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Escola de Economia e Gestão

Hélder Alberto Silva Costa

Labour market institutions and productivity

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Hélder Alberto Silva Costa

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Professor Miguel Portela
Professor Fernando Alexandre

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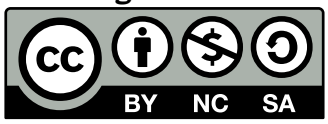
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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

I further declare that I have fully acknowledged the Code of Ethical Conduct of the Universidade do Minho.

Resumo

Instituições de mercado de trabalho e produtividade

Esta tese estuda vários aspetos da Economia Portuguesa, com a exceção de um capítulo onde a análise é alargada a mais do que um país. Concretamente, esta tese estuda o salário mínimo, desigualdade, produtividade, qualidade do emprego e colaborações entre Universidade-Indústria. No primeiro capítulo, fazemos uma avaliação econométrica do impacto da política nacional de salário mínimo no emprego e lucros das empresas. Os resultados sugerem que os aumentos do salário mínimo reduziram o crescimento do emprego e os lucros das empresas, em particular, para empresas numa situação financeira mais vulnerável. Para além disso, os aumentos do salário mínimo aceleram a saída de empresas da economia, novamente com um efeito mais acentuado para as empresas numa situação financeira mais vulnerável. De acordo com estes resultados, as políticas de salário mínimo podem ter tido um efeito no lado da oferta através do aumento da saída de empresas com baixa rentabilidade e produtividade, e dessa forma, contribuindo para um aumento da produtividade agregada. O segundo capítulo usa heterogeneidade regional da incidência de salário mínimo nas ocupações, mostrando que as políticas de salário mínimo diminuíram significativamente a desigualdade no par região/ocupação, particularmente em pares de regiões/ocupações mais expostos ao salário mínimo. Para além disso, este efeito é mais pronunciado quanto menor a diferença entre o salário mínimo e o mediano. Finalmente, encontramos diferenças de efeitos do salário mínimo na desigualdade entre regiões, havendo um efeito maior nas regiões de menor rendimento. No terceiro capítulo, é avaliado o papel das circunstâncias económicas na alocação eficiente dos recursos e crescimento da produtividade. Concluímos que o impacto da entrada e saída de empresas é mediado pelo nível de concentração do mercado, pela flexibilidade do mercado de trabalho e pela alocação eficiente do crédito. Os resultados mostram que o impacto da entrada de novas empresas na alocação dos recursos depende do nível da flexibilidade do mercado de trabalho, da concentração do mercado e da incidência de empresas numa situação financeira vulnerável. O impacto da entrada e saída de empresas na produtividade é também mediado por estas três medidas de circunstância económica. O quarto capítulo analisa a qualidade e inclusividade do emprego em empresas novas. A qualidade do emprego é mensurada em termos de salários, com uma análise adicional na segurança do emprego. A inclusividade é avaliada através da qualidade do emprego nos grupos desfavorecidos no mercado de trabalho, a saber mulheres e estrangeiros. Os resultados mostram que a qualidade do emprego em empresas novas é similar ao das empresas mais antigas. As diferenças médias de salários observadas são

quase totalmente explicadas pelas características dos trabalhadores e pela composição sectorial. Contudo, existem diferenças a nível de inclusividade. A diferença salarial entre homens e mulheres é mais baixa em empresas novas, enquanto o resultado contrário é encontrado para trabalhadores estrangeiros. Em termos da segurança no emprego, empresas novas tendem a oferecer empregos mais seguros. No quinto capítulo, avaliamos o papel das unidades de interface no fomento de relações de I&D conjuntas entre universidades e a indústria. Para o efeito, efetuamos a análise das características das empresas que têm uma interação com as universidades através de unidades de interface, em comparação com empresas que interagem diretamente com as universidades. Os resultados mostram que empresas que interagem através de unidades de interface são mais pequenas, têm menos conhecimento e estão mais próximas geograficamente da universidade. Barreiras culturais e organizacionais são mais significativas entre as empresas que interagem diretamente com universidades, enquanto barreiras de conhecimento de relacionadas com custos são mais relevantes para empresas que interagem através de unidades de interface. A proximidade geográfica tem um papel importante nas ligações entre universidade e indústria, mostrando a importância da existência de universidades de média dimensão para o crescimento regional em zonas tecnologicamente menos avançadas.

Palavras-chave: salário mínimo, produtividade, desigualdade, novas empresas, colaborações Universidade-Indústria

Abstract

Labour market institutions and productivity

This thesis studies several dimensions of the Portuguese labour market and institutions, with one of the essays expanding to a multi-country analysis. Specifically, this thesis is focused on minimum wage policies, inequality, productivity, job quality and University–Industry collaborations. In the first chapter, we provide an econometric evaluation of the impact of minimum wage policies on employment and profitability. Our estimates suggest that minimum wage increases may reduce employment growth and profitability, in particular for financially distressed firms. We also conclude that minimum wage increases may have a positive impact on firms' exit, again amplified for financially distressed firms. According to these results, minimum wage policies may have a supply side effect by accelerating the exit of low profitability and low productivity firms and, thus, contributing to improve aggregate productivity through a cleansing effect. The second chapter uses the regional heterogeneity of minimum wage incidence within occupations to show that minimum wage policies significantly decreased within-region-occupation inequality, especially in region/occupation pairs that are bound by the minimum wage. Furthermore, this effect, particularly felt in lower wage percentiles, is more pronounced as the minimum-to-median wage gap narrows. Finally, we find significant differences in the effect of minimum wage policies on inequality across regions, with a stronger impact on lower-income regions. In the third chapter, we assess the role of the business context on the efficiency of resource allocation and productivity growth. We show that the impact of entry and exit is mediated by the degree of product market competition, labour market flexibility and credit markets efficiency. Our estimates show that the impact of the entry of new firms on the efficiency of resource allocation depends on labour market flexibility, product market competition and on the incidence of financially distressed firms. The impact of both inflow and outflow of firms on productivity growth is also mediated by our three measures of business context. The fourth chapter analyses the quality and inclusiveness of jobs in young firms compared to older ones. Job quality is assessed mainly in terms of wages, with additional analysis on job security. Inclusiveness refers to the job quality of disadvantaged worker groups on the labour market, such as women and foreigners. We found that differences in job quality between young and older firms are marginal. Unconditional gaps in job quality at young firms can be almost entirely explained by differences in workers' characteristics as well as industry composition. Significant differences emerge in the inclusiveness of jobs at young firms. The gender wage gap appears to be smaller in young

firms, while the share of foreign-born worker is larger. Foreign workers seem to experience a larger negative wage gap in young firms. In terms of job security, young firms tend to offer more stable jobs. In the fifth chapter, we evaluate the role of intermediary organizations in fostering University–Industry joint R&D by examining the characteristics of firms that interact with universities via these organizations vis-à-vis firms that interact directly with the university's departments. We find that firms interacting via intermediary organizations are smaller, with less knowledge capabilities and geographically closer to the university, than counterparts. Cultural and organizational barriers are more significant among firms interacting directly with the university, whereas cognitive and cost barriers are more relevant among firms interacting via intermediaries. Geographic proximity has a preponderant role in Univeristy–Industry links highlighting the importance of mid-tier universities to regional growth in less technologically advanced regions.

Keywords: minimum wage, productivity, inequality, young firms, University–Industry collaboration

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Acronyms

CPI Consumer Price Index *(pp. 31, 36)*
CRCs collaborative research centres *(pp. 5, 111, 112, 115, 116, 133)*

DADS Déclarations Administratives de Données Sociales *(pp. 77–80)*
DROM Départements et Régions d'Outre-Mer *(p. 80)*

EBIT Earnings Before Interest, Taxes *(pp. 53, 55, 57)*
EBITDA Earnings Before Interest, Taxes, Depreciations and Amortizations *(pp. 9, 10, 14, 16, 19, 22, 53)*
ECB European Central Bank *(pp. 9, 27)*
EFAP Economic and Financial Assistance Programme *(pp. 1, 45, 48, 49, 51)*
EU European Union *(pp. 48, 51, 70)*

FDF financially distressed firms *(pp. 7, 17, 19, 57)*
FLEX labour market flexibility index *(pp. 47, 49, 57)*

GDP Gross domestic product *(p. 9)*

HHI Herfindal-Hirshman Index *(pp. 47, 51, 57)*

ICR Interest Coverage Ratio *(pp. 9, 10, 53)*
ILO International Labour Organization *(p. 70)*
INSEE French Statistical Institute *(p. 77)*
IO industrial organization *(p. 113)*
ISCO-08 International Standard Classification of Occupations *(pp. 36, 55, 79)*

LEED linked employer-employee data *(pp. 4, 15, 35, 65, 66, 68, 69, 71, 77–79, 86, 109)*

MTSSS Portuguese Ministry of Labor, Solidarity and Social Security *(pp. 15, 31, 35, 78)*

NACE Statistical Classification of Economic Activities in the European Community *(p. 55)*
NUTS Nomenclature of Territorial Units for Statistics *(pp. 31, 34, 36, 37, 40, 85)*

OECD Organisation for Economic Co-operation and Development *(pp. 9, 10, 48, 50, 53, 70, 75, 103)*
OLS Ordinary least squares *(pp. 84, 86, 98, 103, 107)*

PRCI potential relative cost increase *(pp. 1, 8, 11–13, 17–19)*

QP Quadros de Pessoal *(pp. 15, 35, 36, 55, 78, 79, 103, 117)*

R&D Research and development *(pp. 5, 47, 49, 111–120, 122, 126, 130, 135, 136)*
RBV resource-based-view *(p. 113)*

SCIE Sistema de Contas Integradas das Empresas *(pp. 9, 14, 15, 55, 78, 117)*
SMEs Small and medium-sized enterprises *(pp. 45, 113, 115)*

TFP Total-factor productivity *(pp. 57, 59, 61, 63)*
TTOs technology transfer offices *(pp. 5, 111, 112, 115)*

U-I University–Industry *(pp. 4–6, 111–114, 116–122, 126, 130, 133–135)*
UN United Nations *(p. 70)*
UNECE Economic Commission for Europe *(p. 70)*

1

Introduction

This introductory chapter provides an overview of each of the essays presented in this thesis, providing the main motivation for each of the topics studied as well as the main findings. The research essays in this thesis follow an empirical approach. The subjects of study are minimum wage policies, inequality, productivity, job quality and University–Industry collaborations.

The first two chapters of this thesis studies the impact of minimum wage policies in the Portuguese economy. Using firm-level data, chapter 2 assesses the impact on firms of minimum wage policies in Portugal, since the end of the Economic and Financial Assistance Programme (EFAP) in 2014. The goal of those polices was to reduce poverty and income inequality. The strong increase in the share of workers earning the minimum wage raised concerns about the impact of its increase on firms' activity and financial condition. Business associations were vocal about the potential negative consequences of these increases, given that Portugal had been through a severe debt and banking crisis, that left many firms financially vulnerable and constrained in their ability to adjust to the increase in wage costs. After the initial controversy, the discussion on this topic faded away because it occurred in the context of a strong rise in employment and a sharp reduction in unemployment, as the economy rebounded from the crisis. The first contribution of this paper is to present an evaluation of the impact of those policies on firms' employment, profitability and exit.

The costs of 'social policies' implemented through minimum wage increases are, at least partially, borne by firms. The share borne by a specific firm depends on several factors. First, the impact on firms' total costs depends on the share of workers affected by the new minimum wage. Second, it will depend on the firms' ability to absorb the wage cost shock by adjusting its profit margin and/or to pass the cost increase to consumers. Finally, the impact of minimum wage policies will depend on firms' flexibility to change their capital-to-labor ratio. If firms are unable to fully offset the impact of the minimum wage increase, their financial condition will worsen. In more extreme cases, namely when firms are financially distressed, the minimum wage increase may lead to the death of the firm. The second contribution of this paper is to propose a new, more complete measure, of the potential relative cost increase (PRCI) for firms of minimum wage policies, making use of a very rich firm-level database. In our data, the value of PRCI is higher for the group of financially distressed firms than for the rest of the economy, suggesting

that those firms are more vulnerable to minimum wage increases.

The third contribution of this paper is to show that minimum wage increases are particularly detrimental to financially distressed firms. The relation between firms' financial conditions and minimum wage increases is especially relevant in the Portuguese economy because a significant share of the firms are highly indebted, and have very low profitability and liquidity. Therefore, in our econometric analysis we allow for the possibility that the minimum wage increase has a more acute effect on financially distressed firms. Our results warrant this hypothesis. According to the estimates reported in this paper, minimum wage increases lead to lower profits and lower employment growth, with magnified effects for financially distressed firms. These results suggest that policy makers should take into account the financial condition of firms when deciding minimum wage increases.

The fourth contribution of this paper is to show that minimum wage increases acted as a potential accelerator of the exit of financially distressed firms, also known as zombie firms. This conclusion indicates that minimum wage policies may have compensated for some inefficiency of the insolvency framework. Therefore, our results suggest that minimum wage increases produced a cleansing effect, which may have fostered a more efficient resource allocation and productivity growth.

Chapter 3 investigates how minimum wage policies have affected within-region-occupation wage inequality in the Portuguese economy during the period of 1998 to 2021. Between 1998 and 2021, the Portuguese labour market experienced two periods of rapid real minimum wage growth, between 2007 and 2011, and between 2014 and 2021, with annual average real growth rates of 3.6% and 3%, respectively. This minimum wage policies affected the Portuguese regions asymmetrically, with the gap in minimum wage incidence between regions increasing, and the within-region wage compression not following the same trend, predominantly between the Lisbon region and the remaining regions. We take advantage of regional and occupational heterogeneity in the incidence of the minimum wage to assess how changes in the national minimum wage impact wage inequality.

The primary findings of this paper are as follows. First, wage inequality is lower in region/occupation pairs with a higher exposure to the minimum wage. Second, a decrease in the gap between the minimum and median wage is associated with a reduction in inequality. Third, the impact of minimum wage policies on inequality is stronger for minimum wage binded region/occupation pairs. Fourth, the reduction in region/occupation inequality is stronger in regions with higher minimum wage incidence. Finally, our analysis shows that the impact on wage inequality becomes more pronounced as the difference between the minimum and median wage decreases, particularly for lower wage percentiles.

Chapter 4 assesses the role of the business context on the efficiency of resource allocation and productivity growth. Productivity growth and, therefore, real GDP per capita growth, have been very low in the Portuguese economy in the 21st century. The years 2000 marked a regime change in productivity growth, interrupting GDP *per capita* convergence with the European Union. Conditions and barriers to SME performance vary with the business environment, product and labour markets institutions, with infrastructures, the availability and access to knowledge, skills, technology and finance, and with the participation in global value chains. Since the adoption of the Euro, structural reforms aiming to improve

the efficiency of the labour, product and financial markets have been at the centre of the discussion of economic policies on the growth of the Portuguese economy.

Labour market rigidity has been an important issue in the debate about the stagnation of the Portuguese economy in the 21st century. In this paper, we use a novel labour market flexibility index built at the sector level and using firm-level information to investigate whether labour market rigidity has been hampering firms' growth. Competition in markets, innovation and productivity are intrinsically linked. Competitive markets create incentives for companies to innovate and develop innovative products and services, with better quality and lower price. Therefore, we also investigate the role of market concentration in the impact of firms' entry and exit on the efficiency of resource allocation and productivity growth. Finally, financially distressed firms, also known as zombie firms, have represented a significant share of the Portuguese economy in 2008 – 2014, and have been associated with market distortions that hamper productivity growth. We evaluate the impact of zombie firms on efficiency and productivity growth.

In this chapter we use sectoral level data to evaluate the role of the business environment in the efficiency of resource allocation and productivity growth. We show how labour market flexibility, product market concentration and the incidence of financially distressed firms impacts resource allocation efficiency and productivity growth, gauged by the inflow and growth of *good* firms and exit of *bad* firms. We test three main hypothesis. Firstly, is labour market flexibility a key factor in allowing workers to reallocate to more productive firms, resulting in better resource allocation and fostering productivity growth? Secondly, do sectors with lower entry barriers that expose incumbents to competition, promote the growth of more productive firms and the exit of the less productive ones, resulting in an improved allocation of resources and fostering productivity growth? Thirdly, financially distress firms are associated with high levels of debt and poor performance. Is there a misallocation of credit and inefficient insolvency mechanisms, resulting in financially distressed firms capturing important resources of the economy, therefore, hampering economic growth?

The primary findings of this chapter are as follows. Firstly, descriptive statistics analysis show that exiting firms are considerably less productive and are more likely to be financially distressed, suggesting that the overall outflow of firms should improve resource allocation and increase productivity. Secondly, firm entry has a stronger impact on productivity growth in sectors with higher labour market flexibility, higher product market concentration and lower prevalence of financially distressed firms. Thirdly, firm exit is also associated with higher productivity growth in sectors with higher labour market flexibility, but it is inconclusive regarding the level of product market concentration and the incidence of financially distressed firms. Finally, we find that the entry of firms is associated with an increase in productivity dispersion for sectors with a low labour market flexibility, low product market concentration and a higher share of financially distressed firms. On the side of the exit of firms, we only observe an effect on productivity dispersion for sectors with a high incidence of financially distressed firms, resulting in an increase in productivity dispersion.

Chapter 5 is the only one that extends the analysis to a country other than Portugal, by also studying

the French economy, thus proving evidence from a multi-country perspective. Using linked employer-employee data (LEED) for France and Portugal, systematic differences in the jobs at young versus older incumbent firms are investigated along two dimensions: (1) the quality of these jobs, mainly focusing on wages but also exploring job security, and (2) their inclusiveness, in terms of the hiring and payment of more disadvantaged workers.

If the jobs created by young firms prove to be good and inclusive, observed declines in entry rates and business registrations – and the long-term effects of a missing generation of new firms – may be even more worrisome. The current analysis may therefore help policy makers better understand the implications of those declines for the post COVID-19 recovery period, and more generally the role of young firms for the inclusiveness of economic growth.

Inclusiveness in the context of this paper refers to labour market outcomes for groups that typically face challenges in labour markets (henceforth referred to as "disadvantaged groups"), such as women and foreigners. These outcomes include the quality of jobs, but also whether they are hired more by young firms than older ones.

Several key findings emerge from the empirical analysis. Firstly, young firms hire workers who are younger and have less work experience. They also employ more foreigners and labour market entrants compared to older firms. Furthermore, industries that pay lower wages – mainly in services – tend to have higher shares of small, and young firms. Grouping manufacturing and services together can therefore mask important heterogeneities in the quality of jobs provided by young firms. Secondly, there is no overall difference in wages between young and older firms when similar workers are compared. Young firms hire workers with different characteristics than older firms, and differences in pay are due to these worker characteristics rather than to the age of the firm. In fact, when worker's characteristics, such as her age and tenure, are controlled for, young firms seem to pay a small wage premium. Thirdly, both young and older French firms employ around 40% women. For the Portuguese economy, young and old firms employ around 45% and 48% women, respectively. While both economies have different overall gender compositions, the gender wage gap appears to be slightly lower in young firms for both countries. The share of foreign-born workers on the other hand is larger in young firms, but foreign-born workers seem to experience a more negative wage gap in young firms compared to older incumbent firms. Jobs at young firms might thus promote more inclusive labour markets through hiring more from disadvantaged worker groups that may have difficulty entering the labour market, but workers might be having to accept a lower wage in return. Finally, young firms offer more open-ended contracts than older firms for similar types of workers. Given that most firms die within their first years of business, accepting employment at a young firm entails a substantial risk of job loss. Young firms seem to make up for this by offering more secure contracts.

Chapter 6 distinguishes itself from the others by studying the role of intermediary organizations in the context of University-Industry relationships. It is generally accepted that University–Industry (U-I) links have become more important in the strategic response to global competition and particularly important to regional growth, where systems of small- and medium-sized firms are located. In fact, technology transfer

has become a high priority for national governments and the European Commission alike.

In order to succeed in the so-called third mission, universities have been developing several strategies to facilitate knowledge transfer between academia and firms. Alongside with changes in organization and intellectual property appropriation modes, universities have institutionalized intermediary organizations such as technology transfer offices (TTOs), collaborative research centres (CRCs), incubators and science parks.

Intermediary organizations, also referred as 'interface institutions', 'hybrid organizations' or 'fourth pillar organizations' are one of the key elements of the National System of Innovation. The intermediaries' main purpose is to avoid systemic failures by establishing linkages among actors of the innovation system – universities, firms and government agencies. It has been widely acknowledged that these actors have very distinct cognitive, cultural and organizational characteristics, which can create barriers to communication, and therefore to the transfer of knowledge. Another important role played by intermediaries in the support of knowledge transfer is reducing firms' transactions costs, guaranteeing appropriability conditions and building trust.

While there is vast evidence on the firms' determinants to collaborate with universities and on their interaction channel – e.g., Research and development (R&D) collaboration, contract R&D, problem solving, human capital hiring -, there is still a lack of evidence regarding firms' choices with respect to the institutional interaction mode, i.e., via intermediaries or directly with university's departments. The purpose of this paper is to examine the role played by intermediary organizations in U-I interactions by exploring firms' differences across two institutional modes of interaction. We focus on one type of U-I interaction channel – formal joint R&D, therefore on a more similar type of knowledge being exchanged, which should allow for the effect of intermediaries to become apparent.

This study builds on industrial organization and proximity approach literatures to examine firm-specific characteristics as well as motives, benefits from and barriers that underly U-I interactions. These literatures complement each other, and thereby allow us to have a richer theoretical framework to analyse a phenomenon that is inherently complex and context-dependent than a single theoretical approach.

We employ original U-I R&D collaboration data collected from University of Minho, a mid-range university located in Northern Portugal, for the period 2009–2016, which we combine with different data sources—census data, survey data and interviews. With these draw conclusions generalizable to the entire economy, as well as to obtain deeper insights regarding drivers, benefits and barriers of U-I links. This chapter provides evidence, so far lacking, from mid-level universities and regions, particularly regarding U-I links, as much of existing literature focuses on strong research universities situated in developed high-tech entrepreneurial environments. Lastly, from a policy point of view it is relevant to assess U-I joint R&D since this form of interaction has the highest impact on long-term benefits, and previous research has shown that regional innovation performance is highly dependent on formal knowledge (R&D) as well as on public–private interactions and partnerships.

Our evidence confirms the importance of intermediary organizations in promoting U-I linkages. In particular, intermediaries are playing a role in reaching out small and less technologically advanced firms

located geographically close to the University. From a policy point of view, our results provide support to the recent Portuguese Interface Program, implemented by the government and supported by European Funds, that aims at supporting the creation and development of technological interface institutions and enhance U-I collaboration.

2

Minimum wage and financially distressed firms: another one bites the dust

2.1 Introduction

This paper assesses the impact on firms of minimum wage policies in Portugal, since the end of the Financial Assistance Programme in 2014.[1] The goal of those measures was to reduce poverty and income inequality. The strong increase in the share of workers earning the minimum wage — from 13.2% in 2014 to 25.7% in 2017 — raised concerns about the impact of its increase on firms' activity and financial condition. Business associations — especially in the traditional sectors, such as apparel and textiles — were vocal about the potential negative consequences of these increases, given that Portugal had been through a severe debt and banking crisis, that left many firms financially vulnerable and constrained in their ability to adjust to the increase in wage costs. After the initial controversy, the discussion on this topic faded away because it occurred in the context of a strong rise in employment and a sharp reduction in unemployment, as the economy rebounded from the crisis. To the best of our knowledge, there is no evaluation of the impact of those minimum wage increases. The first contribution of this paper is to present an evaluation of the impact of those policies on firms' employment, profitability and exit. Our estimates support business associations' concerns, suggesting that minimum wage increases reduced employment growth and profits, and accelerated the exit of financially distressed firms (FDF). The impact of the COVID-19 pandemic crisis on the financial situation of firms — which led to credit deferrals that amounted to over 20% of total bank credit (European Banking Authority, 2020) — has revived interest in this issue, given that the minimum wage in Portugal has continued to increase in spite of the recession.

The costs of 'social policies' implemented through minimum wage increases are, at least partially, borne by firms. The share borne by a specific firm depends on several factors. First, the impact on firms' total costs depends on the share of workers affected by the new minimum wage. Second, it will depend on the firms' ability to absorb the wage cost shock by adjusting its profit margin and/or to pass the cost

[1] This chapter is co-authored with Fernando Alexandre, Pedro Bação, João Cerejeira and Miguel Portela, and is published as Alexandre, Bação, et al. (2022).

increase to consumers. Finally, the impact of minimum wage policies will depend on firms' flexibility to change their capital-to-labor ratio. If firms are unable to fully offset the impact of the minimum wage increase, their financial condition will worsen. In more extreme cases, namely when firms are financially distressed, the minimum wage increase may lead to the death of the firm. The second contribution of this paper is to propose a new, more complete measure, of the PRCI for firms of minimum wage policies, making use of a very rich firm-level database. In our data, the value of PRCI is higher for the group of financially distressed firms than for the rest of the economy, suggesting that those firms are more vulnerable to minimum wage increases.

While the main dispute in the literature has concerned the impact of minimum wage increases on employment (e.g., contrast the views expressed in Dube, 2019, and Neumark and Shirley, 2021), a very recent strand of the literature has been focusing on the impact of minimum wage increases on the financial condition of firms. Examples include Draca et al. (2011), for the introduction of a minimum wage in the United Kingdom in 1999; Harasztosi and Lindner (2019) for a large increase in the Hungarian minimum wage in 1997-2004; Chava et al. (2019) for 14 states of the USA, with a focus on the credit score of small firms; and Drucker et al. (2021) for Israel in 2003-2010. Bell and Machin (2018) conclude that low-wage UK firms had significant falls in their stock market value following the announcement of a big change in the minimum wage. All these papers present evidence of a negative impact of minimum wage increases on firms' profitability.

