						
RTI	-0.023***	(0.006)	0.008***	(0.002)	-0.015***	(0.004)
Age	-0.023	(0.017)	-0.019**	(0.008)	-0.034**	(0.016)
Public=0	-0.066***	(0.022)	0.012	(0.011)	-0.053***	(0.02)
Coast=0	-0.004	(0.002)	-0.01***	(0.001)	-0.015***	(0.003)
Education	-0.02***	(0.004)	-0.012***	(0.003)	-0.033***	(0.005)
Industry	-0.028**	(0.011)	-0.007	(0.008)	-0.034***	(0.012)
Intercept	0.112***	(0.039)	-0.008	(0.015)	0.093***	(0.032)

Note: Bootstrapped standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.6: RIF decomposition of changes in Gini index - Imputed data

	Gini					
	2000-2010		2010-2017		2000-2017	
Overall						
Final (F)	0.324***	(0.001)	0.319***	(0.001)	0.319***	(0.001)
Counterfactual (C)	0.362***	(0.003)	0.33***	(0.001)	0.369***	(0.004)
Initial (I)	0.358***	(0.002)	0.324***	(0.001)	0.358***	(0.002)
Total change (F-I)	-0.035***	(0.002)	-0.005***	(0.002)	-0.04***	(0.003)
Total composition (C-I)	0.004*	(0.002)	0.007***	(0.001)	0.011***	(0.002)
Total earnings structure (F-C)	-0.039***	(0.003)	-0.012***	(0.002)	-0.051***	(0.004)
RIF aggregate decomposition						
RIF composition	0.007***	(0.002)	0.006***	(0.001)	0.014***	(0.002)
RIF specification error	-0.003***	(0.001)	0.000**	(0.000)	-0.003***	(0.001)
RIF earnings structure	-0.038***	(0.003)	-0.012***	(0.002)	-0.052***	(0.004)
RIF reweighting errors	0.000	(0.000)	0.000	(0.000)	0.001***	(0.000)
RIF detailed decomposition						
RIF composition						
RTI	-0.001*	(0.000)	0.003***	(0.000)	0.002***	(0.000)
Age	0.000	(0.000)	0.000	(0.000)	0.001	(0.001)
Male=0	0.000***	(0.000)	0.000***	(0.000)	0.001***	(0.000)
Public=0	0.002***	(0.000)	0.000	(0.000)	0.002***	(0.001)
Coast=0	0.001***	(0.000)	0.000***	(0.000)	0.000	(0.000)
Education	0.01***	(0.002)	0.001***	(0.000)	0.011***	(0.001)
Industry	-0.006***	(0.001)	0.002***	(0.000)	-0.002***	(0.001)
RIF earnings structure						
RTI	-0.015***	(0.004)	0.008***	(0.001)	-0.007**	(0.003)
Age	-0.009	(0.014)	-0.005	(0.006)	-0.007	(0.015)
Male=0	0.003	(0.002)	0.000	(0.001)	0.005*	(0.002)
Public=0	-0.065***	(0.013)	-0.013*	(0.007)	-0.077***	(0.014)
Coast=0	-0.005**	(0.002)	-0.009***	(0.001)	-0.014***	(0.002)
Education	-0.02***	(0.003)	-0.019***	(0.002)	-0.039***	(0.004)
Industry	-0.034***	(0.012)	-0.026***	(0.006)	-0.059***	(0.01)
Intercept	0.106***	(0.028)	0.053***	(0.013)	0.147***	(0.026)

Note: Bootstrapped standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$