Framed by this line of research, the third contribution of this paper is to show that minimum wage increases are particularly detrimental to financially distressed firms. The relation between firms' financial conditions and minimum wage increases is especially relevant in the Portuguese economy because a significant share of the firms are highly indebted, and have very low profitability and liquidity. Therefore, in our econometric analysis we allow for the possibility that the minimum wage increase has a more acute effect on financially distressed firms. Our results warrant this hypothesis. According to the estimates reported in this paper, minimum wage increases lead to lower profits and lower employment growth, with magnified effects for financially distressed firms. These results suggest that policy makers should take into account the financial condition of firms when deciding minimum wage increases.

The empirical literature on the impact of minimum wage increases on firm exit is also relatively recent. Draca et al. (2011) presents industry-level evidence of the impact of the introduction of a minimum wage in the UK and concludes that the probability of exit increased 1.5 percentage points. Mayneris et al. (2018) detects evidence of a 'cleansing' effect of the large increases in the minimum wage in 2004 in China, i.e., less productive firms were more likely to be exposed to the minimum wage increase and were also more likely to exit. Chava et al. (2019) relate increases in the minimum wage to lower credit scores and consequent higher exit rates of small businesses in the USA. Aaronson et al. (2018) and Luca and Luca (2019) focus on restaurants; both conclude that minimum wage rises increase the probability of exit.

Adding to this discussion, the fourth contribution of this paper is to show that minimum wage increases acted as a potential accelerator of the exit of financially distressed firms, also known as zombie firms. This conclusion indicates that minimum wage policies may have compensated for some inefficiency of the

insolvency framework. Therefore, our results suggest that minimum wage increases produce a cleansing effect, which may foster a more efficient resource allocation and productivity growth. In the context of the COVID-19 pandemic crisis, the issue of zombie firms has re-emerged, given the severity of the crisis and the Governments' intervention to support firms (European Central Bank, 2021). The European Central Bank (ECB)'s 2021 Financial Stability Review highlights the risks of inefficient insolvency frameworks, which might contribute to the prevalence of zombie firms and, thus, hamper productivity growth. In this context, the evaluation of the impact of minimum wage increases on firm exit, namely of zombie firms, becomes even more relevant.

The remainder of this paper is structured as follows. Section 2.2 describes the main facts concerning the evolution and incidence of minimum wage and financially distressed firms in the Portuguese economy. Section 2.3 presents the dataset, empirical strategy and results. Section 2.4 concludes.

2.2 Minimum wage and financially distressed firms in the Portuguese economy

Starting in late 2014, Portuguese Governments adopted an ambitious policy of minimum wage increases. This policy put an end to a long period when the nominal minimum wage was frozen. Between 2008 and 2013, the Portuguese economy went through a severe crisis: Gross domestic product (GDP) decreased by 8%; employment decreased 13% and unemployment increased from 7.7% to 16.4%. Between May 2011 and May 2014, following the bailout by the International Monetary Fund, the European Commission and the European Central Bank, also known as troika, Portugal implemented an Economic and Financial Assistance Program.

The Portuguese crisis was both a debt and a banking crisis. According to data from the Bank of Portugal, total debt of non-financial firms, relative to GDP, reached a maximum of 152% in 2012, one of the highest in the world. Besides being highly leveraged, there was a large fraction of unprofitable firms. In 2013, 34% of the firms had a negative Earnings Before Interest, Taxes, Depreciations and Amortizations (EBITDA) and the average EBITDA to Operating Revenue ratio across all firms in the economy was -15.5% (data from Sistema de Contas Integradas das Empresas (SCIE), INE; see subsection 2.3.1 for further details on the data used in this paper). A high share of firms, accounting for a high share of employment, value added and debt, were financially distressed — see Gouveia, Osterhold, et al. (2018).

In our analysis, following the Organisation for Economic Co-operation and Development (OECD) approach — see, for example, McGowan et al. (2017) and Gouveia, Osterhold, et al. (2018) — we define as financially distressed the firms that report an Interest Coverage Ratio (ICR) — given by the ratio of EBITDA to interest expenses — lower than one over three consecutive years. EBITDA measures the financial performance of the firm and interest expenses gives the costs due to borrowing. As start-ups are not expected to be profitable, in our definition of financially distressed firms we only consider firms that already existed in 2010.

Alternative definitions of financially distressed firms — sometimes also referred to as zombie firms — have been used in the literature. Caballero et al. (2008), in a seminal contribution, define zombie firms as those receiving subsidised bank credit. A firm is assumed to be receiving subsidised bank credit when the implicit interest rate on its debt is less than the prime interest rate. A similar approach is used in Schivardi et al. (2021). Schivardi et al. (2021) label a firm as financially distressed when its return on assets is lower than the cost of capital for the safest borrowers, and the ratio of financial debt to assets is higher than 40%. Both these approaches require more detailed information concerning the financial markets in which the firms fund themselves than the OECD approach. In face of the data available to us, we will not pursue these approaches. An alternative that is closer to the OECD approach is that of Storz et al. (2017), who classify a firm as zombie if it shows negative return on assets for two consecutive years, negative net investment, and a ratio of EBITDA to total financial debt lower than 5%.

In Figure 1, we show the evolution of the share of financially distressed firms in Portugal, in the period 2012–2017, according to both our preferred measure — denoted by '$ICR < 1$' — and the measure proposed by Storz et al. (2017) — denoted by 'ROA'. We also show the evolution of the share of financially distressed firms according to a less stringent version of the OECD criterion, requiring that the ICR be lower than 1.5 rather than 1 ('$ICR < 1.5$'). This brings into the fold firms that are not far above the OECD threshold. We use these two alternative indicators of financial distress in our empirical analysis to perform robustness checks. In both cases, the size of the sample of financially distressed firms is larger than in our main estimations. In fact, using the OECD approach, the share of financially distressed firms reached a peak of 5.8% in 2014. In 2013, financially distressed firms represented 5% of total employment, 1.3% of total gross value added, 11.5% of total debt and 14% of total interest expenses. When we use 1.5 instead of 1 as the cutoff, the share of financially distressed firms increases by more than 1 percentage point (p.p.) in 2012-15, and by a slightly narrower margin in 2016-17. The peak is still in 2013, with a share of 7.2%. According to the measure used by Storz et al. (2017), the share of financially distressed firms in the Portuguese economy is significantly larger and the peak is also reached earlier: the peak is in 2013 with a share of 8.2%. Those firms accounted for 6.5% of total employment, 2.9% of total gross value added, 10.5% of total debt and 11.5% of total interest expenses.

The fragile condition of financially distressed firms raised concerns about the effects of minimum wage policies. Minimum wage increases may induce a further deterioration of the financial condition of those firms, which may lead them to reduce employment and even to close down. Business leaders publicly expressed their concerns on the effects of wage cost increases, namely in sectors where there is a high minimum wage incidence and labor costs weigh heavily in total costs.

The minimum wage in Portugal is set for a month of full-time work. The full-time weekly hours, which by law cannot exceed 40 hours, are set in the collective bargaining agreement. Between 2014 and 2017, the minimum wage increased 14.8%. In October 2014, the minimum wage increased from 485 to 505 euros per month, a 4% change. Notwithstanding being a small increase, the percentage of workers

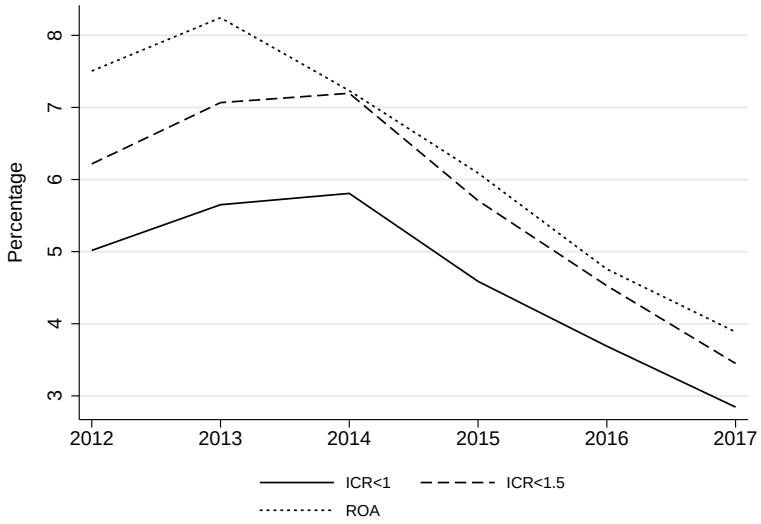


Figure 1: Share of financially distressed firms

receiving minimum wage jumped from 13.2% to 19.6%.[2] In 2016, the Government announced that the minimum wage should reach 600 euros in 2019. In 2016 it increased to 530 euros; in 2017 to 557; in 2018 to 580; and in 2019 to 600 euros. During this period, the share of workers receiving the minimum wage reached a maximum of 25.7% in 2017. However, the debate about the negative impact of minimum wage policies abated because they coincided with the recovery of the Portuguese economy. Between 2013 and 2018, real GDP increased by 11% and the unemployment rate decreased from 16.2% to 7%. This expansion resulted in a 10% increase in employment, corresponding to 437 thousand jobs — for a description of the Portuguese crisis and recovery see, for example, Alexandre et al. (2019) and Blanchard and Portugal (2017).

The costs of minimum wage policies aimed at reducing income inequalities and poverty are, at least partially, borne by firms. However, firms are affected asymmetrically by minimum wage increases. In the short run, the impact on firms' total costs depends on their ability to pass the wage cost increase to consumers, and on the share of workers earning the minimum wage. Since 2016, the share of workers affected by minimum wage policies surpassed 30% in several industries. For example, in 'Manufacturing' it reached a maximum of 31.6% in 2016; in 'Construction' it reached 32% in 2017; in 'Accommodation and food service activities' the share was always above 30%, reaching a maximum of 42.4% in 2017.

In this paper, we measure the impact of the minimum wage increase in total costs through a novel measure, which we call the 'potential relative cost increase', henceforth PRCI. The PRCI measures the potential impact of the minimum wage increase on firms' costs. The PRCI builds on other measures in the minimum wage literature. Card and Krueger (1994), in a study of the impact of minimum wage increases on fast-food restaurants, use a 'gap' variable defined as the proportional increase in the starting wage necessary to raise it to the new minimum wage. In Machin et al. (2003) and Draca et al. (2011), the

[2]The numbers mentioned in this part of the text come from a report on the minimum wage in Portugal published by the Portuguese Ministry of Labor—see Ministério do Trabalho, Solidariedade e Segurança Social (2019).

intensity of the treatment is given by the relative change in wage costs needed to comply with the new minimum wage. Harasztosi and Lindner (2019) and Drucker et al. (2021) employ a simpler measure to evaluate the impact of changes in the minimum wage: the fraction of workers who earn below the new minimum wage. Caliendo et al. (2018) evaluate the impact on employment of the introduction of a national minimum wage in Germany in 2015 by exploring the variation in regional treatment intensity by means of two indicators: the share of affected eligible employees per region and the Kaitz index that gives the relation of the minimum wage to the regional mean wage.

Those studies need to resort to approximate measures of exposure to minimum wage hikes because they lack detailed information about the cost structure within firms. In our case, we have this information. Thus we could compute the firm's average wage and compare it to the minimum wage, or compute the fraction of workers earning below the minimum wage. However, we believe that the PRCI is a more complete measure of the exposure of firms to the minimum wage. One reason for this is the fact that the same minimum wage hike should affect labor-intensive firms more than capital-intensive firms. The PRCI allows for this difference by taking into account how much the wage increase matters for the firm's total costs.

Thus, in our analysis, the intensity of the treatment of minimum wage policies is measured through the PRCI as defined in equation 2.1:

$$PRCI_{it} = \frac{Potential\ wage\ bill_{i,t+1} - Current\ wage\ bill_{it}}{Total\ costs_{it}} \times 100 \tag{2.1}$$

This equation tells that the 'potential relative cost increase' associated with a minimum wage rise is the relative change in total costs that the firm would face in year t if the firm had to pay in year t the year $t+1$ minimum wage, while maintaining the same productive structure, namely, not adjusting the composition, nor the size, of its labor force in view of the minimum wage increase. By computing the 'potential relative cost increase' we take into consideration the fact that the importance of labor costs varies across industries and firms.

Note that the PRCI is zero if the minimum wage does not change, and that it is an increasing function of the change in the minimum wage. Furthermore, in our empirical model (see Section 2.3.2) PRCI is the only variable that depends directly on the variation of the minimum wage. In this sense, the PRCI is an indicator of the exposure of each firm to minimum wage hikes, and its coefficient will reflect the impact of the minimum wage on the dependent variable in each model. As in Harasztosi and Lindner (2019), our identification assumption is that, conditional on the controls, the path followed by those firms where the minimum wage hike matters less may be viewed as a counterfactual for the firms where the minimum wage hike is more important. Harasztosi and Lindner (2019) provide one major argument in favour of this assumption: a minimum wage hike represents a small additional cost for the economy as a whole. Therefore, the associated general equilibrium effects are probably negligible. In addition, the general equilibrium effects would probably be at least partly absorbed by exchange rate fluctuations. Note also that the PRCI does not measure any impact of the minimum wage hike that might occur through a

spillover across the firm's wage distribution.

To control for absenteeism and part time jobs, in the computation of the PRCI we use the hourly minimum wage. In 2014, the minimum wage increased in October, affecting only the last quarter of the year. The next increase occurred in January 2016. Consequently, we split the 2014 increase (from 485 euro to 505 euro) between 2014 (one quarter of the increase) and 2015 (the other three quarters). This amounts to assuming that the minimum wage rose from 485 to 490 in 2014, and from 490 to 505 in 2015.

Figure 2 shows the evolution of the average PRCI for the period 2013-2016. We present data for all firms, 'PRCI (All)', for non-financially distressed firms, 'PRCI (non-FDF)', and for financially distressed firms, 'PRCI (FDF)'.

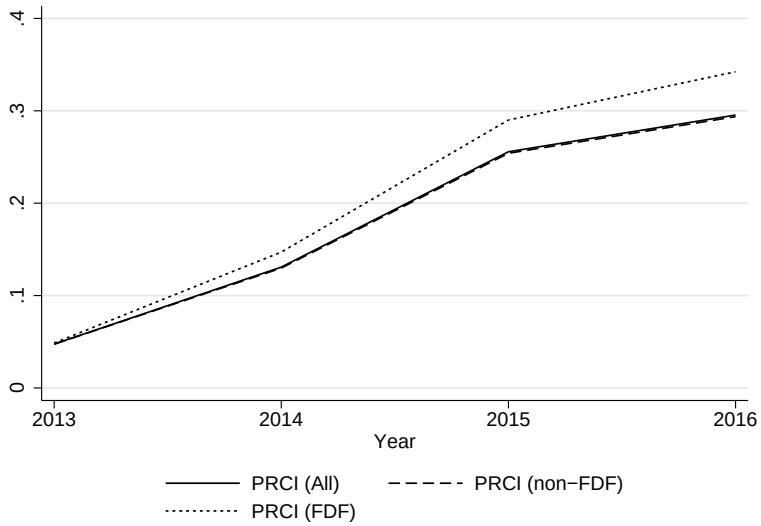


Figure 2: Average PRCI

The average value of the PRCI increased significantly (more than sixfold) over time. The increase in the average PRCI reflects the fact that minimum wage rises resulted in a higher share of workers earning the minimum wage, implying cumulative effects in the value of the PRCI. We should also stress the difference between financially distressed firms and non-financially distressed firms. In 2013, the average value of the PRCI was similar for both groups of firms. However, in the following years, the PRCI for financially distressed firms show a faster increase, raising from 0.05 to 0.34 in 2016 (a 604% increase against 519% in the case of non-financially distressed firms). The evolution of the PRCI suggests that minimum wage increases might have a stronger impact in financially distressed firms, simply because they are more exposed to the minimum wage. However, in this paper, we also test the hypothesis that financially distressed firms are more vulnerable to minimum wage increases in terms of profitability and employment growth, in the sense that the impact of a minimum wage increase is more damaging for a financially distressed firm than for an otherwise identical firm that is not financially distressed. Likewise, we test the hypothesis that minimum wage increases have a stronger impact on the exit of financially

distressed firms.

Previous studies on the impact of minimum wage policies in the Portuguese economy focused on the effects on employment. The results of those studies were ambiguous. S. C. Pereira (2003) analyses the impact of the 1987 minimum wage increase on teenagers' employment and concludes that it reduced the employment of 18 and 19 years old and that it increased employment of 20-25 years old. Portugal and Cardoso (2006) also studied the impact of the 1987 minimum wage increase. They find that it lowered the proportion of teenagers hired by firms, but also lowered the proportion of teenagers in job separations. Portugal and Cardoso (2006) conclude that the net impact on teenager employment was positive. Another study on the effect of minimum wage increases in Portugal, Centeno et al. (2014), focused on the period 2002-2010. This study estimated that a 1 p.p. increase in the minimum wage lowered employment of minimum-wage earners by 1.1 p.p. However, the impact is stronger for young workers and for workers in manufacturing.

The discussion of the impact of minimum wage policies in the Portuguese economy has left out its potential impact on the financial condition of firms. Nevertheless, as mentioned above, there is evidence for the UK (Draca et al., 2011), for the US (Chava et al., 2019) and for Israel (Drucker et al., 2021) that the minimum wage is a determinant of firms' profitability. Given the financial fragility of Portuguese firms and the significant and consecutive increases of the minimum wage in Portugal since 2014, this is an important issue that we also address in this paper, in addition to providing further evidence concerning the impacts on employment and exit.

2.3 Empirical analysis

2.3.1 Data

The data used in our econometric analysis comes from two main sources. The first is the Integrated Business Accounts System (SCIE, INE, Statistics Portugal, 2018b) from Statistics Portugal's Registry of Statistical Units. The SCIE database contains firm-level administrative data regarding the balance sheet and other yearly accounting information for the population of firms in the private sector, from 2006 until 2017. In 2017, the SCIE database had 394,967 firms. From SCIE we collected data for EBITDA, operating and total revenue, interest expenditure, value added, labor costs, total costs, leverage, debt, total assets and exports — see Table 1. We consider that a firm exits the economy, $Exit$, when its information ceases to appear in the SCIE database. It is possible that firms do not report information in SCIE and still exist. This is the case, for example, when they do not have significant economic activity in a given year or when they report the information after the legal due date. The number of cases is expected to be very small. Another possibility is when the economic activity is reclassified from the non-financial to financial sector. As we do not have data on financial firms we cannot confirm this change. However, this is also expected to occur very rarely.

Table 1: Variable description and sources

Variable	Description	Source
Potential relative cost increase	PRCI = $\frac{Potencial\ wage\ bill_{t+1} - Current\ wage\ bill_t}{Total\ costs_t} \times 100$	QP and SCIE
Profitability	Profit = $\frac{EBITDA}{Operating\ revenue} \times 100$, winsorized at percentiles 1 and 99	SCIE
Interest coverage ratio	ICR = $\frac{EBITDA}{Interest\ expenses}$	SCIE
Employment growth	Employment = $\frac{Number\ of\ employees_{t+1} - Number\ of\ workers_t}{Number\ of\ employees_t} \times 100$	QP
Productivity	Productivity = $\frac{Value\ added}{Total\ hours\ worked} \times 100$ (Euro)	QP and SCIE
Part-time workers	Part-time = $\frac{Workers\ with\ a\ part-time\ contract}{Number\ of\ workers} \times 100$	QP
Fixed-term workers	Fixed-term = $\frac{Workers\ with\ a\ fixed-term\ contract}{Number\ of\ workers} \times 100$	QP
Overtime labor	Overtime = $\frac{Overtime\ hours}{Total\ hours\ worked} \times 100$	QP
Relative labor costs	LaborCosts = $\frac{Labor\ costs}{Total\ costs} \times 100$	SCIE
Exports weight	Exports = $\frac{Exports}{Total\ revenue} \times 100$	SCIE
Leverage ratio	Leverage = $\frac{Total\ liabilities}{Total\ assets} \times 100$	SCIE
Short-term debt	DebtST = $\frac{Short-term\ loans}{Total\ assets} \times 100$	SCIE
Long-term debt	DebtLT = $\frac{Long-term\ loans}{Total\ assets} \times 100$	SCIE
Financially distressed firms	FDF = ICR $\geq$ 1 for 3 consecutive years for firms that already existed in 2010	SCIE
Exit	Exit = 1 if the firm exited from the database; 0 otherwise	SCIE

Notes: SCIE stands for "Sistema de Contas Integradas das Empresas" and QP for "Quadros de Pessoal". Total costs includes costs with employees, goods, external services, interest expenses and losses by firm/year. EBITDA stands for earnings before interest, taxes, depreciation and amortization. Potential and current wage bill are computed using data from QP. The variable total hours worked is from QP, while value added is available in SCIE.

The other database used in our analysis is a LEED, the Quadros de Pessoal (QP), (INE, Statistics Portugal, 2018a) collected by the Portuguese Ministry of Labor, Solidarity and Social Security (MTSSS) through a mandatory annual survey. The QP database provides data on all workers in all firms in Portugal (excluding the public sector) with at least one wage earner, besides other firm-level information. In 2017, the QP database had 290,409 firms and 2,973,246 workers. From the QP database we use worker-level information on the number of employees, wage bill, hours of work and type of contract (part-time and fixed-term) — again see Table 1. The SCIE database is linked, through an anonymized firm identifier, to the QP data, resulting in a very rich database.

Table 2 shows aggregate statistics for the period of our empirical analysis (about 370 thousand observations corresponding to almost 100 thousand firms). Note that we only use data concerning mainland

Portugal. Firms from the archipelagos of Madeira and Azores are excluded from our analysis because these regions have specific minimum wage rules.

Table 2: Summary statistics (2013 – 2016)

	Mean	SD	Min.	Max.
PRCI	0.18	0.43	0.00	130.37
FDF	0.05	0.22	0	1
Profit	-9.87	48.91	-227.89	230.61
Employment	-2.16	41.89	-100.00	5980.00
Exit	0.04	0.20	0	1
Productivity	17.46	450.25	-4594.66	248074.48
Part-time	5.65	16.28	0.00	100.00
Fixed-term	22.45	29.26	0.00	100.00
Overtime	0.28	1.75	0.00	83.82
LabourCosts	33.02	20.32	0.02	100.00
Exports	4.15	15.45	0.00	100.00
Leverage	107.01	1699.23	-277.41	810637.50
DebtST	0.08	1.95	0	713.66
DebtLT	0.27	9.23	0	5046.94
Number of workers	18.59	164.10	1	24682

Source: QP & SCIE. The number of observations is 368085. "SD" stands for standard deviation. "Min." stands for minimum. "Max." stands for maximum. See Table 1 for further information.

2.3.2 Econometric strategy

This paper aims at studying the impact on firms of minimum wage policies. We focus our analysis on profitability, employment growth and exit. In our analysis, we also aim at evaluating whether financially distressed firms are more vulnerable to minimum wage increases.

To test our hypothesis we estimate the following model:

$$\Delta Profit_{i,t+1} = \gamma_1 PRCI_{it} + \gamma_2 FDF_{it} + \gamma_3 PRCI_{it} FDF_{it} + \gamma_4' X_{it} + \eta_i + \varepsilon_{it} \tag{2.2}$$

The dependent variable in equation (2.2), $Profit_{it+1}$, stands for firm's i profitability and is given by the change in the EBITDA to Operating Revenue ratio from period t to period $t+1$. In the case that the firm exits the market in period $t+1$, we do not know what would have happened to the profit of the firm. We assume that the performance would have been poor and, therefore, we set the change in $Profit$ equal to the minimum value observed in the series. As this may overestimate the fall in $Profit$, as a robustness check we will also estimate the model omitting these observations.

In equation (2.2), $PRCI_{it}$ is the exposure of firm i in year t to an increase of the minimum wage during year $t+1$ (computed as detailed in the previous section). $FDF_{i,t}$ is a dummy variable that equals 1 if

firm i was classified as financially distressed in year t and equals 0 otherwise. X_{it} is a vector of control variables, which includes the variables productivity, part-time workers, fixed-term workers, overtime labor, relative labor costs, exports weight, leverage ratio, short-term debt, long-term debt — all defined in Table 1 —, as well as the number of workers and its square. η_i represents firm i's unobserved heterogeneity. The key parameters of interest are those associated with our treatment variable, $PRCI_{it}$, i.e. γ_1 and γ_3. If $\gamma_1 < 0$, an increase in the minimum wage will be detrimental to profitability. This impact will be larger for financially distressed firms if $\gamma_3 < 0$.

One possible reaction of firms to a minimum wage increase, namely if they cannot pass the cost to consumers, is to reduce their demand for labor. For firms that are more dependent on low-wage labor, the increase in costs may trigger the closing down of the firm and the destruction of all jobs. Therefore, to assess the impact of minimum wage increases on employment, we estimate a model with the same specification as in equation (2.2), except for the dependent variable, which becomes the change in log-employment from t to $t+1$. For firms that exited in period $t+1$ we recorded a variation in employment equal to minus 100 per cent. The parameters of interest (γ_1 and γ_3) and their interpretation are the same as in the model for profitability.

To evaluate the impact of minimum wage increases on firm exit, we begin by estimating a logit model that accounts for firms' unobserved heterogeneity and in which the dependent variable is the probability that firm i will close down in period $t+1$. This probability is assumed to be a function of a set of explanatory variables — collected in vector Z_{it} — that include PRCI, FDF, their interaction, control variables and an individual dummy:

$$P(E_{i,t+1} = 1|Z_{it}) = \lambda(\theta_{it}) = \frac{\exp(\theta_{it})}{1 + \exp(\theta_{it})} \tag{2.3}$$

$$\theta_{it} = \beta_1 PRCI_{it} + \beta_2 FDF_{it} + \beta_3 PRCI_{it} FDF_{it} + \beta_4' X_{it} + \eta_i \tag{2.4}$$

In equation (2.3), $E_{i,t+1}$ (variable 'Exit' in Table 2) is a dummy variable that equals 1 if firm i exited during year $t+1$ and equals 0 otherwise. The other variables are the same as in equation (2.2).

Given the focus of the paper, the main parameters of interest are β_1 and β_3, with β_2 playing a lesser role. The parameter β_1 is the effect on the argument of the exit probability function, θ_{it}, of increasing wage costs (as a result of raising the minimum wage) in an amount equal to one per cent of total costs, all else equal. Since we use a logit model (equation 2.3), the impact of this increase for the probability of exit of the firm varies with the value of the other variables in the model. The parameter β_2 is the difference in the value of θ_{it} between a financially distressed firm that pays at least the new minimum wage to all workers ($PRCI_{it} = 0$) and a non-financially distressed firm with the same characteristics. If firms pay some workers below the new minimum wage ($PRCI_{it} > 0$), the difference in θ_{it} for a financially distressed firm relative to a non-financially distressed firm with similar characteristics is $\beta_2 + \beta_3 PRCI_{it}$. We interpret $\beta_1 > 0$ as signifying that the minimum wage increase has an adverse impact on the survival of firms that pay the minimum wage to some of its workers. If $\beta_3 > 0$ then the impact of a minimum wage increase is magnified in the case of financially distressed firms. If the increase in the minimum wage raises firms'

probability of exit ($\beta_1 > 0$ or $\beta_3 > 0$), then it will in effect be accelerating their exit. When $\beta_3 > 0$, the minimum wage increase may have a 'cleansing' effect, in the sense that it may contribute to driving out underperformers faster, as Mayneris et al. (2018) suggest was the case for firms in China.

The above logit model is appealing because it restricts the outcome to a number between zero and one, i.e. interpretable as a probability. However, that comes at a cost in terms of observations: the estimation of the conditional logit model uses only the set of firms that change status in the sample, i.e. the firms that did exit the market in the period 2014–2017. Consequently, a significant positive coefficient for PRCI will suggest that firms that exited did so in years when PRCI was high. It does not necessarily follow that, in the full set of firms (i.e. including those that did not exit), firms with a high PRCI exited more often than firms with a low PRCI, i.e. that minimum wage hikes killed firms. To put this sort of conclusion on firmer ground, we should estimate a model with the full set of firms.

An alternative approach is to use the linear probability model with fixed effects, which can be estimated using the data on all firms. This model may be written as:

$$E_{i,t+1} = \tilde{\beta}_1 PRCI_{it} + \tilde{\beta}_2 FDF_{it} + \tilde{\beta}_3 PRCI_{it} FDF_{it} + \tilde{\beta}_4' X_{it} + \tilde{\eta}_i + \tilde{\varepsilon}_{it} \tag{2.5}$$

The interpretation of the sign of the coefficients is the same as in the logit model. However, in the linear probability model the impact of a unit change in one regressor on the probability of exit is constant and equal to that regressor's coefficient. Differently, in the logit model the impact depends on the values taken by the other variables, i.e. the impact depends on the position on the curve. The results reported in the next subsection must be read accordingly.

Models akin to equation (2.5) are common in the literature. As in the case of equation (2.2), the main variation is in the definition of the treatment variable. In Mayneris et al. (2018) the treatment variables are dummy variables that identify firms with different degrees of exposure to the minimum wage. Although it distinguishes several categories of exposure to the minimum wage, this approach is essentially the same as the approach used by Draca et al. (2011), who consider low-wage firms to be the treated group. This dummy-variable approach is in contrast with, e.g., Aaronson et al. (2018). In Aaronson et al. (2018) — as in Luca and Luca (2019) — the treatment variable is the level of the minimum wage in each US state (where the restaurants that constitute their sample are located). Chava et al. (2019) interact the change in the US federal minimum wage with a dummy for those states where the minimum wage is binding and another dummy for firms that suffered a rating downgrade from 80 to 79 points. All these papers find that minimum wage rises lead to a higher probability of exit for the firms in the treated group.

The dummy variables provide only a very coarse measure of the treatment. In the papers that employ that approach, robustness checks that use an alternative measure of the treatment are common. Given that we use a continuous measure of the treatment intensity instead of a dummy (or a set of dummies), our approach appears to be closer to that of Aaronson et al. (2018), Luca and Luca (2019) and Chava et al. (2019). Nevertheless, there are important differences. First, as emphasized in Section 2.2, our treatment measure is probably a more precise indicator of the impact of the minimum wage hike, for it measures

the importance of each minimum wage hike in the context of the firm's total costs. Second, we look at the full set of firms in continental Portugal (subject to the conditions detailed in Subsection 2.3.1), whereas those papers analyze a special population of firms (restaurants or businesses with a Dun&Bradstreet credit score). Finally, while in continental Portugal there is only one minimum wage, those papers exploit the variation of the minimum wage across the states of the USA to achieve identification.

Note that the models described above focus on the 'short-run' (from one year to the next) impact of variations in the minimum wage, and are silent about long-term effects. In addition, these models concern the impact on existing firms, not on potential entrants. These two features suggest that the actual impact of minimum wage changes may be larger than estimated by these models.

2.3.3 Results

The results from estimating models (2.2) (with the change in the EBITDA ratio and the change in employment as dependent variables), (2.3)-(2.4), and (2.5) (using both the sample of firms that exited during 2014-2017 and the full sample) are reported in Table 3. We report two sets of results, with and without control variables. The estimates are virtually unchanged by the inclusion of controls. This invariance to the inclusion of controls — which is also a feature of Harasztosi and Lindner (2019) – means that the control variables are essentially orthogonal to the other variables, namely to PRCI. Panel A in Table 3 presents the estimates of a simpler version of those models, omitting FDF and the interaction from the list of explanatory variables. Again, the coefficient on PRCI — as well as its statistical significance — is hardly affected by this omission.

In columns (1) and (2) of Table 3 (Panel B) we report the estimates of coefficients γ_1 (coefficient on the PRCI), γ_2 (coefficient on the dummy variable for financial distress) and γ_3 (coefficient on the interaction of the two variables) of equation (2.2). The estimates of γ_1 and γ_3 are negative and statistically significant at the 1% significance level. In other words, the results indicate that minimum wage increases have a negative impact on profitability and that the effect is larger for financially distressed firms. In fact, since the estimated γ_3 (-16) is almost the double of γ_1 (-9), the effect of the minimum wage on profitability is almost three times more negative for financially distressed firms. Nevertheless, note that the estimated γ_2 is positive (15.0). This is related to the fact that those financially distressed firms that survive, improve their EBITDA ratio more than non- financially distressed firms. Not doing so would probably have forced those financially distressed firms to exit.

To understand the meaning of the estimates of γ_1 and γ_3, note that the average of the variable that measures treatment ($PRCI_{it}$) is around 0.05 for both financially distressed and non-financially distressed firms in 2013—recall Figure 2. Multiply this average by γ_1 and obtain -0.5. Therefore the model implies that, on average, the minimum wage increase in 2014 reduced the EBITDA ratio of a non-financially distressed firm by 0.5 p.p. Next add to -0.5 the product of γ_3 and 0.05, obtaining -1.2. Now the conclusion is that, on average, the EBITDA ratio of a financially distressed firm fell 1.2 p.p. as a consequence of the

minimum wage increase in 2014. Proceeding in the same way, the average estimated effect on profitability of increasing the minimum wage in 2015, 2016 and 2017 was -1.2, -2.3 and -2.8 p.p., respectively, in the case of non-financially distressed firms, and -3.8, -7.4 and -8.8 p.p. in the case of financially distressed firms.

Notice that we are looking at the average effect on profitability associated with the minimum wage increase, rather than to the marginal effect of increasing the minimum wage. There are two reasons for this choice of focus. First, the minimum wage is not an explanatory variable in our models. In our models, the explanatory variable, $PRCI$, measures the per cent variation in total cost that would occur if, in the current year, the firm adopted the next year's minimum wage (without making any other adjustment). The relation between this variable and the level of the minimum wage depends on the details of the firm's wage and cost structure. Second, given that in the period of our analysis (2013–2017) the Portuguese economy was still recovering from a severe crisis, one might question whether the economy was ready for a minimum wage raise, and what did the raise do to firms' financial condition. In other words, prior to the question of how much it should increase, there was the question of whether it should increase at all, which makes the no-increase case a natural reference point when assessing the impact.

Table 3: Profitability, employment and exit

	Profit		Employment		Exit (Logit)		Exit (LPM - A)		Exit (LPM - B)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					Panel A: Baseline					
PRCI	-9.8842***	-9.9816***	-3.9870***	-5.5859***	4.2621***	4.2169***	0.5652***	0.5631***	0.0420***	0.0421***
	(3.197)	(3.179)	(1.458)	(2.000)	(0.203)	(0.193)	(0.044)	(0.043)	(0.014)	(0.014)
					Panel B: Full specification					
PRCI	-9.3802***	-9.4769***	-3.7410***	-5.3030***	4.2181***	4.1676***	0.5513***	0.5489***	0.0400***	0.0400***
	(3.093)	(3.079)	(1.408)	(1.950)	(0.254)	(0.222)	(0.045)	(0.045)	(0.013)	(0.013)
FDF	15.0175***	14.9387***	-2.0298***	-2.1600***	0.2577***	0.2783***	0.0590***	0.0642***	0.0024	0.0027
	(0.987)	(0.988)	(0.685)	(0.721)	(0.070)	(0.073)	(0.022)	(0.022)	(0.004)	(0.004)
PRCI × FDF	-16.2153***	-16.3066***	-9.8711***	-11.0962***	0.5415	0.5893	0.2048***	0.2050***	0.0787***	0.0792***
	(2.994)	(3.026)	(1.669)	(1.942)	(0.335)	(0.370)	(0.056)	(0.056)	(0.013)	(0.013)

Notes: Standard errors are clustered at the firm level for models (1)-(4) and (7)-(10); for models (5) and (6) standard errors are computed by bootstrap. Significance levels: *, 10%; **, 5%; ***, 1%. The dependent variables are identified in each set of columns. Panel A reports estimates for a baseline model without the financial distress indicator and its interaction with PRCI; in Panel B those variables are included. LPM stands for Linear Probability Model. The estimations reported in columns (1), (3), (5) and (7) include additionally the following control variables: productivity, part-time workers, fixed-term workers, overtime labor, relative labor costs, exports weight, leverage ratio, short-term debt, long-term debt and the number of workers and its square. Results under Exit (Logit) are estimated by conditional logit while the remaining models account for firm unobserved heterogeneity using the fixed effects estimator. The number of observations is 31185 for columns (5), (6), (7) and (8). The number of observations is 368085 for the remaining estimations. The model Exit (LPM - A) is estimated with the same sample as the model Exit (Logit) model. The model Exit (LPM-B) is estimated with the same sample as the Profit and Employment models.

Equation (2.2) was also estimated with the per cent change in employment as the dependent variable. The corresponding estimates are in columns (3) and (4) of Table 3. The estimates are statistically significant at the 1% significance level, and the estimated γ_1 and γ_3 are negative. Thus, increases in the minimum wage depress employment growth, especially in the case of financially distressed firms. In the case of employment growth, the average effect in 2014, 2015, 2016 and 2017 is, respectively, -0.2, -0.5, -1.0, and -1.1 p.p. for non-financially distressed firms, and -0.7, -2.0, -3.9 and -4.7 p.p. for financially distressed firms. These results, as well as those for profitability, show that the impact of the minimum wage increases rose over time. This is not unexpected, for one effect of each minimum wage increase has been to augment the concentration of workers on, or close to, the minimum wage level, and these workers are those that will be affected by the next minimum wage increase. In addition, note that γ_2 is now negative: financially distressed firms record lower employment growth than non-financially distressed firms with the same characteristics. This may be part of their strategy to improve performance.

The estimates in columns (5) and (6) of Table 3 — regarding parameters β_1, β_2 and β_3 of the logit model in equation (2.4) — indicate that an increase in the minimum wage does raise the probability that firms exit ($\beta_1 > 0$). As was the case for employment growth and the EBITDA ratio, the magnitude of the impact (in this case, on the argument of the probability of death function) of the minimum wage increase is larger for financially distressed firms ($\beta_3 > 0$). However, using robust (bootstrap) standard errors this coefficient is not statistically significant at the 10% significance level.

Assume that the firm has a zero fixed effect ($\eta_i = 0$) and ignore controls (as remarked above, the estimates do not change much). Under these conditions, for non-financially distressed firms ($FDF_{i,t} = 0$), the impact of a minimum wage increase on a firm's probability of exit is given by the difference between the probability of exit when there is a fraction of workers affected by the future minimum wage increase ($PRCI_{it} > 0$) and the probability of death when there is no minimum wage increase in the following year ($PRCI_{it} = 0$). Mathematically, this difference is given by

$$\Delta_{non}(PRCI_{it}) = \lambda\left(\beta_1 PRCI_{it}\right) - \lambda(0) \tag{2.6}$$

For financially distressed firms ($FDF_{i,t} = 1$), the impact of a minimum wage increase is

$$\Delta_{full}(PRCI_{it}) = \lambda\left[\left(\beta_1 + \beta_3\right) PRCI_{it} + \beta_2\right] - \lambda(\beta_2) \tag{2.7}$$

If we continue to take the logit model literally, the impact of the minimum wage increase may be represented by the diagram in Figure 3. In terms of Figure 3, $\lambda(0)$ corresponds to 'non-FDF & no Treatment', $\lambda\left(\beta_1 PRCI_{it}\right)$ to 'non-FDF & Treatment', $\lambda(\beta_2)$ to 'FDF & no Treatment', and $\lambda\left[\left(\beta_1 + \beta_3\right) PRCI_{it} + \beta_2\right]$ to 'FDF & (full) Treatment'. In Figure 3 there is another curve, 'FDF & (simple) Treatment', which represents the function $\lambda\left(\beta_1 PRCI_{it} + \beta_2\right)$. This is the effect on a hypothetical financially distressed firm in the case when increases in the minimum wage impact both financially and non- financially distressed firms in the same way, i.e. when $\beta_3 = 0$. For this hypothetical firm, the effect is

$$\Delta_{simple}(PRCI_{it}) = \lambda\left(\beta_1 PRCI_{it} + \beta_2\right) - \lambda(\beta_2) \tag{2.8}$$

Note that in Figure 3 the variable on the horizontal axis is the treatment variable ($PRCI$). Thus, the vertical difference between the 'non-FDF & Treatment' and the 'non-FDF & no Treatment' curves gives $\Delta_{non}(PRCI)$; $\Delta_{full}(PRCI)$ is the vertical difference between the 'FDF & (full) Treatment' and the 'FDF & no Treatment' curves; and $\Delta_{simple}(PRCI)$ is the vertical difference between the 'FDF & (simple) Treatment' and the 'FDF & no Treatment' curves. The vertical lines in Figure 3 identify the average $PRCI_{it}$ for financially distressed firms in each year in our sample (2013–2016), i.e., they correspond to 'PRCI (FDF)' in Figure 2. The average treatment for non-financially distressed firms in 2013 and 2014 is similar to that of financially distressed firms, in 2015 is 0.25 and in 2017 is 0.29, which is the average for financially distressed firms in 2015. Consequently, to avoid cluttering the plot, we did not draw additional lines to represent the average values for non-financially distressed firms in Figure 3.

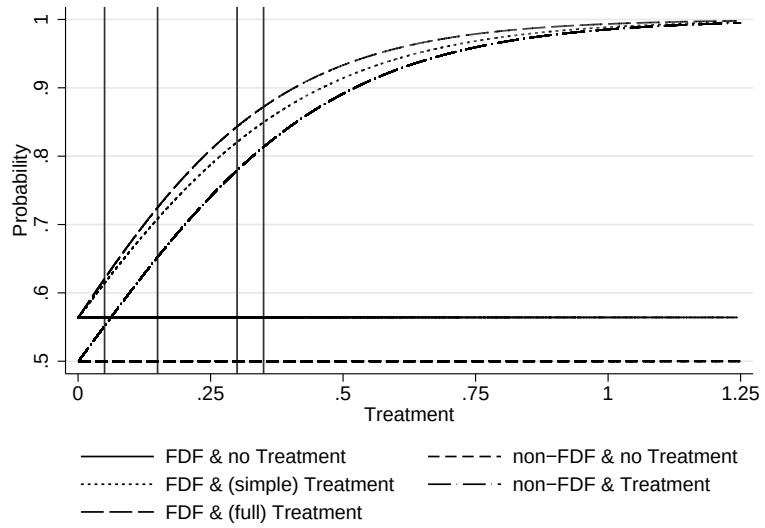


Figure 3: Minimum wage PRCI treatment effects

Thus, on average, the minimum wage increase in 2014 (treatment in 2013) led to the probability of exit rising five percentage points — see Table 4. The estimated average impact rises over time to about 30 percentage points in 2017. The variations for financially distressed firms are a bit higher than for non-financially distressed firms, namely in later years. It is also visible in Figure 3 that the additional impact on financially distressed firms ($\beta_3 > 0$) led to the probability of exit rising by a relatively low amount; unsurprising given that β_3 is not statistically significant. This additional effect is about half of a percentage point in 2014, one percentage point in 2015, two in 2016 and three in 2017. Obviously, these results are conditional on the fixed effect equaling zero; on other points of the curve, the impacts will be different. These results are also conditional on the logit functional form.

As an alternative to the logit functional form, in columns (7) and (8) of Table 3 we report the estimates obtained using the linear probability model, estimated in the same sample as the logit model, i.e., the

sample of firms that did exit during 2014-2017. The coefficients are all positive and statistically significant at the 1% significance level. Hence, qualitatively the results are the same as in the logit model, with the added significance of the interaction term. Quantitatively, the change in the probability of exit assigned to the minimum wage rise is a bit lower than in the logit model — see the mid-section of Table 4. This is especially so for non-financially distressed firms, for which this model estimates impacts that are not much higher than half of the logit estimates. Nevertheless, the magnitude of the average impact is still reasonably large, reaching 16 p.p. in 2016. For financially distressed firms, the linear model also produces lower estimates of the average impact than the logit model, but the difference is relatively small (less than 6 p.p.). In short, the linear probability model attenuates the magnitude of the average impact of the minimum wage increases, but is in line with the conclusions derived from the logit model.

Table 4: Impact on the probability of exit (%) of the average firm

	2013	2014	2015	2016
Logit				
Non-FDF	5.0	13.4	24.5	27.5
FDF	5.6	15.9	27.3	30.4
LPM – A (firms that exited)				
Non-FDF	2.6	7.2	14.0	16.2
FDF	3.7	11.1	21.9	25.9
LPM – B (all firms)				
Non-FDF	0.2	0.5	1.0	1.2
FDF	0.6	1.7	3.4	4.1

Notes: The numbers are the difference in the probability of exit between a firm with a value for the treatment variable equal to the average of that variable for the same category of firms (non-FDF or FDF) in each year, and a firm with the same characteristics but a zero value for the treatment variable. "Logit" uses the estimates in column (5) of Table 3. "LPM - A" and "LPM - B" use the estimates in columns (7) and (9), respectively.

We also estimated the linear probability model on the full sample of firms. The results are in columns (9) and (10) of Table 3. Extending the sample to include the firms that did not exit during 2014-2017 makes some difference. First, the dummy for financially distressed firms is no longer statistically significant. Second, and more importantly, the attenuation effect detected above is now much stronger — see the lower section of Table 4. The estimated average impact is now in the range $0.2 - 1.2$ for non-financially distressed firms, and in the range $0.6 - 4.1$ for financially distressed firms. Nevertheless, the conclusion that the minimum wage rises increased the probability of death still holds.

The positive impact of minimum wage increases on the probability of exit contributed to accelerate the

insolvency of less productive firms. In Table 5, we report productivity and profitability statistics, by class of firms and year, for firms that survived and for firms that exited the market. The statistics for productivity show that the firms that exited the market tended to be much less productive than the firms that survived. Therefore, our results suggest that minimum wage policies might have produced a cleansing effect, as in Mayneris et al. (2018), contributing to improve aggregate productivity.

Table 5: Productivity and profitability by exit and financial status

Year		2013		2014		2015		2016	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
Productivity (Euro per hour)									
Non-Exited	All	16.16	10.80	16.33	11.10	20.77	11.71	17.92	12.15
	Non-FDF	16.74	11.13	17.02	11.47	21.50	12.03	18.36	12.39
	FDF	5.57	4.74	4.19	4.67	4.47	4.83	5.51	5.14
Exited	All	9.21	6.48	9.89	6.68	12.67	7.56	12.91	8.86
	NonFDF	12.83	7.38	12.34	7.51	14.22	8.32	14.41	9.58
	FDF	-11.18	2.97	-3.59	2.59	2.04	2.51	-0.74	2.93
Profitability (%)									
Non-Exited	All	1.91	4.97	2.76	5.50	4.98	6.14	6.14	6.51
	Non-FDF	3.66	5.42	4.56	6.01	6.38	6.56	7.23	6.86
	FDF	-29.87	-16.65	-28.98	-14.95	-26.29	-13.77	-24.58	-13.08
Exited	All	-22.76	-6.71	-22.09	-4.85	-14.70	-0.41	-8.37	2.37
	NonFDF	-18.15	-1.59	-17.04	-0.02	-9.86	1.69	-4.72	3.62
	FDF	-48.71	-31.86	-49.78	-29.45	-47.69	-30.96	-41.48	-27.82

Source: QP & SCIE. The number of observations for the year 2013, 2014, 2015 and 2016 is, respectively, 99790, 94146, 89145 and 85004.

As a robustness check we estimated the models in Table 3 adding interactions between FDF and the control variables. The estimates of these robustness checks corroborate the conclusions of the paper. The main results of the paper are also robust to different definitions of financially distressed firms, namely the ones discussed in Section 2.2. In other words, the results are not dependent on a specific, narrower definition of financial distress. As another robustness check, we estimated Equation (2.2) omitting the observations for firms that exited in $t+1$. Our main conclusions are not affected: $PRCI$ has a statistically significant negative impact on profitability, although the interaction with FDF is not statistically significant in this version. The estimates corroborate the conclusion that $PRCI$ and FDF have a negative impact on employment and that FDF amplifies the effect of $PRCI$. Finally, note that, to preempt endogeneity issues, all explanatory variables are lagged relative to the dependent variables: the dependent variables represent changes from t to $t+1$, while the explanatory variables concern period t. Nevertheless, we also estimated the models with FDF lagged one period, which did not change our conclusions.

2.4 Conclusion

In this paper, we evaluated the impact of significant and consecutive minimum wage increases in the Portuguese economy since 2014. Our estimates suggest that minimum wage policies had a negative impact on profitability and employment. Additionally, the results indicate that the impact was magnified for financially distressed firms. The financial vulnerability of those firms also lowered their ability to survive following the increase in wage costs.

These results contribute to a better understanding of the impact of minimum wage policies on firms. So far, most studies of the impact of minimum wage policies have been focused on employment and other dimensions of labor markets. This paper presents evidence that minimum wage policies affect the financial situation of firms and their survival. Therefore, these are issues that policymakers should bear in mind when setting new floors for wages.

The assessment of minimum wage policies in Portugal, since 2014, carried out in this paper suggests that the negative impact on employment and profitability may have been compensated for the economy as a whole by the expansionary phase of the business cycle. On the other hand, our results also suggest that minimum wage policies might have had a supply side effect. The exit of lower productivity firms caused by the increase in wage costs might have worked as a cleansing effect, contributing to higher aggregate productivity.

The impact of the COVID-19 pandemic crisis and Governments' intervention to support firms revived the issue of zombie firms. The ECB's 2021 Financial Stability Review calls the attention to the risks of inefficient insolvency frameworks, which might contribute to an increasing share of zombie firms in the economy. Our results suggest that minimum wage increases might work similarly to the "high-pressure economy" zombie firms selection mechanism advocated by Gagnon (2021): in a "high-pressure economy", only non-zombie firms will be able to pay the wages required to retain and attract workers.

Therefore, the channels through which productivity may benefit from minimum wage policies deserve further investigation, namely by analyzing the reallocation of resources from the firms that exit the market to new or incumbent firms.

3

Regional heterogeneity of the impact of a national minimum wage policy on inequality

3.1 Introduction

This paper investigates how minimum wage policies have affected wage inequality in the Portuguese economy during the period of 1998 to 2021 using the regional and occupational heterogeneity exposure to minimum wage.[1] Minimum wage policies have been one of the main instruments in developed countries to reduce inequality and poverty, especially among women and young people. While the main focus of the literature has concerned the impact of minimum wage increases on employment, and more recently on the impact on firms' financial conditional – see Alexandre, Bação, et al. (2022) for a detailed discussion of the literature around the impact of minimum wage policies on firms' financial conditional, as well as a discussion about the policy goals of the minimum wage in Portugal.

The impact of the minimum wage on inequality is a well-researched topic, with several works already highlighting the importance of minimum wage policies to reduce inequality. Refer, for example, to DiNardo et al. (1996), D. Lee (1999), Teulings (2003), Neumark et al. (2004), Autor et al. (2016), Cengiz et al. (2019) for the United States; Dickens and Manning (2004) and Machin and Van Reenen (2008) for the United Kingdom; Bosch and Manacorda (2010) for Mexico. With the exception of Dickens and Manning (2004) that find small impacts of the minimum wage on inequality, all these papers present evidence that the minimum wage is a key factor in decreasing inequality. Oliveira (2023) shows that minimum wage increases in Portugal have significantly reshaped wage distribution and reduced inequality. Other works on the impact of minimum wage policies in the Portuguese labour market include S. C. Pereira (2003), Portugal and Cardoso (2006), Centeno et al. (2014) and Alexandre, Bação, et al. (2022).

Similarly to other developed countries, the Portuguese labour market observes a single statutory minimum wage common to all regions. Several papers explore this regional dimension of common national minimum wages, see for example, Caliendo and Wittbrodt (2022), Ahlfeldt et al. (2018) and Garloff (2019) for Germany, and Robinson (2005) for Britain. Card (1992) for the USA also explore heterogeneous effects

[1] This chapter is co-authored with Fernando Alexandre and Miguel Portela.

at the regional level, although a single statutory minimum is not in effect.[2] These papers conclude that higher regional exposure to the minimum wage, for example by how large the minimum wage 'bite' is, seems to be associated with stronger minimum wage effects on reducing the gender gap (Caliendo & Wittbrodt, 2022; Robinson, 2005), reducing between-regions wage disparities (Ahlfeldt et al., 2018), higher growth in employment and unemployment rates (Garloff, 2019) and increasing wages for young workers without a penalty in employment and school enrolment (Card, 1992).

Between 1998 and 2021, the Portuguese labour market experienced two periods of rapid real minimum wage growth, between 2007 and 2011, and between 2014 and 2021, with average real growth rates of 3.6% and 3%, respectively. This minimum wage policies affected the Portuguese regions in an asymmetrical way, with the gap in minimum wage incidence between regions increasing, and the within-region wage compression not following the same trend, predominantly between the Lisbon region and the remaining regions.

We use an empirical approach similar to that used by D. Lee (1999) and Autor et al. (2016). The richness of our data, which contains information on workers, their occupations, wages, and regional locations, enables us to improve the identification of the effects of minimum wage policies. We take advantage of regional and occupational heterogeneity in the incidence of the minimum wage to assess how changes in the national minimum wage impact wage inequality. To the best of our knowledge, no previous work relates minimum wage with inequality, exploring a regional/occupational dimension. See J. Pereira and Galego (2014) and Ribeiro et al. (2022) for works that explore regional effects on wages for the Portuguese economy.

The primary findings of this paper are as follows. First, wage inequality is lower in region/occupation pairs with a higher exposure to the minimum wage. Second, a decrease in the gap between the minimum and median wage is associated with a reduction in inequality. Third, the impact of minimum wage policies on inequality is stronger for minimum wage binded region/occupation pairs. Fourth, the reduction in region/occupation inequality is stronger in regions with higher minimum wage incidence. Finally, our analysis shows that the impact on wage inequality becomes more pronounced as the difference between the minimum and median wage decreases, particularly for lower wage percentiles.

This paper is structured as follows. Section 3.2 presents an overview of the Portuguese labour market, as whole and at the regional level, regarding the minimum wage and inequality between 1998 and 2021. Section 3.3 presents the empirical strategy used, the dataset, and results. Section 3.4 concludes.

3.2 Wage and regional inequality in 1998-2021: an overview

In this section, we first describe the evolution of the minimum wage incidence and wage distribution in the Portuguese economy from 1998 to 2021, as well as characterize the Portuguese NUTSII regions in terms

[2] Xing and Xu (2016) analyses the factors contributing to different regional minimum wages in China.

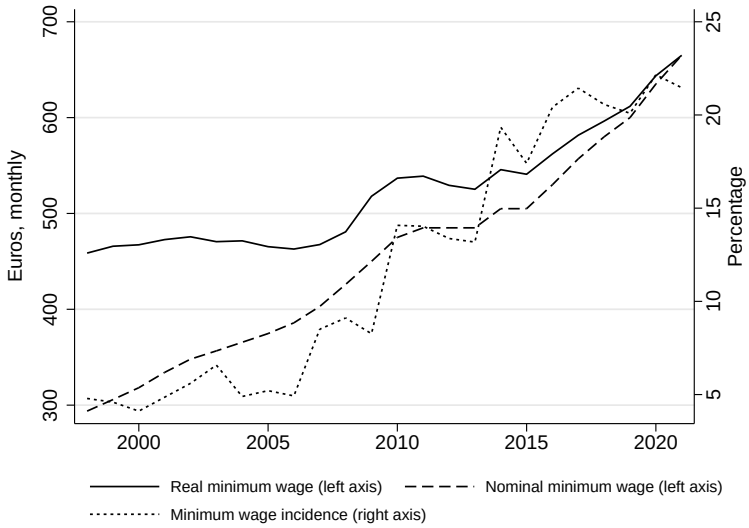


Figure 4: Minimum wage in the Portuguese economy, 1998 – 2021

of wealth, wages and inequality.[3] To measure the evolution of wage inequality in the private sector, we examine several wage percentile ratios. From 1998 to 2006, the monthly real minimum wage remained relatively steady at around €460, as shown in Figure 4.[4] Since 2006, except for the interruption during the Portuguese debt crisis from 2012 to 2014, the real minimum wage saw a growth of over 44%, reaching €665 in 2021. This rise in the minimum wage led to a substantial increase in the incidence of minimum wage earners, from approximately 4.9% in 1998 to 21.5% in 2021, peaking at 22.2% in 2020 – see Figure 4.

Concurrent with the growth of the real minimum wage post-2006, we observe a compression in the wage distribution, indicative of a substantial reduction in the gap between wage percentiles. Figure 5 reveals that between 1998 and 2006, the ratios of the 50^{th} to 25^{th}, 50^{th} to 20^{th}, and 50^{th} to 10^{th}, wage percentiles did not demonstrate any distinct trends. However, post-2006, there was a marked compression, with the P50/P10 decreasing from 1.47 in 2007 to 1.2 in 2021. Indeed, the P50/P20 also reached 1.2 in 2021, showing a complete compression of the wage distribution at these percentiles. This coincidence drives our investigation into the causal relationship between the increase in the minimum wage and the reduction in wage inequality.

Despite a common national minimum wage, Portugal has highly asymmetric regions in terms of wealth – see Alexandre, Costa, Portela, and Rodrigues (2021) for a detailed discussion of the regional economic dynamics of the Portuguese regions. Figure 6[5] shows the GDP *per capita* of the Portuguese Nomenclature of Territorial Units for Statistics (NUTS)II regions in 2000 and 2021. The main source of heterogeneity comes from the Lisbon region in relation to the rest of the country, with its GDP *per capita* being 39.5%

[3]Calculating the minimum wage incidence before 1998 is not straightforward, given that multiple minimum wages and weekly working hours were in effect until 1998.

[4]Minimum wage information is provided by the MTSSS. Nominal values are deflated with the Consumer Price Index (CPI) from the Bank of Portugal.

[5]GDP data is from Eurostat. Values are deflated using the GDP deflator from the Bank of Portugal.

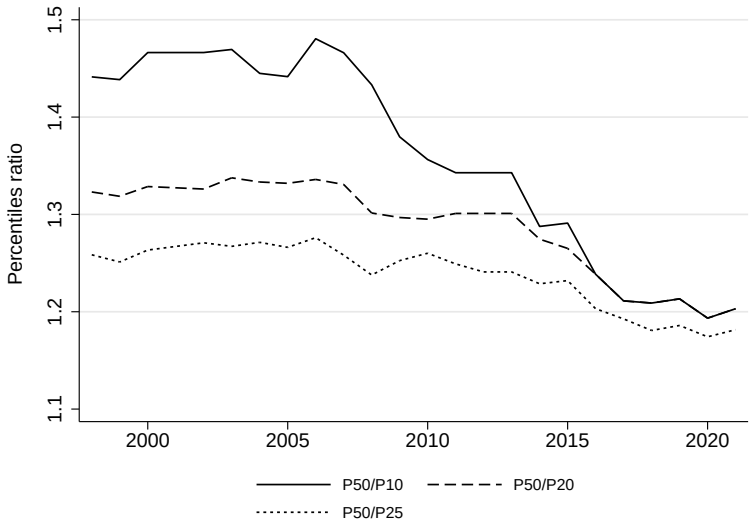
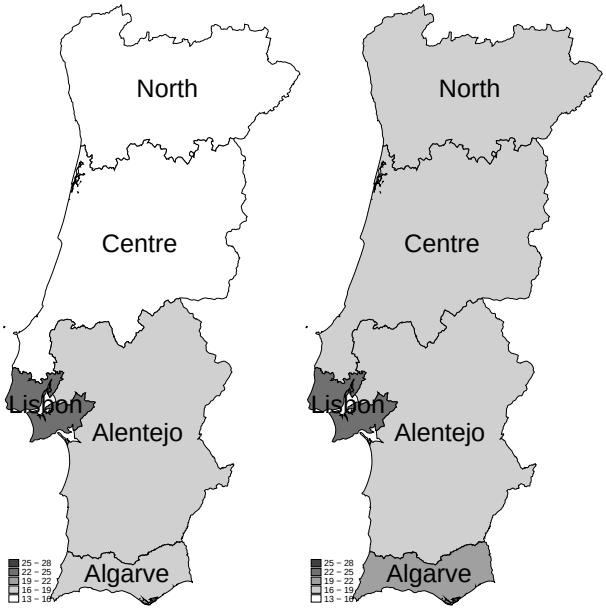


Figure 5: Wage percentile ratios, 1998 – 2021

higher than the next richest region in 1998, although this gap decreased significantly to 25.9% in 2021. Although there is a clear large gap between the Lisbon region and the rest, we also observe differences in wealth between the remaining regions of around 29% and 16% in 2000 and 2021, respectively, between the richest (excluding Lisbon) and the poorest.

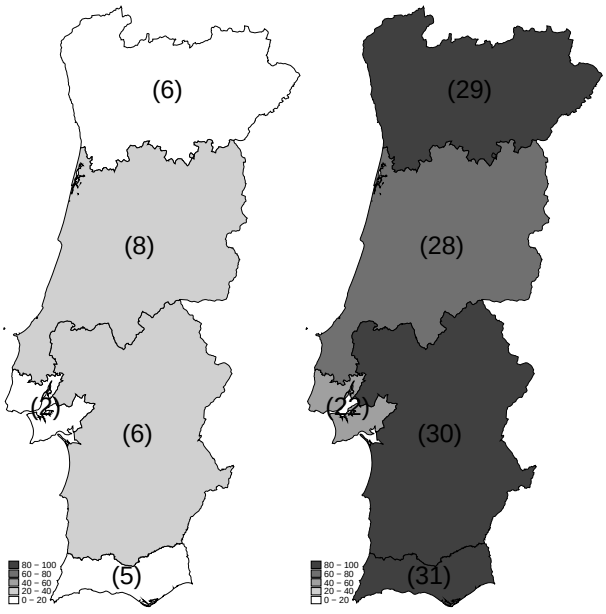
This highly asymmetric level of regional wealth combined with the same minimum wage policies results in different levels of impact of these policies. We measure the reach that the minimum wage has in each region by pairs of region/occupation that are minimum wage binded. We define a region/occupation pair as 'minimum wage binded' when its 10^{th} percentile wage matches the national minimum wage. For instance, in 2017, the 10^{th} percentile of "Business and administration associate professionals" in the Lisbon region, Portugal's wealthiest region, earned €3.64 hourly (8.33% above the minimum wage), while in the Centre region, it was equal to the minimum wage. Hence, we define the pair "Centre region/Business and administration associate professionals" as binded. Figure 7[6] presents the share of employment present in binded region/occupation pairs in each region in 1998 and 2021, the first and last years present in our dataset, as well as the number of occupations considered binded – see section 3.3 for a detailed discussion of the data. As a result of the real minimum wage increases, the share of employment in binded region/occupation pairs rose significantly. In 1998, the Lisbon region had the lowest share of employment in binded region/occupation pairs at 8%, while the highest value was 27% for the Alentejo region. These values reached 52% and 88% in 2021, respectively, although the highest value was now held by Algarve. This increase in minimum wage earners was not restricted to a small number of occupations. Table 6 reports the number of non-binded and binded region/occupation pairs for 1998 and 2021. In 1998, there were an average of 5.4 binded occupations on all regions, reaching an average of 28 in 2021, from a total of 39. This increase in binded occupations shows that not only the increases

[6]Values in parentheses represent the number of binded occupations in the region/occupation pair.



(a) Year: 2000 (b) Year: 2021

Figure 6: GDP *per capita* (Euros in thousands, 2016 prices)



(a) Year: 1998 (b) Year: 2021

Figure 7: Employment in binded occupations (%)

in minimum wage exposed more workers from occupations at the lower end of the wage distribution but as well workers from occupations not previously exposed.

Furthermore, Table 6 also presents the differential between the logs of the 50^{th} hourly wage percentile and the minimum wage for each region/occupation pair and binded status. We observe a considerable compression of wages in all regions in this period, especially for binded occupations. In 1998, with the

Table 6: Descriptive statistics of region/occupation pairs

	N occupations		log(P50) - log(MW)		
	Binded	non-Binded	Binded	non-Binded	All
Panel A: 1998					
North	6.00	32.00	0.12	0.34	0.31
Centre	8.00	30.00	0.14	0.40	0.34
Lisbon	2.00	36.00	0.25	0.66	0.62
Alentejo	6.00	32.00	0.13	0.40	0.32
Algarve	5.00	33.00	0.15	0.37	0.35
Panel B: 2021					
North	29.00	10.00	0.07	0.73	0.12
Centre	28.00	11.00	0.08	0.47	0.12
Lisbon	22.00	17.00	0.10	0.71	0.30
Alentejo	30.00	9.00	0.08	0.38	0.11
Algarve	31.00	8.00	0.11	0.57	0.13

Notes: Wages are reported as real hourly wages. Binded are pairs region/occupation that are minimum wage binded. 'P50' stands for wage percentile 50. 'MW' stands for minimum wage. 'N occupations' stands for the number of region/occupation pairs.

exception of the Lisbon region, there was a difference between 31% and 35% in the median and minimum wage at the regional level, when considering all workers. Lisbon observed almost twice the difference between its median and minimum wage, being around 62%. In 2021, this difference reduced considerably to around 30% in Lisbon and 12% for the rest of the regions. For binded occupations, the gap between median and minimum wage was already considerably small in 1998 at around 13%, with Lisbon having a considerably larger value of 25%, indicative of a larger within-occupation inequality. However, it is worth noting that only two occupations were considered binded in 1998 for the Lisbon region. In 2021, we see a smaller and homogeneous levels of this difference. In fact, the Algarve region presents the highest gap in median to minimum wage at 11%. Finally, in non-binded occupations we observe an overall increase in inequality. This happens in large part because the lowest paid non-binded occupations in 1998 changed status to binded, thus in 2021 a very restricted number of occupations are being considered.

Figure 8 presents the minimum wage incidence for each NUTSII region between the period 1998 and 2021. In 1998, the minimum wage incidence was relatively low, with only two regions having a minimum incidence above 6%. This low values of minimum wage incidence prevailed in the Portuguese labour market until 2006, with the differential between the with highest and lowest minimum wage incidence regions being around 4 percentage points (pp). From 2007 to 2011 and from 2014[7] to 2021, the real minimum wage increase rapidly – see Figure 4, resulting in the minimum wage incidence to increase for

[7] Although the national minimum wage was frozen between 2011 and October of 2014, we consider the updated 2014 value in our data, as the report for our data refers only to the month of October of each year.

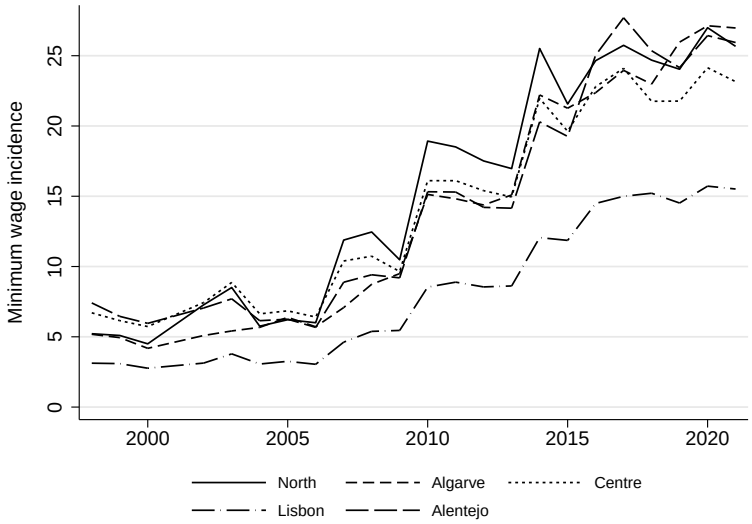


Figure 8: Minimum wage incidence by region, 1998 - 2021

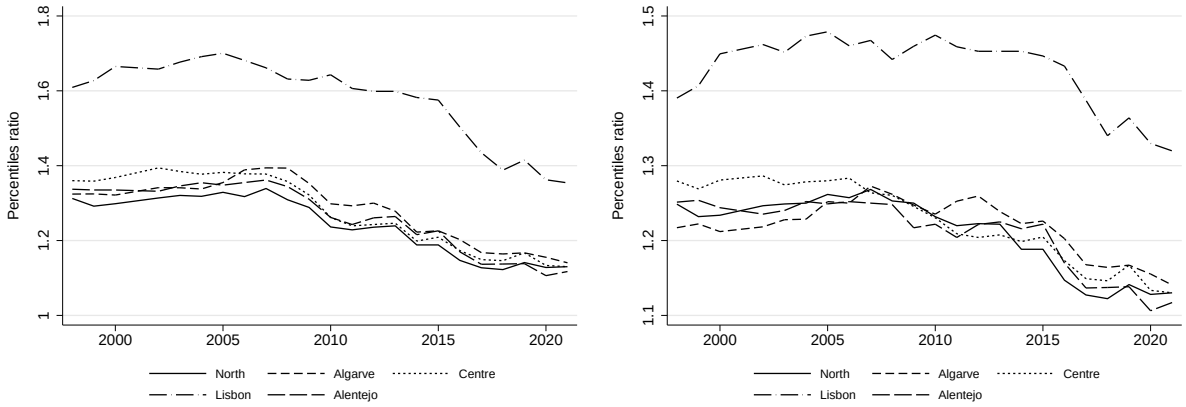
all regions, although at different rates. Thus, the gap in minimum wage incidence between between lowest and highest incidence regions increased to around 11 pp, with the Algarve and Lisbon regions observing a minimum wage incidence of 27% and 16% in 2021, respectively.

Figure 9 presents the compression of wages at the lower end of the distribution for all regions, measured by the ratios between the median wage and the 10^{th} percentile, and the median wage and 20^{th} percentile. Panel (a) of Figure 9 shows a similar regional trend as in Figure 8, with the wage compression being stable from 1998 until 2006, followed by two different periods of increasing compression between the 50^{th} and 10^{th} percentiles. The difference between the highest a lowest compressed regions decreased during this period, with the Lisbon and North regions having a ratio of around 1.6 and 1.31, respectively, in 1998, to the Lisbon and Alentejo regions having a ratio of around 1.35 and 1.12, respectively, in 2021. Thus, this gap decreased from around 0.3 points in 1998 to 0.23 points in 2021. Although the overall trend is similar in Panel (b), tree main aspects are evident. First, the ratio between the 20^{th} and 50^{th} increased in the first years of the analysis for the Lisbon region, while for all others it remained stable. Second, while the wage compression started to increase after 2006 of all others, the Lisbon region remained stable until 2014, implying that this 'high wage region' was, at first, less affected by the minimum wage. Third, contrary to what was observed in Panel (a), the gap between the highest and lowest compressed regions increased, although by a small amount, from 0.17 points in 1998 to 0.19 points in 2021.

3.3 Empirical analysis

3.3.1 Data

The data is derived from a LEED, specifically, the QP, (INE, Statistics Portugal, 2018a), gathered by the MTSSS through a compulsory annual survey. The QP database provides detailed worker-level data on all



(a) P50/P10

(b) P50/P20

Figure 9: Wage percentile ratios by region, 1998 - 2021

workers employed by firms with at least one wage earner, along with firm-level information.[8] In 2021, the QP reported information on 282,736 firms and 3,132,695. We restrict our analysis on dependent workers, workers with a full pay scheme, full time workers, workers in mainland Portugal and workers between 18 and 65 years old, resulting in our data containing 220,669 firms and 2,125,971 workers in 2021. We use information on worker's wage, hours worked, age, and occupation for the five NUTSII regions in Portugal mainland for the period 1998–2021.[9] We categorize occupations using the two-digit International Standard Classification of Occupations (ISCO-08) classification[10]. Cohorts are defined by the worker's birth decade. Wages are adjusted to 2021 prices using the CPI from the Bank of Portugal.

3.3.2 Econometric strategy

Our empirical strategy closely follows the specifications used by D. Lee (1999) and Autor et al. (2016). These papers regress the differential between the 10^{th} and 50^{th} wage percentiles on the differential between the minimum wage (state or federal) and the median wage in the USA. Autor et al. (2016) enhances Lee's model by using an instrumental variable strategy to correct for biased estimates due to measurement errors and transitory shocks. Similarly, we base our econometric strategy on Lee's specification to evaluate the impact of minimum wage changes on inequality. However, our worker-level data allows us to implement an identification approach that explores differences in occupational wage levels across regions due to significant regional income inequality (e.g., Alexandre, Costa, Portela, and Rodrigues, 2021). Despite all regions being subject to the same national minimum wage, the regional

[8] Central administration, regional and local entities, and public institutions, as well as firms in activities of private households, are excluded from the analysis.

[9] Data is not available for the year 2001.

[10] A conversion of the Portuguese occupations classification is needed from 1998 to 2009, as this classification only matches the ISCO-08 classification from 2010 onwards. This results in the classification only having 38 categories in the period 1998–2009 and 39 categories in the period 2010–2021. A list with all 39 categories can be found in Appendix A.

variation of occupational wages enables us to improve our estimation of the impact of the minimum wage on inequality. That is, our identification approach explores the heterogeneity in the incidence of minimum wage across local labour markets.

Our econometric model is specified as follows:

$$\begin{aligned} W^{10}_{i,k,c,t} - W^{50}_{i,k,c,t} &= \beta_1 Binded_{i,k,t} + \beta_2(MW_t - W^{50}_{i,k,c,t}) + \beta_3(MW_t - W^{50}_{i,k,c,t})^2 \\ &+ \beta_4(MW_t - W^{50}_{i,k,c,t}) \times Binded_{i,k,t} + \beta_5(MW_t - W^{50}_{i,k,c,t})^2 \times Binded_{i,k,t} \\ &+ \eta_i + \lambda_k + \psi_c + \gamma_t + \varepsilon_{i,k,c,t} \end{aligned} \tag{3.1}$$

where, following D. Lee (1999), the dependent variable, $W^{10}_{i,k,c,t} - W^{50}_{i,k,c,t}$, represents the differential between the logs of the 10^{th} and 50^{th} percentile hourly wages for NUTSII region i, occupation k, cohort c, in year t.

Equation (3.1) contains two explanatory variables of interest. On the one hand, we consider the differential between the log of the hourly national minimum wage at time t, MW_t, and the median wage at the NUTSII region i, occupation k, cohort c, and year t, $MW^{50}_{i,k,c,t}$. On the other hand, we include a binary indicator that equals 1 for pairs region/occupation that are minimum wage binded, $Binded_{i,k,t}$ – see section 3.2 for the definition and discussion on pairs region/occupation that are minimum wage binded.

The model includes a second-order polynomial on $MW_t - W^{50}_{i,k,c,t}$ to capture non-linearities in the effect of the change in the national minimum wage on inequality. The interaction terms between the variable $Binded_{i,k,t}$ and $MW_t - W^{50}_{i,k,c,t}$ and its square capture whether the impact of a national minimum wage increase on wage inequality differs between $Binded$ and non-$Binded$ region/occupation pairs. This interaction captures how the effects of minimum wage changes differ across local labour markets within each occupation.

Figure 10 motivates the inclusion of cohort fixed effects, ψ_c. The Portuguese labour market presents a negative relation between experience and years of education, where the older cohorts have high average levels of experience but very low average number of years of formal education, while young cohorts present the opposite relation. This two factors are identified both by D. Lee (1999) and Autor et al. (2016) as important determinants of the impact of the minimum wage. Therefore, the inclusion of cohort fixed effects allows to address this relation particular to the Portuguese economy among developed countries, due to faster pace of the educational progress and an initial lower starting point – see OECD (2022). Finally, η_i, λ_k, and γ_t denote NUTSII, occupation, and time fixed effects, respectively, while $\varepsilon_{i,k,c,t}$ is a white noise error term.

The estimation of equation (3.1) enables us to address the following questions: (1) How does wage inequality differ between binded and non-binded region/occupation pairs? (2) What is the impact of a national minimum wage increase on the wage distribution? (3) How does the magnitude of this impact vary between binded and non-binded region/occupation pairs?

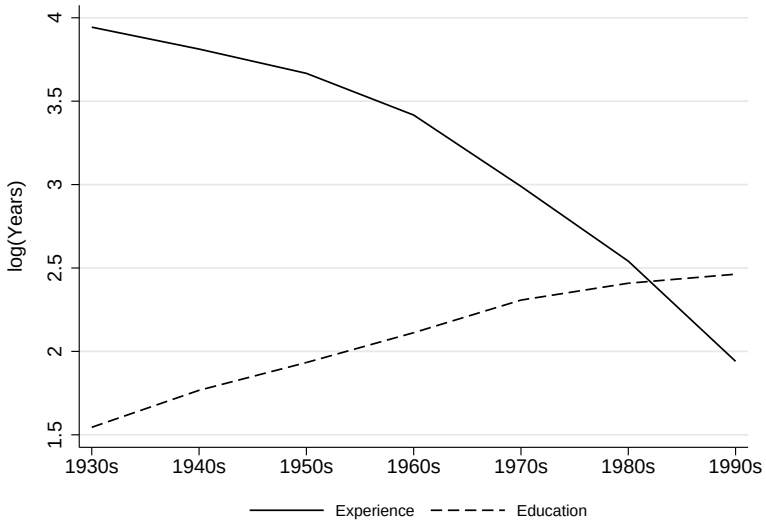


Figure 10: Average log years of potential experience and formal education by decade of birth

3.3.3 Results

The results of our estimations are presented in Table 7. Firstly, we perform a simple regression where we only include the binded status, along with the fixed effects. Column (1) shows that inequality is 6% lower in $Binded$ region/occupation pairs. Next, we estimate a specification where we use, instead, $MW_t - W^{50}_{i,k,c,t}$ and its square to quantify the treatment induced by minimum wage changes – column (2). We conclude that reductions in the gap between the minimum and median wage correlate with decreases in occupational wage inequality. Our results corroborate the findings of D. Lee (1999), Autor et al. (2016), and Oliveira (2023) regarding the impact of minimum wages on inequality. For a gap of 50%, a 1% reduction in the gap between the minimum wage and median wage results in a 0.74% decrease in occupational wage inequality. The positive estimate associated with the quadratic term indicates that the impact of minimum wage changes on inequality becomes more pronounced as the gap between the minimum wage and the median wage narrows. For instance, when considering an average gap of 20%, the elasticity is now 0.87%, implying a variation of 0.13 pp. The difference is statistically significant at the 1% significance level.

In column (3), we report the estimation results for the full specification defined in equation (3.1). The estimates confirm our previous findings. We conclude that the effect of minimum wage increases on wage inequality is stronger for $Binded$ region/occupation pairs. For example, if we consider a minimum to median wage gap of 50%, the elasticity for non-$Binded$ pairs is 0.71, whereas for $Binded$ pairs this value is 0.98%, a difference of 0.27 pp (statistically significant at the 1% significance level). Given a gap of 25%, the elasticity for the $Binded$ group stands at 1.04%, while for the non-$Binded$ group, it increases to approximately 0.80%, marking an increment of about 0.09 pp. Figure 11 encapsulates these findings, illustrating how the disparity in elasticity between $Binded$ and non-$Binded$ pairs attenuates as the gap between the minimum and the region/occupation pair's median wage decreases – see Panel (a) of Figure

Table 7: Regression estimates for within-region-occupation inequality

	$W^{10} - W^{50}$			$W^{20} - W^{50}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$Binded$	0.0599***		0.0246	0.0016		0.0134
	(0.003)		(0.019)	(0.011)		(0.011)
$MW - W^{50}$		0.9592***	0.8880***		0.6915***	0.6415***
		(0.037)	(0.051)		(0.032)	(0.035)
$[MW - W^{50}]^2$		0.2177***	0.1730***		0.1933***	0.1537***
		(0.015)	(0.021)		(0.016)	(0.016)
$[MW - W^{50}] \times Binded$			0.2018**			0.2659***
			(0.045)			(0.024)
$[MW_t - W^{50}]^2 \times Binded$			-0.0667*			-0.0251
			(0.027)			(0.027)

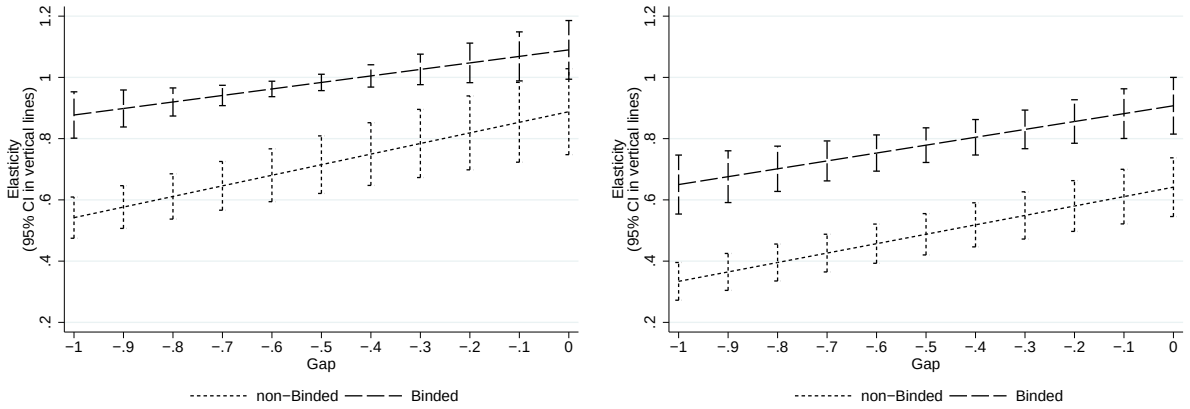
Notes: clustered standard errors at the NUTS2 level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Decade of birth, NUTS II and year dummies are included. The number of observations is 24262.

11.

The second part of Table 7 and Panel (b) in Figure 11 present the results of our analysis replicating the study using the difference between the 20^{th} and 50^{th} percentiles as the measure of inequality. The findings yield two insights. Firstly, our previous conclusions are validated, highlighting the spillover effects as the observed impacts extend to higher wage levels in the wage distribution. Secondly, the magnitude of these effects is considerably diminished, suggesting that the spillover effects gradually dissipate across the wage distribution.

3.3.4 Minimum wage effect on inequality at the regional level

This section tests the hypothesis of whether there is a difference in the impact of the minimum wage between the Lisbon region and the remaining regions. As discussed in section 3.2, the Lisbon region stands out as the main source of heterogeneity for the Portuguese regions, both in terms of wealth, and both within- and between-region inequality. Figure 8 and Panel (b) of Figure 9 show different regional trajectories according to the regional exposure to the minimum wage, with the Lisbon region standing out by only showing a trajectory similar to the remaining regions from 2015 onwards, while Panel (a) of Figure 9 already showed this similar trajectory since 2005. This suggest that wages in the Lisbon region were less prone to be affected by the minimum wage. Although the results from the estimation of equation (3.1) presented in Table 7 and Figure 11 show that the impact of minimum wage policies on inequality is stronger for minimum wage binded region/occupation pairs, we cannot disentangle these effects for



(a) $W^{10}_{i,k,c,t} - W^{50}_{i,k,c,t}$ (b) $W^{20}_{i,k,c,t} - W^{50}_{i,k,c,t}$

Figure 11: Elasticity of inequality with respect to the minimum-to-median wage gap, $MW_t - W^{50}_{i,k,c,t}$

regions alone. We adapt equation (3.1) by interacting the main variables of interest, $MW_t - W^{50}_{i,k,c,t}$ and $Binded_{i,k,t}$, with a dummy variable $Lisbon_i$ taking the value of 1 if the observation corresponds to the NUTSII Lisbon and 0 otherwise. This interaction captures how the effects of minimum wage changes differ across the Lisbon region and the base group containing all other regions. The model is now specified as:

$$
\begin{aligned}
W^{10}_{i,k,c,t} - W^{50}_{i,k,c,t} &= \beta_1 Binded_{i,k,t} + \beta_2 (MW_t - W^{50}_{i,k,c,t}) + \beta_3 (MW_t - W^{50}_{i,k,c,t})^2 \\
&+ \beta_4 (MW_t - W^{50}_{i,k,c,t}) \times Binded_{i,k,t} + \beta_5 (MW_t - W^{50}_{i,k,c,t})^2 \times Binded_{i,k,t} \\
&+ \beta_6 Binded_{i,k,t} \times Lisbon_i + \beta_7 (MW_t - W^{50}_{i,k,c,t}) \times Lisbon_i \\
&+ \beta_8 (MW_t - W^{50}_{i,k,c,t})^2 \times Lisbon_i + \beta_9 (MW_t - W^{50}_{i,k,c,t}) \times Binded_{i,k,t} \times Lisbon_i \\
&+ \beta_{10} (MW_t - W^{50}_{i,k,c,t})^2 \times Binded_{i,k,t} \times Lisbon_i \\
&+ \beta_{11} Lisbon_i + \lambda_k + \psi_c + \gamma_t + \varepsilon_{i,k,c,t}
\end{aligned}
\tag{3.2}
$$

Figure 12 presents the results from the estimation of equation (3.2) plotting the elasticity of $Binded$ and non-$Binded$ pairs of regions/occupations for the North, Centre, Alentejo & Algarve regions in Panel (a) and the Lisbon region in Panel (b). We include on the secondary axis the p-value of the hypothesis test that the two lines overlap. Panels (c) and (d) present the same values plotted in Panels (a) and (b), but comparing the statistical difference between the elasticities for Lisbon and the other regions. Figure 12 reveals two main insights. First, the effect for $Binded$ region/occupation pairs is not statistically different for the two region groups - see Panel (d) for the results on $Binded$ pairs and p-value regarding the equality of elasticities. For example, for a gap of around 50%, a 1% reduction in the gap between the minimum wage and median wage results in a 0.98% decrease in region/occupational inequality. Second, we find differences in magnitude of the effects for non-$Binded$ region/occupation pairs for each group, Lisbon and the other regions in Portugal mainland, with the effect being weaker for the Lisbon region. The

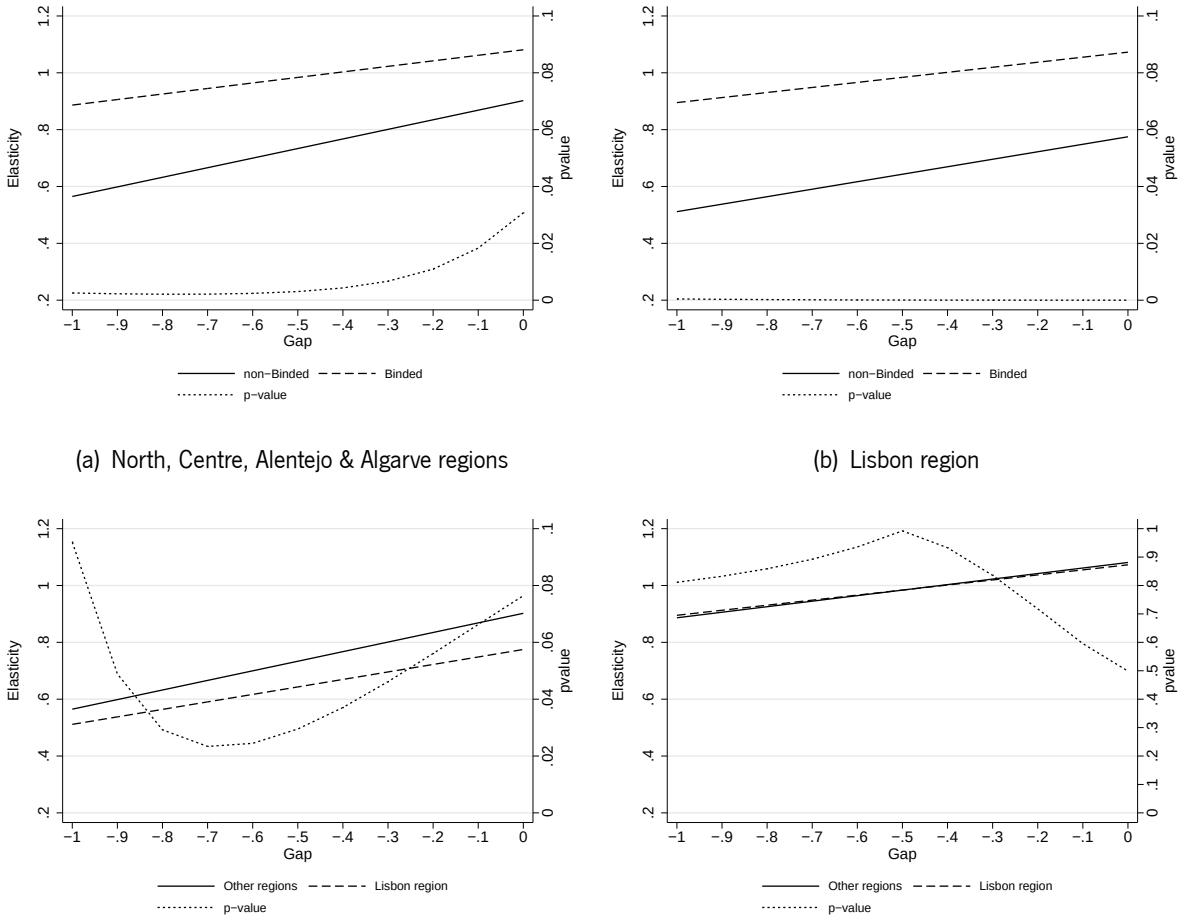
difference in elasticity between the two groups is statistically significant at the 5% significance level for gaps in the interval 90% to 30% – see Panel (c). For a gap of around 50%, a 1% reduction in the gap between the minimum wage and median wage results in a 0.73% decrease in regional/occupation inequality for the North, Centre, Alentejo & Algarve regions. For the Lisbon region, this elasticity is around 0.64%, representing a difference of 0.09 pp. Similarly to the results from equation (3.1), the impact of minimum wage changes on inequality becomes more pronounced as the gap between the minimum wage and the median wage narrows. For a gap of around 20%, the elasticities become 0.83% and 0.72% in Lisbon and the other regions, respectively, for non-$Binded$ region/occupation pairs, although this differences are only statistically significant at the 10% significance level.

Using the results from the estimation of equation 3.2, Figure 13 presents the elasticity of inequality with respect to the minimum-to-median gap for non-$Binded$ pairs of regions/occupations in each region. Panels (a) Panel (b) evaluate this elasticity at a 50% and 20% gap, respectively. Panel (a) shows that the North, Centre and Alentejo regions have very similar elasticities at around 0.75, with a gap between the highest and lowest of only 0.04pp. On the other hand, results for Lisbon and Algarve show that these two regions are very similar, with a gap between the two of around 0.01pp, at around 0.63%. Panel (b) shows that when evaluated at a lower minimum-to-median gap, that is, a minimum wage closer to the median, elasticities increase, with the diversity between regions also increasing. For the North, Centre and Alentejo regions, the gap between the highest and lowest is now 0.1pp, while the gap between Lisbon and Algarve sits at 0.03pp. Comparing the differences in elasticities according to the minimum-to-median wage gap, the two most populated regions, North and Lisbon, have a difference in elasticity of about 0.12pp when considering a 50% gap, with this difference increasing to about 0.14pp for a 20% gap.

3.4 Concluding remarks

In this paper, using a comprehensive database and building upon existing literature, we assess the wage impacts of minimum wage policies. Our identification strategy is rooted in the regional heterogeneity of wages at the occupational level. Our central finding is that decreases in the minimum-to-median wage gap correlate with a reduction in wage inequality. This reduction is especially pronounced in region/occupation pairs that are more affected by minimum wage policies. Our results show that the minimum wage policies' effects varied across Portuguese regions, with the Lisbon region, being the wealthiest and least exposed to the minimum wage, being the least affected. In pairs region/occupation characterized by a lower minimum wage prevalence, the amplification of this effect becomes evident as the wage gap narrows, highlighting an avenue for policymakers aiming to address wage inequality.

Our results shed light on the nuances of the impact of minimum wage policies in areas not extensively covered in prior studies. While most research has looked at the overall country level, gender, and regional inequality, our approach pairs regions with occupations. This provides insights into disparities in occupational wage levels across regions, stemming from marked regional income inequality.



(a) North, Centre, Alentejo & Algarve regions

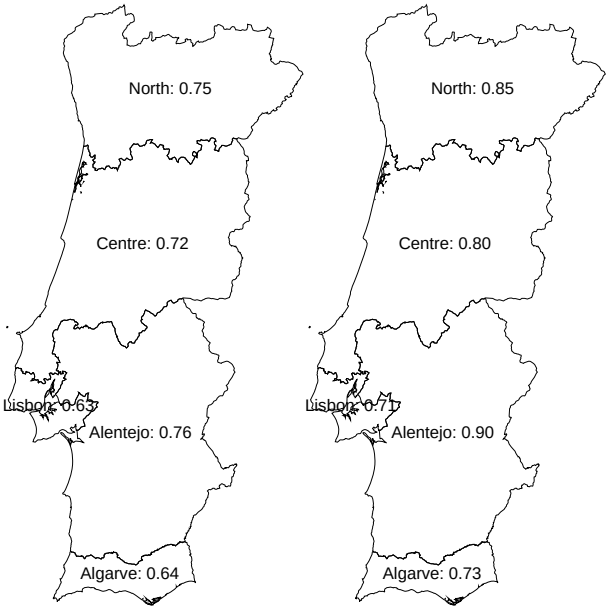
(b) Lisbon region

(c) non-Binded

(d) Binded

Figure 12: Elasticity of inequality with respect to the minimum-to-median wage gap, $MW_t - W^{50}_{i,k,c,t}$

The importance of regional and occupational diversity suggests that when crafting minimum wage policies, policymakers should consider their implications for local labor markets.



(a) 50% minimum-to-median wage gap

(b) 20% minimum-to-median wage gap

Figure 13: Elasticity of inequality with respect to the minimum-to-median wage gap, $MW_t - W^{50}_{i,k,c,t}$, non-Binded pairs only

4

Business context, business dynamism and productivity growth

4.1 Introduction

Productivity growth and, therefore, real GDP per capita growth, have been very low in the Portuguese economy in the 21st century.[1] The years 2000 marked a regime change in productivity growth, interrupting GDP *per capita* convergence with the European Union – see Figure 14[2].

Productivity slowdown in the last decades is a common trend in several developed countries. Several explanations have been proposed to explain low productivity growth in developed countries. Gordon (2017) argues that recent innovations have a lower potential to increase productivity; that is, there are diminishing returns from new technologies. Jones (2009) and Bloom et al. (2020) suggest that innovation has become more challenging or that there are diminishing returns to innovation investment. Decker et al. (2017), and Decker et al. (2020) emphasise the decline in business dynamism, which might have hampered the reallocation of resources to the most productive firms. In the same vein, Philippon (2019) argues that declining competition and rising barriers to entry may have 'allowed incumbents to rest on their laurels'. Andrews et al. (2015) suggest that the productivity growth slowdown in developed countries was caused by the slowdown in innovation and technology diffusion from frontier firms to the rest of the economy.

The long stagnation and interruption of the convergence process in the 21st century reflect the exhaustion of a development model (e.g., Alexandre et al., 2019) and suggest that the Portuguese economy may have fallen into the 'middle-income country trap' (Jalles et al., 2021). The way out of this trap is only possible by giving knowledge, skills and innovation a central place in the wealth creation process (e.g., Aghion et al., 2021).

Micro and small-sized firms are pervasive in the Portuguese economy. As noted by Hurst and Pugsley (2012), small businesses have little desire to innovate and grow. Micro and small-sized firms show deficient

[1] This chapter is co-authored with Fernando Alexandre and Miguel Portela.

[2] Source is AMECO.

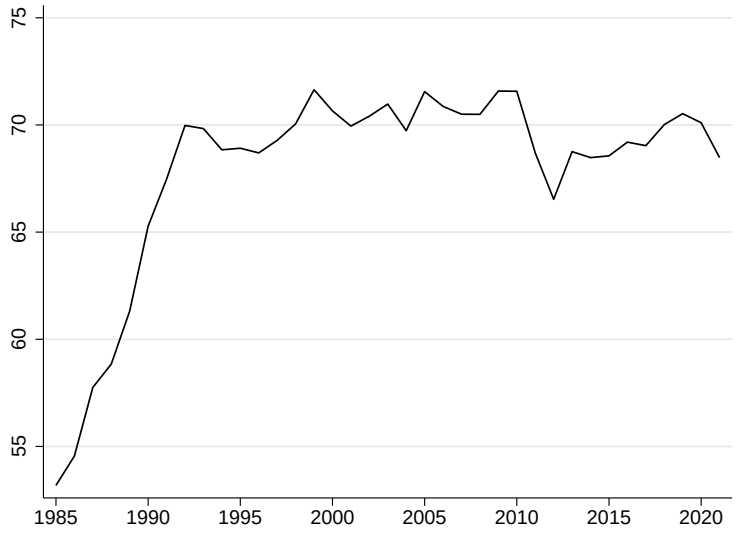


Figure 14: Gross national income per head of population – PPS: EU-15 = 100

productivity levels, and most do not exhibit any productivity growth. Therefore, a high share of micro and small-sized firms, namely if they are *lifestyle* businesses, thwarts productivity growth. A business environment that favours resource allocation towards micro and small-sized firms may cause low aggregate productivity growth (e.g., Garicano et al., 2016).

In Europe, only a small percentage of Small and medium-sized enterprises (SMEs) scale up and grow (e.g., EBI, 2019). Conditions and barriers to SME performance vary with the business environment, product and labour markets institutions, with infrastructures, with the availability and access to knowledge, skills, technology and finance, and with the participation in global value chains (e.g., OECD, 2020a). Since the adoption of the Euro, structural reforms aiming to improve the efficiency of the labour, product and financial markets have been at the centre of the discussion of economic policies on the growth of the Portuguese economy.

Monteiro et al. (2017) analyse the impact of product market reforms during the EFAP (2011–2014) and conclude that they contributed to enhancing resource efficiency and productivity gains. Labour market rigidity has been an important issue in the debate about the stagnation of the Portuguese economy in the 21st century (e.g., Blanchard, 2007; IMF, 2008). In this paper, we use a novel labour market flexibility index built at the sector level and using firm-level information to investigate whether labour market rigidity has been hampering firms' growth. Competition in markets, innovation and productivity are intrinsically linked (e.g., Aghion et al., 2021; Philippon, 2019). Competitive markets create incentives for companies to innovate and develop innovative products and services, with better quality and lower price. Therefore, we also investigate the role of market concentration in the impact of firms' entry and exit on the efficiency of resource allocation and productivity growth. Finally, financially distressed firms, also known as zombie firms, have represented a significant share of the Portuguese economy in 2008 – 2014 — see, for example, Gouveia, Osterhold, et al. (2018) —, and have been associated with market distortions that hamper

productivity growth.

This paper uses sectoral level data to evaluate the role of the business environment in the efficiency of resource allocation and productivity growth. We show how labour market flexibility, product market concentration and the incidence of financially distressed firms impacts resource allocation efficiency and productivity growth, gauged by the inflow and growth of *good* firms and exit of *bad* firms. We test three main hypothesis. Firstly, is labour market flexibility a key factor in allowing workers to reallocate to more productive firms, resulting in better resource allocation and fostering productivity growth? Secondly, do sectors with lower entry barriers that expose incumbents to competition, promote the growth of more productive firms and the exit of the less productive ones, resulting in an improved allocation of resources and fostering productivity growth? Thirdly, financially distress firms are associated with high levels of debt and poor performance. Is there a misallocation of credit and inefficient insolvency mechanisms, resulting in financially distressed firms capturing important resources of the economy, therefore, hampering economic growth?

In a earlier version of this paper in Alexandre, Costa, and Portela (2021), we used firm-level data to evaluated the factors that determined the ability of a firm reaching the frontier, that is, to reach a productivity level corresponding to the top 10%. We show that the business environment, measured by the sectoral level of labour market flexibility, product market concentration and the incidence of financially distressed firms, as well as the characteristics of the firms' founders have an impact on firms' growth. Firms in a sector with a higher labour market flexibility, low product market concentration and low incidence of financially distressed firms are able to grow faster. Furthermore, firms are more likely to become a frontier firm the higher the founders' education level.

The primary findings of this paper are as follows. Firstly, descriptive statistics analysis show that exiting firms are are considerably less productive and are more likely to be a financially distressed, suggesting that the overall outflow of firms should improve resource allocation and increase productivity. Secondly, firm entry has a stronger impact on sectoral productivity growth on markets with a higher labour market flexibility, higher product market concentration and lower prevalence of financially distressed firms. Thirdly, firm exit is also associated with higher productivity growth in sectors with higher labour market flexibility, but inconclusive regarding the level of product market concentration and incidence of financially distressed firms. Finally, we find that the entry of firms is associated with an increase in productivity dispersion for sectors with a low labour market flexibility, low product market concentration and high share of financially distressed firms. On the side of the exit of firms, we only observe an effect on productivity dispersion for sectors with a high incidence of financially distressed firms, resulting in an increase in productivity dispersion.

The paper has the following structure. We start by characterising the business context for productivity growth, particularly the characteristics of the labour, product and financial markets, in Section 4.2. In Section 4.3 we implement the empirical analysis. We start by discussing the data used in this paper in Subsection 4.3.1. We then analyse our three hypotheses. We present evidence on entry, exit and efficiency in resource allocation and productivity growth at the sector level in Subsection 4.3.2. Section

4.4 concludes and proposes policies to foster firms' productivity growth.

4.2 Business environment and productivity growth: product, labour and capital markets

Firms' growth depends on factors that can be classified as internal and external — see Marchese et al. (2019). Internal factors depend on the decisions of the owners and management teams that affect the performance of the firm: human resource management and training, management practices (investment in ICT and digitalisation), the participation in business networks (global value chains, for example), investment in R&D and the capacity to innovate in products and processes. Nicholas Bloom, John Van Reenen and their co-authors conclude that better management practices are positively associated with higher levels of education and that firms with better management practices tend to be larger, more efficient, grow faster and have higher survival rates (e.g., Bloom and Van Reenen, 2007; Bloom et al., 2013). Alexandre, Cruz, and Portela (2021), using firm-level data for the Portuguese economy, conclude that the formal education of management teams reduces the probability of micro and small-sized firms becoming financially distressed and increases the likelihood of their subsequent recovery. Queiró (2018) concluded that firms founded by more educated entrepreneurs tend to be larger at entry and also exhibit higher growth.

However, the effectiveness of management and investment decisions on firms' growth and productivity growth depends on external factors, that is, on the business environment. As discussed above, an efficient product market, which allows for the entry and growth of the most innovative efficient firms and the exit of the least efficient firms, is vital for firms' growth and productivity growth (e.g., Philippon, 2019). In addition, the labour market should provide incentives for firms to invest in the training of their workforce and to allow its adjustment to new market conditions and technologies (e.g., Blanchard and Portugal, 2017). Efficient financial markets and availability of credit are crucial for firms' investment and, therefore, for the adoption of new technologies and productivity growth (e.g., Gopinath et al., 2017). These are the three dimensions of the business environment considered in our sectoral level econometric analysis which are gauged by the labour market flexibility index (FLEX), the Herfindal-Hirshman Index (HHI), and by the share of financially distressed firms in the sector.

OECD (2020a) identifies several dimensions of the business context that are crucial for firms' performance and productivity growth, namely, product and labour market institutions, capital markets, infrastructures, the availability and access to knowledge and skills.

An economic context that favours the concentration of resources in micro- and small-sized firms can limit the growth of aggregate productivity (e.g., Garicano et al., 2016).

4.2.1 Labour market rigidity

Empirical evidence suggests that strict dismissal regulation reduces the scope for the reallocation of workers from low- to high-productivity firms (e.g., Andrews and Cingano, 2014; Bravo-Biosca et al., 2016; OECD, 2020a). Dismissal and hiring regulations (employment protection legislation) are an important determinant of firm adaptability, that is, the ability for firms to respond swiftly to changes in markets and technologies. The rigidity of the labour market has occupied a central place in the debate on the causes of low productivity growth in the Portuguese economy (e.g., Blanchard, 2007). For example, very restrictive legislation on dismissals can make restructuring and the adoption of new technologies more difficult (e.g., Andrews and Cingano, 2014). Blanchard and Portugal (2017) highlighted the importance of increasing flexibility in the Portuguese labour market to facilitate the reallocation of workers to high growth sectors. The EFAP included various measures intended to increase flexibility in the labour market, among others, the reduction in the level and duration of unemployment benefit; the reduction of severance pay; increased flexibility of work schedules; the reduction of holidays and public holidays and limitation of automatic extensions of collective agreements. Many of these reforms contributed towards a more flexible, although still very segmented, labour market - see Varejão et al. (2021). In the new version of the OECD's Employment Protection Legislation (EPL) index, Portugal ranks third in terms of labour market rigidity (after Israel and the Czech Republic) (OECD, 2020c). However, the EPL value for Portugal (2.9) is not very far from the OECD average (2.3) and Spain has an EPL of 2.4. The new version of the OECD EPL index includes four components. The first relates to the procedural requirements in the dismissal of workers (PT 8th in labour rigidity: 2.3 vs OECD average 1.8). The second component concerns notice and severance pay (PT: 18th in labour rigidity: 1.7 vs OECD average 1.7). The third component refers to the regulatory framework for unfair dismissals (PT: 1st in labour rigidity: 4.2 vs OECD average 3.2). Lastly, it also includes the application of the regulations on unfair dismissals (PT: 16th in labour rigidity: 3.3 vs OECD average 2.6). According to Varejão et al. (2021), the fact that labour market regulation requirements are currently limited to specific aspects, leads employers to not consider labour law among the major obstacles to investment, at least no more than European employers (6th place in the European Union (EU) and 7th in Portugal).

Varejão et al. (2021) highlight the fact that employment under temporary contracts (fixed-term or otherwise) represent a not insignificant fraction (around 20%) of total employment, raising concerns regarding the segmentation of the Portuguese labour market. In fact, Portugal occupies third place in the European ranking of incidence of temporary work.

Labour market rigidity has been an important issue in the debate on the causes of low productivity growth in the Portuguese economy (e.g., Blanchard, 2007; IMF, 2008). Blanchard and Portugal (2017) emphasises the importance of enhancing *micro flexibility* in the Portuguese labour market to foster the reallocation of workers to high-growth sectors.

The EFAP included several measures aiming at increasing labour market flexibility, among others, the reduction of the level and duration of unemployment benefits; the decrease in severance payments; the

increase in the flexibility of working time arrangements; the decrease in vacations and holidays and the limitation of automatic extensions of collective agreements. Most of these reforms contributed to a more flexible, although still very segmented, labour market — see Varejão et al. (2021).

In this paper, we use a novel index of labour market flexibility built on firm-level information, which has the following composition:

$$\text{Flex}_{st} = \prod_{j=1}^{6} \left\{ 0.5 + \frac{\exp\left(f_{j,st}\right)}{1 + \exp\left(f_{j,st}\right)} \right\}$$

where

$$f_{j,st} = \frac{Z_{j,st} - \bar{Z}_{j,st}}{\sigma_{Z_{j,st}}},$$

where $Z_{j,st}$ denotes one of the following labour market flexibility dimensions for sector s and time t: $Z_{1,st}$, the share of workers not covered by a collective agreement; $Z_{2,st}$, the share of workers with a fixed-term contract; $Z_{3,st}$, the share of overtime hours of work $Z_{4,st}$, within sector/year Kaitz index (inverse) $Z_{5,st}$, wage cushion defined as the ratio of aggregate irregular components of wages to total base wages; $Z_{6,st}$, average tenure (inverse).

This measure allows the classification of sectors according to their degree of labour market flexibility. Figure 15 presents the evolution between 2006 and 2021 of the FLEX index measured at the mean, median, the 10^{th} and the 90^{th} percentiles. The data shows that there is a large level of heterogeneity between sectors. From 2007 to 2012, we observe an overall decrease in the labour market flexibility from a maximum average value of 1.01 in 2007 to a minimum average value of 0.87 in 2011 and 2012. This trend is inverted in the following years, resulting in an overall increase in sectoral labour market flexibility, reaching a maximum value post-EFAP of 0.93. Therefore, we observe a very small increase in average flexibility is this period. This is mainly explained by the index capturing different levels of flexibility across sectors in the same year. However, trends across time are more difficult to capture in some components. For example, the reduction is severance payments introduced in both open-ended and fixed-term contracts during the EFAP is not capture by this index, as we are simply considering the share of workers with each contract.

4.2.2 Product market competition

The theoretical and empirical literature on the relationship between competition and productivity growth is ambiguous (e.g., Aghion et al., 2021). Competition reduces the expected returns from innovation and therefore it may discourage investment in R&D. This argument was stressed by Joseph Schumpeter (Schumpeter, 1942). The corollary of his argument was that there should be some temporary profit advantage over the firm's competitors.

Griffith and Reenen (2021) emphasize the benefits of competition on the entry of new firms, forcing the incumbents to innovate to keep their leading position.

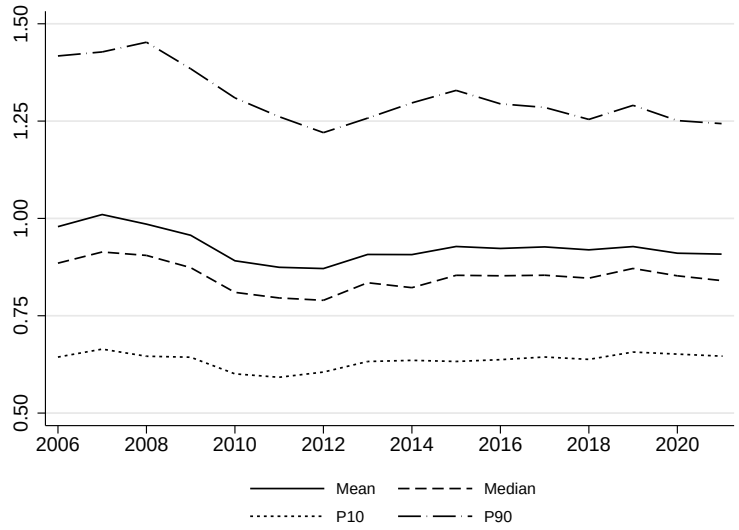


Figure 15: Labour market flexibility index at the sectoral level

Several authors have emphasized the role of the business environment on productivity growth – see, for example, Decker et al. (2017) and Decker et al. (2020). The business environment is shaped by geographical, technological and institutional features.

Philippon (2019) attributes the low productivity growth to the reduction in competition and to the increase in entry barriers that protect the incumbents.

Jalles et al. (2021), using OECD data, show that, in general, regulatory barriers to product market competition are slightly below the OECD average. However, the services sector is less favourable to competition than in many other OECD countries. Also, in the area of the simplification and assessment of regulations, within the regulatory framework of the transport sector there are still numerous restrictions on competition. The authors also highlight the fact that energy is relatively highly priced, affecting the competitiveness of companies.

An institutional environment that promotes business dynamism, i.e., accelerates the reallocation of resources between incumbents and innovators, is essential for productivity growth. Reforms that favour firm entry, the growth of more productive firms and the exit of the less productive ones are expected to improve the allocation of resources and foster productivity growth (e.g., Haltiwanger et al., 2001; Restuccia and Rogerson, 2008).

Conversely, when market distortions deter more productive firms from growing and less productive firms from exiting the economy, we should observe a rise in productivity dispersion and a decline in productivity (Foster et al., 2021). Philippon (2019) provides an excellent discussion about the importance of free entry as a mechanism to foster business dynamism.

Since the adoption of the Euro in 1999 and the recession that followed in 2002/2003, structural reforms have been at the centre of the discussion of economic policies in the Portuguese economy. Structural reforms may enhance productivity growth by contributing to a more efficient allocation of resources

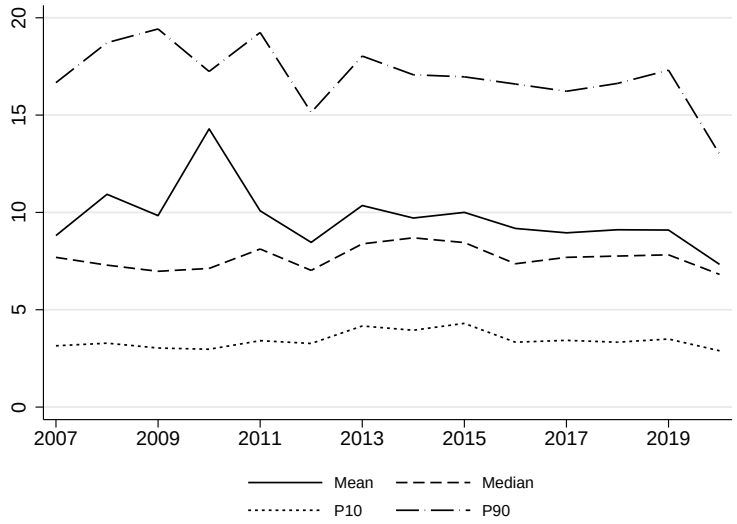


Figure 16: Entry rate at the sectoral level (in %)

(e.g., Acemoglu and Robinson, 2012). The EFAP, following the bailout of the Portuguese economy in 2011, included a set of structural policies that, among other goals, aimed at increasing the competitiveness of the product market, the flexibility of the labour market and at improving the efficiency of the insolvency framework (e.g., Eichenbaum et al., 2016). On the other hand, the European Semester — the fiscal framework of the Euro area launched in 2011 to coordinate the fiscal policies of the EU Member States — aims at implementing structural reforms to increase employment and foster economic growth (e.g., EC, 2020).

Figures 16 and 19 show, respectively, the sectoral entry and exit rates measured by the mean, median, the 10^{th} and the 90^{th} percentiles in the period 2007 – 2020. We compute entry and exit rates as the number of entering and exiting firms, respectively, over the number of firms in the previous year, for each sector. Figure 16 shows that, for the whole economy, the entry rate remained stable at around 9% during this period, with the exception of the years 2010 and 2020. However, entry rates varied significantly by sectors, with the sectors with the lowest and highest entry rates observing a value of around 3% and 17% throughout this period.

Monteiro et al. (2017) assess the impact of the product market reforms implemented during the Economic and Financial Adjustment Programme on productivity growth of the Portuguese economy. The liberalisation of gas and electricity markets, the creation of a transport regulator, the reduction of ports operating costs and the revision of the competition law were among some of the implemented product market reforms— see Jalles et al. (2021) and Cruz and Januário (2021) for a detailed analysis of these reforms. Monteiro et al. (2017) conclude that product market deregulation enhanced the efficiency of resource allocation and resulted in productivity gains.

In our analysis, product market competition is gauged by the HHI computed for each sector-year and calculated as the sum of each firm's market shares' squares within the industry. Figure 17 shows the evolution of the sectoral HHI index, measured by the mean, median, the 10^{th} and the 90^{th} percentiles

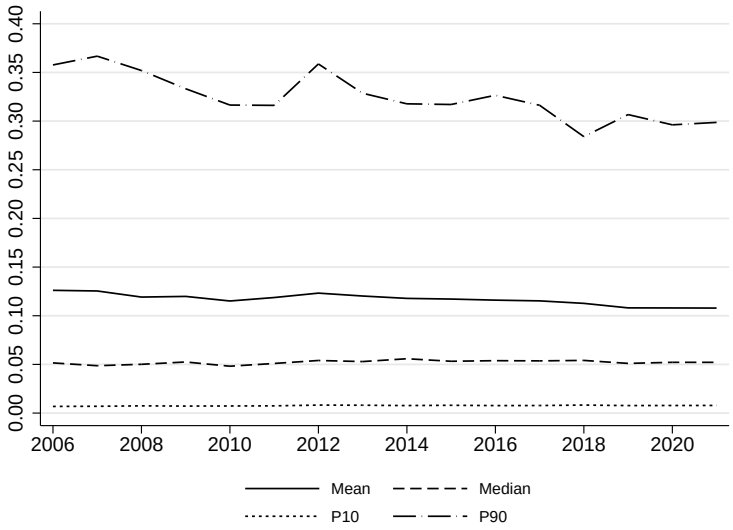


Figure 17: Herfindahl–Hirschman Index at the sectoral level

in the period 2006 – 2021. Sectoral product market competition varies significantly across sectors, with highest and lowest concentrated sectors presenting values above 0.3 and around 0.01, respectively. The overall trajectory presents a negative trend, with the average sector presenting a value of 0.13 in 2006 and 0.11 in 2021, although the median is constant throughout the period at a value of 0.05.

4.2.3 Capital markets

The availability of venture capital is a factor that contributes towards the probability of success of the most innovative companies (e.g., Aghion et al., 2021). This source of financing is still very incipient in Portugal and is an obstacle to the establishment of high potential start-ups, namely in the embryonic stage of projects originating from universities or research centres where patent holders may have difficulties accessing capital.

Efficient financial markets and credit availability are crucial for firms' investment, for the adoption of new technologies and, therefore, for productivity growth (e.g., Akcigit and Ates, 2021). Financially distressed firms, also known as zombie firms, have been associated with high leverage and weaker economic performance (e.g., Caballero et al., 2008). The survival of zombie firms congests markets, hampers the growth of more productive firms and create barriers to entry Andrews et al. (2017). Several factors may contribute to persistent high shares of financially distressed firms, namely, banks' evergreen lending to inefficient firms (e.g., Acharya et al., 2019; Caballero et al., 2008); credit misallocation due to underdeveloped financial markets (e.g., Azevedo et al., 2021; Gopinath et al., 2017; Reis, 2013) and inefficient insolvency regimes (e.g., Andrews et al., 2017). Financially distressed firms divert resources from the most efficient firms, distort market competition and, therefore, hamper productivity growth. The impact of the COVID-19 crisis has raised concerns that the share of zombie firms in advanced economies may increase significantly.

Financially distressed firms were pervasive in the Portuguese economy during the financial, banking and debt crises (2008 – 2014). In that period, financially distressed firms accounted for a high share of total firms, total value-added, employment and total exports — see, for example, Gouveia, Osterhold, et al. (2018).

Figure 18 presents the weight of financially distressed firms in the Portuguese economy in 2008 – 2021. Following the OECD approach — see, for example, McGowan et al. (2017) and Gouveia, Osterhold, et al. (2018) — we define as financially distressed the firms that report an ICR, given by the ratio of Earnings Before Interest, Taxes (EBIT) to interest expenses, lower than one over three consecutive years.[3] Figure 18 measures the weight of financially distressed firms by the share of firms, exports, value added and employment captured by financially distressed firms. The share of employment appears as the main dimension captured by financially distressed firms, pointing towards these firms keeping a significant share of the workforce from being incorporated by more productive firms. This factor has presented a declining trend, falling from 11% in 2008 to 5% in 2021. The share of financially distressed firms as the total of the number of firms presented an initial similar value to employment, suggesting that until 2011 financially distressed firms were of similar size to non-financially distressed firms. From 2012 onwards, the gap between these two dimensions has increased, with the decrease in share of workers lagging behind. Contrasting with the weight of employment, the share of value added capture by financially distressed firms was considerably lower in relative terms throughout this period, pointing towards these firms being significantly less productive than the average, although from 2014 to 2021, the share of firms and valued added capture by financially distressed firms have converged. Finally, the share of exports presents a more erratic trend, first by being similar to the share of value added up to 2013, followed by a significant sharp jump and staying above the share of employment throughout most of the remaining period. This can be a possibly sign that exports were an important mechanism identified by financially distressed firms for recovery.

Figure 19 shows that, as in the case for Figure 16, there is a considerable heterogeneity between sectors in terms of exit rates. The average exit rate increased significantly from a starting point of 7% to 11% in 2010, remaining high until 2013, and declining to 6% in 2020.[4] Sectors with the lowest exit rates remained stable at around 3% throughout the entire period, reaching 4% in 2010–2013. Sectors with the highest rates presented a similar trend to the average, going from 11% in 2007 to 13% in 2010–2013, followed by a decrease to 9% in 2020.

4.3 Empirical analysis

We estimate a model at the sector level to evaluate the role of the business context on productivity. We assess how the impact of the entry and exit of firms on resource allocation and productivity growth is

[3] We use EBIT instead of EBITDA because the later is only available from 2010 onwards.

[4] These are unweighted sector averages. Considering weighted averages, the years 2011 and 2012 present the highest exit rates.

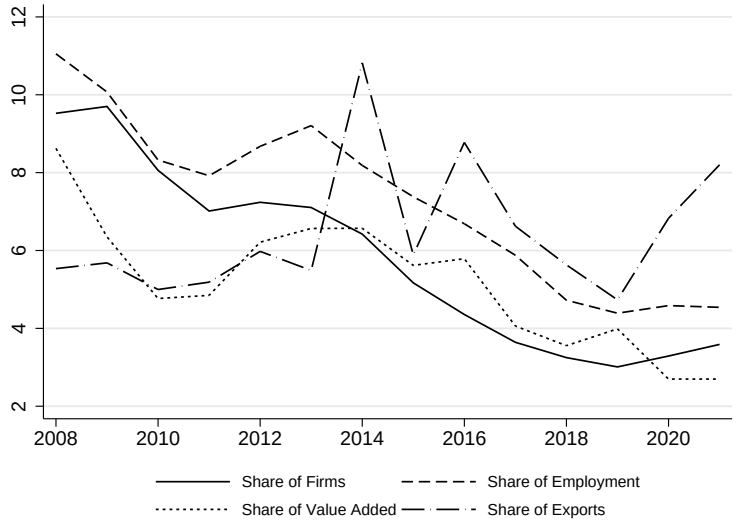


Figure 18: Share of financially distressed firms in the whole economy (in %)

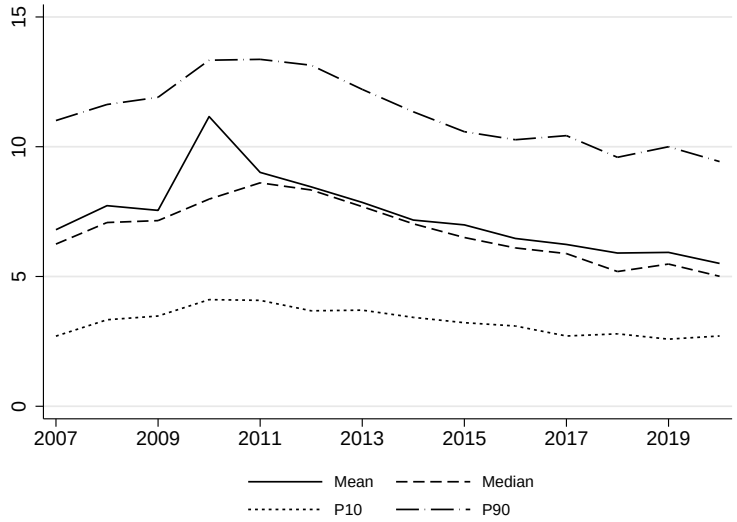


Figure 19: Exit rate at the sectoral level (in %)

mediated by the degree of labour market flexibility, product market competition and by credit markets efficiency.

4.3.1 The data

We combine data from two sources: (i) the SCIE and the database on companies' Personnel Records (QP). Data sets from these two sources can be merged at the firm level, using a common (anonymised) firm identifier. The SCIE contains firm-level administrative data, including balance sheet and other accounting data, information on turnover, value-added, number of employees, exports, interests, EBIT, industry and firm entry and exit. These data are available every year for the population of firms in the private sector, from 2006 to 2021 (about 400 thousand firms per year).

The QP database is a linked employer-employee dataset available between 1985 and 2021 and is gathered through a mandatory annual survey. It provides data on all workers in Portuguese firms, excluding the public sector, with at least one wage earner (about three million workers each year). The available data include information on workers' formal education, age, gender, occupation, monthly wage (distinguishing between base wage, regular and irregular components), hours of work (regular and overtime), and the type of labour contract.

The data is aggregated at the four digit sector-year level for regression analysis using the ISCO-08 classification. We consider sectors that report information for all years, resulting in 364 sectors. Table 8 presents descriptive statistics for the main variables of interest. Labour productivity is computed as the total sector value added over the number of employees. Total factor productivity is computed following the approach by Gandhi et al. (2020) at the Statistical Classification of Economic Activities in the European Community (NACE) 1-digit sectors (10 sectors). The outcome is the log of real sales and the inputs considered are fixed assets, hours worked, and intermediate inputs. All variables are represented in logs and monetary variables are adjusted for inflation and winsorized.[5] Our regression analysis uses data from 2007 to 2020, based on the availability of information on entry and exit rates, with the exception of regressions with information on financially distressed firms, which is only available from 2008 onwards. Monetary values are adjusted to 2016 prices.

4.3.2 Entry, exit and productivity growth

We estimate a model at the sector level to evaluate the role of the business environment, namely the efficiency of the product, labour and financial markets, in enhancing an optimal reallocation of resources towards more productive firms to the detriment of firms with poorer economic performance.

The seminal paper by Hsieh and Klenow (2009) shows that productivity dispersion can be interpreted as the presence of frictions or resource misallocation. Within-sector productivity dispersion reflects the coexistence of low and high productivity firms. An efficient allocation of resources implies the growth

[5] Alternative measures of total factor productivity are estimated for robustness checks following Ackerberg et al. (2015) with the outcome being log of value added.

Table 8: Descriptive statistics - sectors

	P10	Mean	P50	P90
2008				
IQR Labour Productivity	0.84	1.87	1.49	3.15
Var. Labour Productivity	-0.25	-0.02	-0.01	0.18
IQR TFP	0.39	0.70	0.63	1.11
Var. TFP	-0.15	-0.03	-0.02	0.07
Entry rate	1.12	9.91	6.67	18.16
Exit rate	1.32	6.99	6.67	11.18
Flex	0.65	0.99	0.91	1.45
HHI	0.01	0.12	0.05	0.35
FDF	3.21	9.82	9.23	17.39
2020				
IQR Labour Productivity	0.85	2.07	1.59	3.75
Var. Labour Productivity	-0.41	-0.10	-0.06	0.13
IQR TFP	0.37	0.70	0.63	1.14
Var. TFP	-0.20	-0.05	-0.04	0.04
Entry rate	0.99	6.71	6.39	12.87
Exit rate	1.61	5.05	4.71	8.70
Flex	0.65	0.91	0.85	1.25
HHI	0.01	0.11	0.05	0.30
FDF	0.78	3.67	3.06	6.80

Notes: Authors calculations using data from QP and SCIE. 'IQR' stands for interquantile range of the 75^{th} and 25^{th} percentile. 'Var.' stands for the average yearly growth rate. 'TFP' stands for total factor productivity. 'P' stands for percentile. Source: authors' calculations based on QP and SCIE datasets.

of the most productive firms and the exit of the less productive firms. Thus, an efficient allocation of resources would tend to equalise the marginal value product of inputs or revenue productivity. Within-sector dispersion in labour productivity across firms may be due to idiosyncratic productivity shocks or to market frictions and distortions in the product, labour or financial markets – see, for example, Syverson (2011). In an analysis of the US economy, Decker et al. (2017), and Decker et al. (2020) argue that a surge in market frictions may have hindered the reallocation of resources to the most productive firms, reducing business dynamism, with high productivity firms less likely to grow and low productivity firms less likely to exit the market.

We start by characterizing the firms that exited the market versus the firms that remained active, as well as financially distressed firms and non-financially distressed firms. Table 9 presents descriptive statistics for these groups of firms for the period 2008-2020. Table 9 shows that there is a clear distinction between exiting firms and firms that remain active. Exiting firms are considerably less productive, produce

less value added, present a negative average EBIT, employ significantly less workers, are younger and are more likely to be a financially distressed firm. Thus, this confirms that worst performing firms are exiting the market. When comparing financially distressed firms with the rest, the relation is not so clear cut. These firms are older than the rest, employ more workers and produce almost as much valued added as non-financially distressed firms. They are also more productive than exiting firms. Financially distressed firms distinguish themselves from all other groups by their average EBIT, indicating that these firms are not operating profitably.

Following the approach of Foster et al. (2021), we estimate the following model to evaluate how the entry and exit of firms affect the efficiency of resource allocation within sectors and how it contributes to productivity growth:

$$y_{s,t} = \lambda_s + \eta_t + \sum_{k=1}^{r} \left[\beta_k \overline{M}_{s,t} F_{s,t-k} + \delta_k \underline{M}_{s,t} F_{s,t-k} \right] + \varepsilon_{s,t} \tag{4.1}$$

where $y_{s,t}$ stands either for within sector/year productivity dispersion, measured by the interquartile range, that is, the difference between the log of the 75^{th} and the log of the 25^{th} percentiles, or sector productivity growth, measured by the variation in the log of productivity and Total-factor productivity (TFP), in sector s and year t. $\overline{M}_{s,t}$ and $\underline{M}_{s,t}$ are dummy variables that classify sectors as being high or low, respectively, gauged by the degree of flexibility (FLEX), market concentration (HHI), and FDF. The classification in each of these indicators is based on their position relative to the median value for each one of these dimensions. F_{st} stands for firms' flow at the sector level measured either by entry or exit rate. We estimate equation (4.1) separately for the entry and exit rate. λ_s stands for sectors' fixed effect and η_t stands for time effects. ε_{st} is a white noise error term. Finally, r indicates the number of lags used in each model. Except for the productivity dispersion equation and the exit of firms, where $r = 1$, we consider that the dynamics of the transmission of the effects resulting from the entry and exit of firms on productivity dispersion and productivity growth takes two lags and, in these cases, we define $r = 2$.

We start by estimating equation 4.1 without gauging by the degree of FLEX, HHI or FDF. Equation 4.1 thus becomes:

$$y_{s,t} = \lambda_s + \eta_t \sum_{k=1}^{r} \beta_k F_{s,t-k} + \varepsilon_{s,t} \tag{4.2}$$

We present the results for equation 4.2 in Table 10. Panels A and B present the impact of entry and exit rates, respectively. Panel A shows that higher entry rates are associated with TFP growth. A one percentage point (p.p.) increase in the entry rate results in a 0.05pp increase in TFP growth rate. This result is also found using the TFP measure by Ackerberg et al. (2015) (henceafter, TFP ACF), presented in Appendix B Table 37. In the case of labour productivity, we do not find any statistically significant results. Panel B shows that higher exit rates result in higher productivity growth. A one p.p. increase in the exit rate is associated with a 0.04pp increase in TFP growth, a result also observed in labour productivity and TFP ACF. Regarding productivity dispersion, we do not observe an impact from either firms' entry or exit.

Table 9: Descriptive statistics - firms

	P10	Mean	P50	P90
Non-exiting firms				
Labour Productivity (ths)	-2.45	25.34	12.16	40.00
Value added (ths)	-3.08	241.00	28.21	274.74
EBIT (ths)	-23.62	62.22	2.30	63.79
Employment	1.00	7.93	2.00	12.00
Firm age	1.00	13.70	10.00	30.00
Share of FDF	0.00	0.06	0.00	0.00
Exiting firms				
Labour Productivity (ths)	-5.91	2.22	0.00	15.70
Value added (ths)	-7.89	18.94	0.00	45.22
EBIT (ths)	-33.73	-19.93	-1.77	8.44
Employment	1.00	2.76	1.00	4.00
Firm age	2.00	11.37	8.00	25.00
Share of FDF	0.00	0.09	0.00	0.00
Non-FDF firms				
Labour Productivity (ths)	-2.36	24.53	11.76	39.56
Value added (ths)	-2.91	223.32	25.71	257.45
EBIT (ths)	-19.74	68.54	2.34	62.33
Employment	1.00	7.36	2.00	11.00
Firm age	1.00	13.43	10.00	29.00
Share of FDF	0.00	0.00	0.00	0.00
FDF firms				
Labour Productivity (ths)	-10.42	7.28	3.78	20.66
Value added (ths)	-17.18	202.03	7.91	176.55
EBIT (ths)	-140.22	-160.54	-16.27	-0.24
Employment	1.00	9.47	2.00	13.00
Firm age	3.00	15.98	12.00	33.00
Share of FDF	1.00	1.00	1.00	1.00

Notes: Authors calculations using data from QP and SCIE. 'IQR' stands for interquantile range. 'Var.' stands for the average yearly growth rate. 'FDF' stands for financially distressed firms. 'P' stands for percentile. Values correspond to the period 2008–2020. Source: authors' calculations based on QP and SCIE datasets.

Table 10: Regression analysis by Sector/Year – Entry and Exit

	Labour Productivity		TFP	
	Dispersion	Growth	Dispersion	Growth
		Panel A: Entry		
$Entry_{t-1}$	0.0015	0.0007	0.0001	0.0003**
	(0.0011)	(0.0005)	(0.0001)	(0.0001)
$Entry_{t-2}$	0.0070	0.0009	0.0001	0.0002**
	(0.0045)	(0.0006)	(0.0002)	(0.0001)
N	3681	4732	3561	3560
		Panel B: Exit		
$Exit_{t-1}$	0.0031	0.0020**	0.0004	0.0004*
	(0.0021)	(0.0010)	(0.0003)	(0.0002)
$Exit_{t-2}$		0.0008		0.0001
		(0.0005)		(0.0002)
N	4001	4732	3835	3560

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. The dependent varaible for 'Dispersion' is the IRQ. The dependent variable for 'Growth' is the log difference of the productivity measure. See Table 37 for robustness checks. Source: authors' calculations based on QP and SCIE datasets.

Moving to the full specification of equation 4.1, Tables 11 and 12 present the results for firms' entry and exit flows, respectively. Tables 37, 38 and 39 present robustness checks, measuring dispersion by the coefficient of variation and presenting results for TFP ACF. Additional robustness checks are done where we group each time period into two and three years, reported in Tables 40, 41, 42, 43, 44 and 45. Equation 4.1 is estimated separately for productivity dispersion – odd columns –, and productivity growth – even columns in both tables. This set of estimates is implemented for each measure of business environment: the degree of flexibility, market concentration, and financial distress.

Results in Panel A of Table 11 suggest that the entry of firms in sectors characterised by high labour market flexibility has a positive effect on productivity growth. An one p.p. increase in the entry rate in more flexible labour markets increases TFP growth rate by 0.07pp, and labour productivity growth rate by 0.17pp. Conversely, the entry has a considerably smaller effect at improving productivity growth in sectors with a rigid labour market, at around 0.02pp. These results suggest that in sectors with a higher labour market flexibility, the entry of firms contributes to productivity growth. In terms of the efficiency of resource allocation, measured by productivity dispersion, results suggest that the entry of firms in sectors with a high labour market rigidity results in an increase in labour productivity dispersion. An one p.p. increase in the entry rate in a labour market with a high rigidity is associated with an IQR increase of around by

Table 11: Entry flows - regression analysis by sector/year

	Labour Productivity		TFP	
	Dispersion	Growth	Dispersion	Growth
Panel A: Labour market flexibility (Flex)				
$High_{t-1}$	-0.0011	0.0017**	0.0001	0.0007**
	(0.0018)	(0.0008)	(0.0003)	(0.0003)
$High_{t-2}$	0.0007	0.0012	-0.0000	0.0003
	(0.0016)	(0.0014)	(0.0006)	(0.0002)
Low_{t-1}	0.0029	0.0001	0.0002	0.0002
	(0.0018)	(0.0005)	(0.0002)	(0.0001)
Low_{t-2}	0.0131***	0.0007*	0.0002	0.0002*
	(0.0038)	(0.0004)	(0.0002)	(0.0001)
N	3681	4732	3561	3560
Panel B: Market concentration (HHI)				
$High_{t-1}$	0.0009	0.0012*	0.0001	0.0004**
	(0.0019)	(0.0006)	(0.0002)	(0.0002)
$High_{t-2}$	-0.0009	0.0010	0.0001	0.0002
	(0.0019)	(0.0011)	(0.0003)	(0.0002)
Low_{t-1}	0.0027***	0.0001	0.0002	0.0002
	(0.0008)	(0.0004)	(0.0002)	(0.0001)
Low_{t-2}	0.0132***	0.0007*	0.0002*	0.0002
	(0.0041)	(0.0003)	(0.0001)	(0.0001)
N	3681	4732	3561	3560
Panel C: Financial Distressed Firms (FDF)				
$High_{t-1}$	0.0058	0.0008	0.0014	0.0009
	(0.0067)	(0.0017)	(0.0011)	(0.0009)
$High_{t-2}$	0.0156*	0.0006	0.0006	0.0004
	(0.0091)	(0.0009)	(0.0010)	(0.0008)
Low_{t-1}	0.0012	0.0007	0.0001	0.0003**
	(0.0011)	(0.0005)	(0.0001)	(0.0001)
Low_{t-2}	0.0067	0.0008	0.0002	0.0002*
	(0.0045)	(0.0006)	(0.0002)	(0.0001)
N	3681	4732	3561	3560

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. The dependent varaible for 'Dispersion' is the IRQ. The dependent variable for 'Growth' is the log difference of the productivity measure. See Table 38 for robustness checks. Source: authors' calculations based on QP and SCIE datasets.

1.31pp. Considering the average value of 0.7 in 2020, this implies an increase of about 1.9%.[6]

Results in Panel B suggest that the entry of new firms contributes to productivity growth in sectors characterized by higher product market concentration. A one p.p. increase in the inflow rate is associated with a 0.04 pp increase in the TFP growth rate and a 0.12 pp increase in labour productivity growth rate. In sectors characterized by lower market concentration, the inflow of new firms does not impact TFP growth and has a considerably smaller effect on labour productivity growth. This suggests that while firms entry in markets with lower concentration contribute to labour productivity growth, they are less effective than in sectors with higher concentration. Regarding productivity dispersion, both TFP and labour productivity estimations indicate that the entry of new firms leads to an increase in productivity dispersion in sectors with low product market concentration. However, this is only statistically significant at the 10% significance level for TFP.

Finally, our estimates present in Panel C suggest that the entry of firms in sectors with a higher share of financially distressed firms does not promote productivity growth. In contrast, sectors with a lower share seem to benefit from the entry of new firms. A one p.p. increase in entry rate is associated with a TFP increase of around 0.05pp, with a similar effect being observed with the TFP ACF (see Table 38), but not with labour productivity. These results suggest that financially distressed firms may be a source of distortion that hampers to positive effects of firm entry on sectoral productivity growth. Regarding productivity dispersion, results suggest that the entry of firms in sectors with a high concentration of financially distressed firms is associated with an increase in productivity dispersion, although only statistically significant at the 10% level, and only observed for labour productivity.

Table 12 presents the econometric results for the impact of firm exit on the efficiency of resource allocation and productivity growth. We start by noting that our preferred specifications and most of robustness checks presented in Appendix B do not show any statistically significant effects on productivity dispersion when gauging the outflow of firms by the level of labour market flexibility or market concentration.

Results in Panel A of Table 12 point towards a positive impact on productivity growth by the exit of firms on sectors with a higher labour market flexibility. An one p.p. increase in the exit rate increases TFP growth by 0.09pp. Looking at labour productivity, we find positive effects on both high and low flexibility labour markets, although with this effect being considerably larger in high labour markets flexibility sectors. Robustness checks the TFP ACF measure show similar effects on both high and low flexibility labour markets (see Table 39).

Results in Panel B show that TFP growth is only affected by a higher exit rate in sectors with a low market concentration, with a one p.p. increase in the exit rate increasing TFP growth by 0.04pp. On the other hand, labour productivity growth is positively affected by the outflows of firms in sectors with both a high and low market concentration, although this effect is about twice as large in sectors with a high market concentration. Robustness checks using TFP ACF presented in Panel B of Table 39 show similar sized positive effects for both types of concentration.

[6] 0.0131/0.7=0.0187.

Table 12: Exit flows - regression analysis by sector/year

	Labour Productivity		TFP	
	Dispersion	Growth	Dispersion	Growth
Panel A: Labour market flexibility (Flex)				
$High_{t-1}$	0.0028	0.0034**	0.0003	0.0009**
	(0.0031)	(0.0015)	(0.0004)	(0.0005)
$High_{t-2}$		0.0001		-0.0003
		(0.0006)		(0.0004)
Low_{t-1}	0.0032	0.0012	0.0004	0.0001
	(0.0030)	(0.0010)	(0.0004)	(0.0003)
Low_{t-2}		0.0012**		0.0003
		(0.0005)		(0.0002)
N	4001	4732	3835	3560
Panel B: Market concentration (HHI)				
$High_{t-1}$	0.0007	0.0033**	0.0003	0.0005
	(0.0036)	(0.0013)	(0.0004)	(0.0003)
$High_{t-2}$		0.0000		-0.0001
		(0.0006)		(0.0002)
Low_{t-1}	0.0051	0.0005	0.0006	0.0002
	(0.0036)	(0.0009)	(0.0004)	(0.0002)
Low_{t-2}		0.0016***		0.0004**
		(0.0004)		(0.0002)
N	4001	4732	3835	3560
Panel C: Financial Distressed Firms (FDF)				
$High_{t-1}$	0.0098	0.0071***	0.0020**	0.0010
	(0.0080)	(0.0018)	(0.0010)	(0.0008)
$High_{t-2}$		0.0002		0.0006
		(0.0017)		(0.0008)
Low_{t-1}	0.0013	0.0015*	0.0003	0.0003*
	(0.0015)	(0.0009)	(0.0002)	(0.0002)
Low_{t-2}		0.0005		0.0000
		(0.0005)		(0.0002)
N	4001	4732	3835	3560

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. The dependent varaible for 'Dispersion' is the IRQ. The dependent variable for 'Growth' is the log difference of the productivity measure. See Table 39 for robustness checks. Source: authors' calculations based on QP and SCIE datasets.

Finally, Panel C presents the impact of the outflow of firms in sectors with a high and low incidence of financially distressed firms. Similarly to the results presented in Panel B, we find different results depending on which measure of productivity is used. It is worth noting that the results found for TFP are only statistically significant at the 10% level, while the results for labour productivity are significantly larger and statistically significant at the 1% level. In sectors with an incidence lower than the median of financially distressed firms, a one p.p. increase in the exit rate results in a TFP growth of around 0.03pp, with no effect observed in sectors with a high share of financially distressed firms. Regarding labour productivity and TFP ACF (see Table 39), we find positive impacts on productivity growth for both high and low incidence of financially distressed firms, with the effect being significantly larger for high incidence sectors. Regarding productivity dispersion, we find that the exit of firms from sectors with a high concentration of financially distressed firms is associated with an increase in productivity dispersion, although this result is only observed for the TFP measure.

To conclude, the results presented in Table 12 show that the exit of firms is positively associated with productivity growth in sectors with a high labour market flexibility. Effects conditional of the level of product market concentration depend on the measure of productivity used. Our results also suggest that the prevalence of financially distressed firms hampers productivity growth, in particular in sectors with a high incidence of these type of firms.

4.3.3 Robustness checks

This subsection debates additional robustness checks presented in Appendix B. Tables 37, 38 and 39 present the estimations from equations 4.1 and 4.2 using an alternative measure of productivity dispersion, the coefficient of variation, and an alternative estimation method for TFP, TFP ACF, following Ackerberg et al. (2015) to what is presented in the main text. The results presented in Tables 37, 38 and 39 show that the estimations using these alternative measures, commonly used in the literature, are mostly aligned with the results presented in the main text.

Following Foster et al. (2021), where each time period corresponds to grouping of three years, we also present the estimations for equations 4.1 and 4.2 using groups of two and three years. These estimations are presented in Tables 40 and 43 for equation 4.2, Tables 41 and 44 for the inflow of firms, and Tables 42 and 45 for the outflow of firms with equation 4.1. Considering the estimations from equation 4.2, the results presented in Table 10 hold only when considering groups of two periods. For the inflow of firms with equation 4.1, the estimations in Tables 41 and 44 show that the larger the number of years grouped, the lesser the statistical significance of the coefficients. This is particular evidence in Panel C of Table 44, which measures the incidence of financial distressed firms, where no coefficient is statistical significant. Considering the outflow of firms, Table 42 shows similar results as in the main text, with the exception of Panel A, measuring the sectoral labour market flexibility, where most coefficients become not statistical significant. In Table 45 only Panel B, measuring product market concentration, shows similar results as in the main text, but only for the labour productivity growth rate.

4.4 Concluding remarks

In this paper we have explored the role that the business environment and flow of firms at the sectoral level play in affecting the resource allocation and productivity growth of the Portuguese economy between 2007 and 2020. The impact of the entry and exit of firms on resource allocation efficiency and productivity growth is contingent upon the efficiency of the product, labour and financial markets. Although our analysis shows that the least productive firms are forced to cease operation, we do not find an impact of the exit of firms on the improvement of resource allocation, gauged in our analysis by productivity dispersion, except on sectors with a high incidence of financially distressed firms. This may indicate inefficient exit mechanisms.

Estimates regarding productivity growth suggest that policies that promote a more favourable business environment may contribute to fostering productivity growth by allowing *good* firms to grow and *bad* firms to exit. Namely, reducing labour market rigidity seems to contribute to sectoral productivity growth. Our estimates also suggest that the entry of new firms is particularly effective in improving productivity growth in sectors with high levels of product market concentration. Therefore, enhancing product market competition should also be a goal for policy makers. Our results also suggest that better bankruptcy legislation, aiming to accelerate financially distressed firms' exit or recovery, may improve productivity growth.

Turning to the limitations and future research, the work presented in this paper has three main limitations that need to be addressed in future research. The first limitation arises from the labour market flexibility index. As noted in section 4.2, this index does not capture time trends in labour market flexibility, as shown by its low variability throughout time and its inability to reflect the labour market reforms introduced during the period of analysis. A second limitation may result from the measurement of resource allocation. Future research on this topic should link the results found in the descriptive statistics regarding the characteristics of exiting firms and the econometric results regarding productivity growth. Finally, the results presented in this paper regarding productivity growth are sensitive to the productivity measure, the time grouping and the sectoral level analysis. Future research should aim to further explore the different outcomes from each specification, bringing them together. The availability of data across a longer time span should also be an important asset in improving the analysis carried out.

5

Young firms, job quality and inclusiveness: Evidence from France and Portugal

5.1 Introduction and motivation

Young firms and start-ups play a key role in market economies and disproportionally contribute to employment creation (see (Criscuolo et al., 2014; Haltiwanger et al., 2013), among others).[1] While the quantity effect, i.e. the fact that new firms are important motors of job creation, has been well established and confirmed by a multitude of empirical studies, the quality and inclusiveness of those jobs have received less attention. Conversely, among the many empirical studies on the quality of jobs, very few take into account the firm dimension.

This paper aims to contribute to filling this knowledge gap. Using LEED for France and Portugal, systematic differences in the jobs at young versus older incumbent firms are investigated along two dimensions: (1) the quality of these jobs, mainly focusing on wages but also exploring job security, and (2) their inclusiveness, in terms of the hiring and payment of more disadvantaged workers.

These topics are of high policy relevance. Young firms have been found to be particularly exposed to the regulatory environment (Calvino et al., 2016), and government policies and support programs fostering start-ups may want to consider not only the quantity, but also the quality of jobs they create. Young firms are engines of creative destruction, and besides creating a substantial amount of new jobs, they also destroy old ones. If the newly created jobs are of a worse quality, or less inclusive, this might be a cause for concern – and inversely, if they prove to be good and inclusive, this could provide additional motivation for fostering entrepreneurship, lowering barriers to firm entry, and promoting business dynamism.

This study is particularly relevant also in the context of the widespread long-term declines in business dynamism (Calvino et al., 2020) and the shocks to business registrations amid the COVID-19 pandemic (OECD, 2020d, 2021). If the jobs created by young firms prove to be good and inclusive, observed declines in entry rates and business registrations – and the long-term effects of a missing generation of new firms – may be even more worrisome. The current analysis may therefore help policy makers better

[1] This chapter is co-authored with Flavio Calvino, Francesco Manaresi and Nathalie Scholl.

understand the implications of those declines for the post COVID-19 recovery period, and more generally the role of young firms for the inclusiveness of economic growth.

Inclusiveness and workers' well-being are of intrinsic value, and improving the quality of jobs for a large part of the labour force is a policy goal in itself. In addition, there are instrumental reasons for providing high-quality employment, which has been linked to firm performance and a number of aggregate economic outcomes such as productivity and labour force participation (Cazes et al., 2015; Erhel & Guergoat-Larivière, 2010).

The rich LEED for France and Portugal on which this analysis relies allows addressing a number of challenges to the identification of causal effects, such as sorting (both on the worker and firm side) and omitted variable bias. The empirical findings represent one of the first results on the quality of jobs generated by different types of French and Portuguese firms and, with the exception of one study on Germany (Fackler et al., 2019) the first to simultaneously account for differential effects of wage penalties or premia for disadvantaged groups.

While LEED provide the unique opportunity to investigate the firm dimension of job quality, they put some restrictions on the type of characteristics that can be analysed. As the data are based on administrative sources, most LEED do not contain survey questions to employees (e.g., on subjective perceptions of job satisfaction), but record observable aspects of job quality, which can be considered more objective (such as wage, type of contract, hours worked and employment spell length).[2]

This paper is therefore restricted to specific types of information that can serve as indicators of job quality, with the main measure of job quality analysed in this paper being the worker's (hourly) wage, and additional exploratory results investigating job security through the analysis of open- vs. fixed-term contracts.

Inclusiveness in the context of this paper refers to labour market outcomes for groups that typically face challenges in labour markets (henceforth referred to as "disadvantaged groups"), such as women and foreigners. These outcomes include the quality of jobs, but also whether they are hired more by young firms than older ones.[3]

Several key findings emerge from the empirical analysis:

1. Young firms hire workers who are younger and have less work experience. They also employ more foreigners and labour market entrants compared to older firms. Furthermore, industries that pay lower wages – mainly in services – tend to have higher shares of small, and young firms. Grouping manufacturing and services together can therefore mask important heterogeneities in the quality of jobs provided by young firms.

[2]That job quality is a multidimensional concept that contains many other aspects such as job security, task variety, or training opportunities, is reflected in the guidelines of numerous initiatives on measuring job quality (e.g., Cazes et al., 2015).

[3]This paper does so by showing the aggregate hiring patterns of firm age groups. It does not, however, directly estimate the determinants of the probability of firms to hire from disadvantaged groups.

2. There is no overall difference in wages between young and older firms when similar workers are compared. Young firms hire workers with different characteristics than older firms, and differences in pay are due to these worker characteristics rather than to the age of the firm. In fact, when worker's characteristics, such as her age and tenure, are controlled for, young firms seem to pay a small wage premium.

3. Both young and older French firms employ around 40% women. For the Portuguese economy, young and old firms employ around 45% and 48% women, respectively. While both economies have different overall gender compositions, the gender wage gap appears to be slightly lower in young firms for both countries. The share of foreign-born workers on the other hand is larger in young firms, but foreign-born workers seem to experience a more negative wage gap in young firms compared to older incumbent firms. Jobs at young firms might thus promote more inclusive labour markets through hiring more from disadvantaged worker groups that may have difficulty entering the labour market, but workers might be having to accept a lower wage in return.

4. Young firms offer more open-ended contracts than older firms for similar types of workers. Given that most firms die within their first years of business, accepting employment at a young firm entails a substantial risk of job loss. Young firms seem to make up for this by offering more secure contracts.

These findings have important implications for economic policy. The quality of jobs created by different types of firms, and the hiring patterns from disadvantaged worker groups are relevant for labour market inclusiveness and polarisation. As young firms provide entry points into the labour market, they can play an important role for the integration of disadvantaged groups into employment, thereby fostering an inclusive labour market. This strengthens the case for reducing barriers to firm entry and fostering a dynamic business environment.

The rest of the paper is structured as follows. The next section defines job quality, inclusiveness, and firm age and provides theoretical arguments linking these concepts, before reviewing findings and discussions from the literature on young firms, job quality, and inclusiveness. Section 5.3 discusses the institutional setting of the French and Portuguese economies, in particular to the role of young firms in each country. Section 5.4 introduces the French and Portuguese data used in the analysis, before the empirical strategy and identification are discussed in section 5.5. Section 5.6 presents the results, and section 5.8 provides some concluding remarks and an outlook of what more can be done in the future.

5.2 Definitions, background and previous evidence

5.2.1 Outline of terms and concepts

5.2.1.1 Young firms

Given the focus of this study on the quality and inclusiveness of jobs in young firms vis-à-vis those in older incumbents, a first important step is the identification and definition of these firms.

Despite a clear theoretical distinction between "transformational" young firms founded with the intention to grow, and "subsistence" firms founded primarily to sustain its owners (Schoar, 2010), in empirical studies, all types of young firms are typically lumped together. This decision is often data-driven, as the intentions and aspirations of firm founders are rarely observed in large administrative datasets. Firm age on the other hand is readily available in many administrative databases with universal coverage such as business registers or social security records, upon which the LEED exploited for the empirical analysis also rely.

This study therefore follows the common approach in the literature and focuses on new and young firms below a certain age (typically a threshold of 3-5 years is used), specifically, in this paper a firm is defined to be young if it has 5 years or less. This ensures on the one hand comparability with existing evidence and on the other hand allows future extension of this analysis to other countries with more sparse information in their LEED datasets.

5.2.1.2 Job quality

The main measure of job quality used in this paper is the level of wages paid to a worker. Wages are measured as pre-tax (and before the deduction of social contributions) gross earnings, including commissions, bonuses, extra pays, and premia, including in-kind. Social security contributions paid by the employer are not included.

The analysis on wages is supplemented by additional exploratory analysis of open-versus fixed-term employment as a measure of job security.

Besides contributing to job security – conditional on survival of the firm –, open-ended contracts tend to entail a number of other non-monetary advantages. These can include training opportunities, participation in benefits voluntarily provided by employers such as subsidised catering or commuting, as well as advantages outside of work, such as on the housing market. The focus on contract types is further motivated by the fact that fixed-term contracts seem to be particularly adverse for young workers and labour market entrants, for whom a first fixed-term appointment can trigger a string of temporary contracts before finding a permanent job (Blanchard & Landier, 2002). Even though young firms have a high risk of exiting in the first few years, workers may choose to take this risk if it is partially compensated though the provision of an open-ended contract.

While job quality is an inherently multidimensional concept that contains both objective and subjective

aspects, from a policy perspective, focusing on single objective and observable indicators at a time is more informative. The identification of tangible and distinct characteristics of jobs is a necessary first step for evidence-based policy making and allows for an evaluation of the importance of different characteristics in an explicit and transparent manner.

Although not the focus of this analysis, an overview of subjective approaches to job quality is presented in subsection 5.2.1.4. While inherently restricted to a narrower range of dimensions of job quality, LEED have a number of important advantages over other types of data such as surveys. They typically provide a comprehensive coverage (often including the universe of firms or a large sample thereof), and data quality of core employment characteristics such as wages, contract types, industry, and occupation is high given that the data are typically sourced from administrative records, often entailing mandatory reporting requirements.

Furthermore, LEED often allow following workers as they move across different types of firms, which enables a clear separation of worker and firm characteristics that determine job quality outcomes. Investigating the firm dimension of job quality can provide important insights with direct relevance to policy makers, as targeting becomes much easier if specific types of firms can be identified as being associated with distinct job quality characteristics. This is especially relevant to inform the design of policies for start-ups, where aspects of job quality have not been always given as much attention as employment creation.

5.2.1.3 Inclusiveness

The inclusiveness concept adopted in this paper refers to labour market outcomes for groups of workers that typically face challenges in labour markets (in terms of employment as well as job quality outcomes). Specifically, the analysis focuses on women and foreigners.

Outcomes of interest considered in the analysis include the quality of the jobs these groups of workers have in young compared to old firms, focusing on wage gaps and differences in contract types providing differing levels of job security, as well as the extent to which they are hired more by young firms than older ones. Analysing these two margins of inclusiveness provides an important and novel perspective, complementary to the one on job quality, on the role of young vis-à-vis older firms in the economy, exploiting the availability of information on gender and foreign-born status in the French LEED.

5.2.1.4 Subjective measures of job quality

Subjective approaches to measuring job quality take into account the heterogeneity of employees in terms of their needs and preferences (e.g., workers with children may attach more value to flexible working time arrangements, middle-aged workers may care more about career-advancement opportunities, etc.). This makes them inherently subject to circumstances, norms, adaptation, and aspirations that influence people in their perceptions and value judgements. In particular, as argued by (Brown et al., 2007), deriving the need for policy intervention from subjective measures can be challenging given that, despite being in

objectively low quality jobs, many workers report high job satisfaction simply because they evaluate their own job against a low benchmark level. In this regard, the conceptual discussion of job quality is closely related to that of objective vs. subjective measures of well-being and human development. Schokkaert et al. (2009) provide an excellent formalisation of the relationship between objective and subjective measures of job satisfaction, clarifying their relative strengths and weaknesses.

There are a number of initiatives on measuring the quality of jobs from different public institutions, following a surge in interest since the early 2000s. Several projects have been launched by national governments (e.g., the UK through the 2017 "Taylor Review") as well as different international organisations, including the OECD through its Framework on Job Quality (Cazes et al., 2015). Most of these are very broad in scope, take an employee-perspective, and are designed for survey-based measurement of job quality. The "OECD Job Quality Framework" overview article (Cazes et al., 2015) contains a summary of the different initiatives on job quality of various institutions and international organisations. Murtin et al. (2022) further extends the analysis in Cazes et al. (2015) by providing comparable measures of the quality of the working environment to 28 countries.

Besides the EU's numerous activities (e.g., through the development of the Laeken indicators on job quality, or the EU Employment Committee), very comprehensive initiatives are those of the International Labour Organization (ILO) and Economic Commission for Europe (UNECE). The ILO has been developing its own "Decent Work Agenda", and the United Nations (UN), through its UNECE , has published a handbook on job quality. The handbook provides a comprehensive statistical framework with a list of dimension, sub-dimensions, and statistical indicators for measuring them, which can serve as a useful starting point for structuring different aspects of job quality.

5.2.2 Background and overview of existing evidence

Given its twofold contribution, the paper links two largely separate discussions and streams of literature in entrepreneurship and labour market research. The first relates to the topic of job quality, and the second to the debate on labour market inclusiveness, with the latter having focused mainly on gender.

The literature investigating job quality is large, both for conceptual and empirical work. While the conceptual literature provides important insights motivating the importance of the topic, there is little overlap with theories of entrepreneurship and firm-level empirical research. Firm-level research on employment creation has started to consider the quality of the jobs created by young firms only recently.

Within the literature on the inclusiveness of labour markets and of jobs in start-ups and young firms, there are numerous studies documenting a gender gap in entrepreneurship (e.g., Guzman and Kacperczyk, 2019; OECD, 2012; OECD and European Commission, 2021). Studies focusing on the characteristics of employees and composition of the labour force of new firms are scarcer, as are those investigating other disadvantaged groups such as foreigners.

Among the studies focusing on firms' employees rather than founders, the only systematically investigated group are the young, with evidence consistently indicating that start-ups tend to hire younger

employees (Coad et al., 2014; Nyström & Elvung, 2014; Ouimet & Zarutskie, 2014). This highlights the importance of young firms as entry points into the labour market. The mechanisms and reasons that lie behind these hiring patterns can be equally relevant for other disadvantaged groups such as foreigners or women, which are more closely examined in this work.

The following section summarises concepts and findings from the literature, pointing to the theory and focusing on recent empirical studies using LEED . First, studies on the quality of jobs for the entire population of workers are summarised before moving to more disaggregated findings for different (disadvantaged) groups of workers.

5.2.2.1 The quality of jobs at young firms: Previous findings

From a theory perspective, it is not clear whether young firms pay higher or lower wages than older ones. On the one hand, employment at start-ups tends to be riskier (Calvino et al., 2018; Haltiwanger et al., 2013), with many young firms going out of business during their first years of existence. Paying a wage premium would be one way to attract employees despite this uncertainty. Non-monetary dimensions of job quality can also compensate for this to a certain degree. For example, employees may have more diverse tasks, more responsibility, and more influence on the fate of the firm. Firms may also choose to provide more secure contracts. On the other hand, start-ups and young firms typically have fewer resources at their disposal, constraining them in their ability to pay a wage premium. This might be leading them to hire workers demanding lower wages, especially in tense labour markets (such as during economic upswings). Lower reservation wages can be indicative of less qualified workers, but it could also be that these workers come from groups that face challenges entering the labour market and therefore demand lower wages.

An excellent overview of these concepts based on the recent empirical literature on the quality (and quantity) of jobs created by young firms is provided by Block et al. (2018), to which only a few more recent studies can be added. Generally, most of the literature focuses on monetary measures of job quality, with only a few studies investigating other benefits such as pension schemes or job security.

While the prevailing view in the earlier literature is that young firms pay lower wages (Brixy et al., 2006; Nyström & Elvung, 2014; Shane, 2009), more recent evidence (summarized in Block et al. (2018) suggests that when controlling for certain worker characteristics, this no longer holds true. Some studies (Adrjan, 2018; Burton et al., 2017; Kim, 2018; Ouimet & Zarutskie, 2014; Schmieder, 2013) even find that a small group of high-growth young firms pay wage premia, while Schmieder (2023) finds large wage premiums for workers who start in new establishments.

In particular, Adrjan (2018) convincingly combines a number of strategies to elicit the difference in wages paid by new and established firms in the UK. Using a fixed effects model, he finds a small, but statistically significant wage premium for young firms, which is higher for surviving and successful young firms.

Burton et al. (2017) and Nyström and Elvung (2014) follow a different empirical strategy using rich

Danish and Swedish data, respectively. They opt for a matching approach to deal with selection issues, which are ubiquitous in the pairing of firms and workers. With this approach, Nyström and Elvung (2014) find a wage penalty of being employed in entrepreneurial firms on Swedish data, while Burton et al. (2017) find a wage premium. Focusing on job switchers, Nyström and Zhetibaeva Elvung (2015) find that the share of those transitioning into a lower-wage job is higher for those moving to new firms compared to incumbents.

One of the main differences between studies finding premia (Adrjan, 2018; Burton et al., 2017) and those finding penalties Nyström and Elvung (2014) is that the former control for tenure at the firm. Controlling for tenure is an important challenge to the identification of causal effects, as tenure is, by construction, lower at young firms, and at the same time leads to higher wages. This is difficult to do with data that do not follow workers over long periods of time. Many papers (including Adrjan, 2018, and Burton et al., 2017) focus on new hires to mitigate the problem.

A more recent line of literature focuses on the long-term effects on wages of employment in young firms, with Sorenson et al. (2021) and Fackler et al. (2022) for the Danish and German labour markets, respectively. Both these studies find similar long lasting negative effects on workers careers.

In section 5.6, building upon the literature discussed above, this paper will address potential omitted variable bias not only by employing a panel approach and directly controlling for tenure, but also restricting the sample to new hires.

5.2.2.2 Inclusiveness of jobs at young firms: Previous findings

Despite a large literature investigating the representation of disadvantaged groups amongst entrepreneurs (see for instance OECD and European Commission, 2021), few studies focus explicitly on employees in young vs. established firms. The lack of research on the composition of young firms' workforce is somewhat surprising, given the importance of the first employees for firm success (Dahl & Klepper, 2015; Koch et al., 2012). Hiring women among the first few employees has been found to be conducive to firm survival, and discriminatory hiring practices lead to worse survival rates (Weber & Zulehner, 2010, 2014).

The literature on firm founders documents a low share of female-led start-ups, as well as females facing higher barriers to start-up funding (e.g., Guzman and Kacperczyk, 2019; Lassébie et al., 2019). Taking into account the stylised fact that women are more likely to hire other women (Hensvik, 2014; Weber & Zulehner, 2010), and that the firm founders are the ones making the hiring decisions in start-ups – particularly at early stages – one would expect the gender composition of start-up hires to be tilted towards male employees.

On the other hand, self-selection of women into lower-paying firms has been widely documented, e.g. by Cardoso et al. (2016) and Card et al. (2016), who find that firm-specific pay premia account for around one fifth of the gender wage gap in Portugal. Gupta and Rothstein (2005) find similar patterns in Denmark. However, none of the studies investigates whether firm age plays a role in the observed relationships. If, as conventionally assumed, new firms pay lower wages, women might self-select into these types of firms.

The gender gap in entrepreneurship may have further implications for the relative pay of male and female employees in start-ups and young firms. There is empirical evidence showing that the gender pay gap diminishes with the presence of female firm owners and with high-level female managers (Cardoso & Winter-Ebmer, 2010; P. Cohen & Huffman, 2007; Newton & Simutin, 2015). Given the well-documented gender gap in start-ups, this might imply that the gender wage gap is in fact higher in new firms, as they tend to be relatively more dominated by men.

In line with the ambiguous theoretical predictions, empirical evidence on the gender composition and characteristics of the labour force of young firms is inconclusive, with some studies finding that women are less likely to be employed in new firms (Nyström, 2012) and others finding mixed results (Coad et al., 2016).

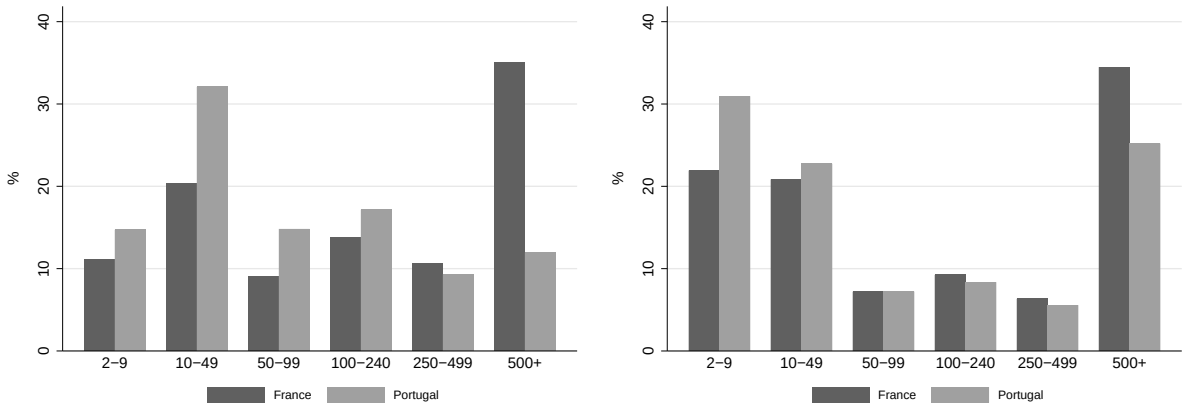
For foreign workers, results are clearer, with young firms hiring relatively more migrants in Sweden (Nyström, 2012) and Denmark (Coad et al., 2016). Fackler et al. (2019) is to the best of our knowledge the only study simultaneously investigating employment of disadvantaged groups in new firms, and the quality of their jobs. While disadvantaged groups – women, migrants, and unemployed– are more likely to be hired by start-ups in Germany, the authors also find that they suffer from wage penalties that go above and beyond the lower wage levels observed in young firms.[4]

Summarising the findings from the studies on disadvantaged groups in new firms, migrants (as well as labour market entrants) seem to have better employment opportunities at young as opposed to established firms. At the same time, they experience worse outcomes in terms of wages. The results for gender are more heterogeneous, with women being equally or less likely to be working in new firms in Nordic countries (Denmark and Sweden), but equally or more likely to be employed in new firms in Germany, while at the same time experiencing wage penalties.

While important in their own right, the employment opportunities and quality of jobs for disadvantaged groups may also have longer-term implications for labour market outcomes for at least two reasons. First, a job at a new firm provides an entry point (back) into the labour market, with the possibility to transition into a high-quality job. There are also direct opportunities for longer-term positive effects at young firms, e.g. through flat hierarchies and faster promotion in the case of firm success and growth. Evidence from Tåg et al. (2016) indeed shows that employees from firms with flatter hierarchies have higher transition probabilities into other jobs. In this sense, jobs in new firms may be more likely to provide stepping stones for disadvantaged workers.

Second, there is evidence that working at a start-up entails a distinct type of work experience inherent to the learning process within a young firm, which yields higher return in future jobs compared to work

[4]Although not comprehensively explored in the current analysis, part of the literature has also focused on young workers or labour market entrants. Nyström (2012) and Nyström and Elvung (2014) as well as Fackler et al. (2019) find that young firms are more likely to hire labour market entrants. However, when distinguishing employee age from first employment, Ouimet and Zarutskie (2014) find that young firms hire employees who are younger on average, while Fackler et al. (2019) find the opposite when controlling for a number of individual characteristics. Focusing on wage gaps rather than employment, Nyström and Elvung (2014) estimate the wage penalty for labour market entrants in new firms in Sweden to be 2.9%. Nyström and Zhetibaeva Elvung (2015), focusing on job switchers, find that employees who lose their previous job do not experience lower wages in new- than in incumbent firms.



(a) Manufacturing

(b) Services

Figure 20: Size distribution, manufacturing and non-financial market services

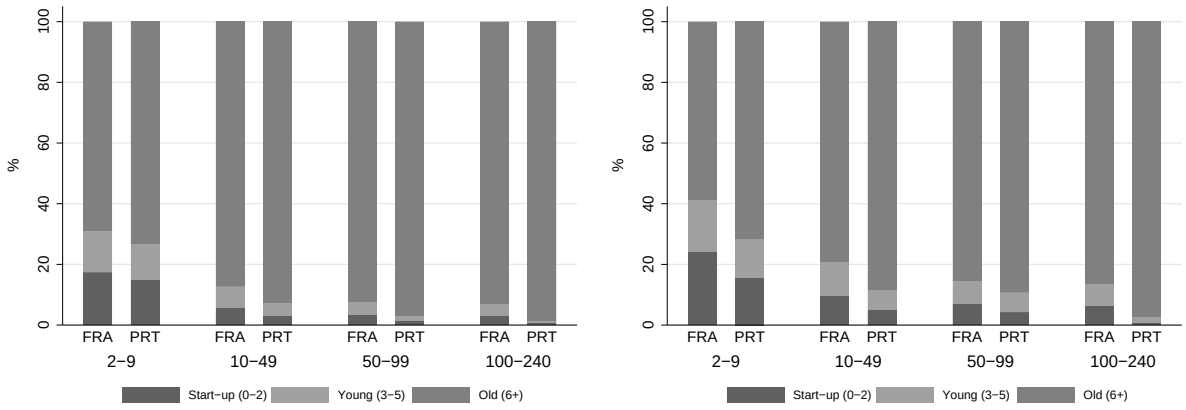
experience in an established firm (Miranda et al., 2018). Lazear (2004) argues that being an entrepreneur requires a minimum effort and ability of setting up and managing a business, which is a skill in itself. To a certain degree, similar demands are put on a firm's first employees. Workers hired by new firms are typically not entering into a highly specialised organisational structure, but a smaller entity at the starting point of developing its structure, which evolves organically, and may be shaped by the employees themselves as the firm matures. Working at a young entrepreneurial firm may therefore entail a variety of tasks that is higher than that at older (and larger) firms, which typically have developed a more fine-grained and established division of labour between workers (Bryson et al., 2017).[5]

5.3 Overview of business dynamism in France and Portugal

This section provides an overview on business dynamics in the French and Portuguese economies, paying special attention to the importance of young and small firms. As noted in OECD (2019, 2020b), economies with a large number of small firms can arise from a high share of small entrants or by incumbents firms that did not upscale. This is particularly important for the Portuguese economy, which is characterized by a high share of small firms, both in number of firms and share of employment. Additionally, new firms are one of the main mechanisms of job creation in the economy (see Criscuolo et al., 2014). Therefore, understanding the differences in this regard between these two countries will provide an important perspective when comparing the role of new firms on job quality and inclusiveness.

An important insight into the French and Portuguese economies comes from the diverging firm size structures. On average, a French and Portuguese incumbent firm employs around 44 and 16 workers,

[5]However, Sorenson et al. (2021), analysing Danish data suggest that after being employed by a small start-up, workers do not often return to large employers that may offer higher wages.



(a) Manufacturing

(b) Services

Figure 21: Firm age distribution by size class, manufacturing and non-financial market services

respectively. Figure 20[6] presents firm size distribution in terms of employment for each country for the manufacturing and services sector. Employment is highly concentrated in micro- and medium-sized firms in the Portuguese economy, particularly in the manufacturing sector. Contrasting this, employment in the French economy is more concentrated in large firms, resulting in France having large firms that are larger than other OECD countries.[7]

In terms of firm age distribution, significant differences between the two countries are also observed, with France having younger smaller firms. Figure 21[8] presents firms age distribution for both countries, by size class and sector. Although the Portuguese economy relies heavily on micro and medium-sized firms, for all size classes and in both macro sectors, France presents a higher share of new firms. This suggests that France has a more dynamic economy, while a significant amount of Portuguese firms remain small. Comparing French firms to benchmark countries, OECD (2020b) shows that only micro French firms are younger due to a larger share of firms up to two years of age, for both macro sectors.

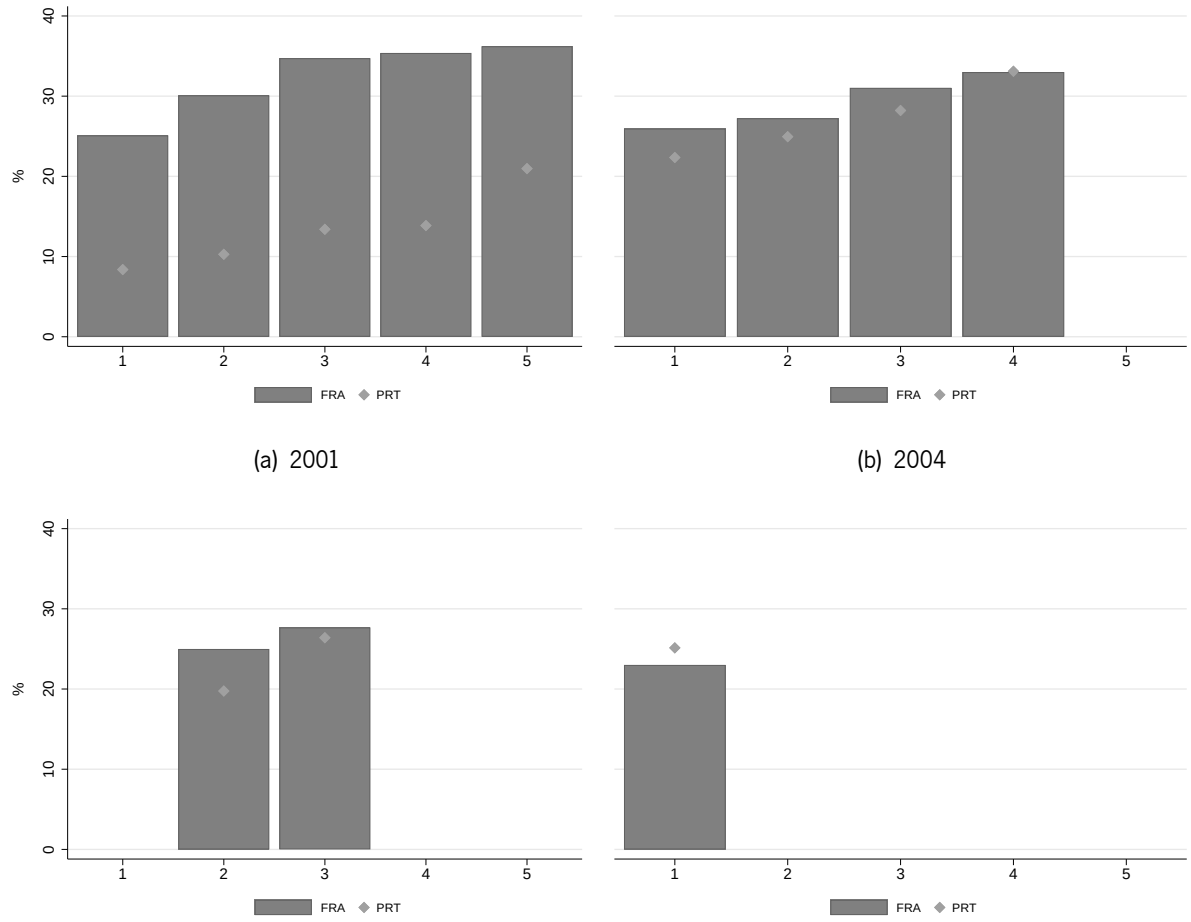
Figures 22 and 23[9] compares the average growth of entrants for both economies. Entrants in Portugal in the cohort of 2001 have a particularly large growth gap in comparison to French firms, in both macro sectors. For recent cohorts, there seems to be a convergence in growth rates with French firm in the

[6]This figure reports the size distribution in France and Portugal for six size classes, separately for manufacturing and non-financial market services on average in the period 1998-2015 and 2002-2015, respectively. Shares are calculated in terms of employment. Source: Calculations based on OECD DynEmp3 database, August 2019. Figures extracted and adapted from OECD (2019, 2020b).

[7]See OECD (2019, 2020b) for a comparison of each country against benchmarks.

[8]This figure reports the share of start-ups, young, and old units by size class of firms with employment between 2 and 249, in manufacturing and non-financial market services in 2015. Source: Calculations for France are based on OECD DynEmp3 database, August 2019, in OECD (2020b). Calculations for Portugal are based on calculations by the authors using the dataset Quadros de Pessoal.

[9]This figure reports the average employment growth rate by firms founded in different years (t = 2001, 2004, 2007 and 2012) after 3, 5, 7, 10 and 14 years. Source: OECD DynEmp database, August 2019. Figures extracted from OECD (2019, 2020b)..



(a) 2001 (b) 2004

(c) 2007 (d) 2012

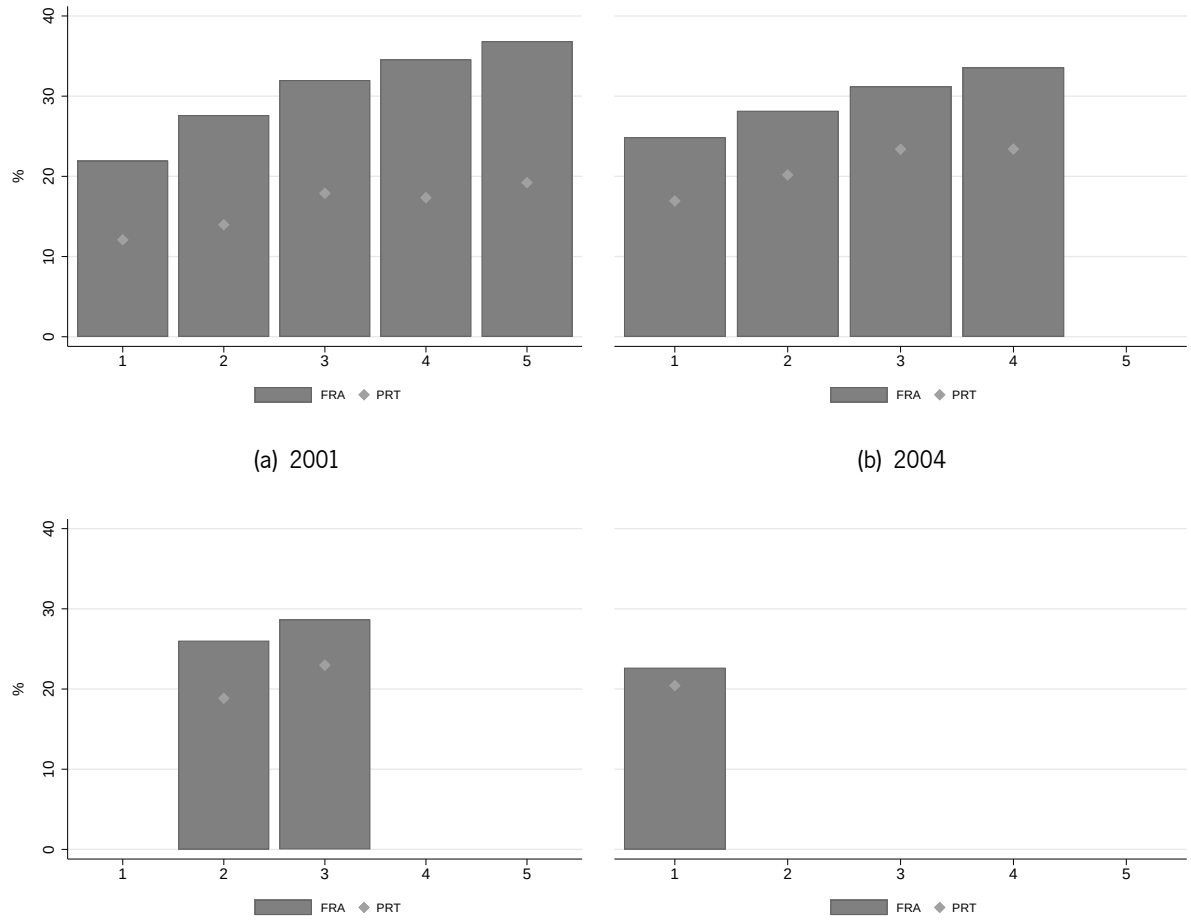
Figure 22: Average growth of cohorts of entrants over different time horizons, manufacturing

manufacturing, while a considerable gap remains in the services sector. This provides an important insight into the higher share of smaller firms in Portugal, as they are characterised by relatively low growth. As an important mechanism for business dynamics of an economy, a limited growth performance of new firms can have important implications for economic growth, productivity, and wages. This difference in the performance of entrants in the two countries provides a relevant background that may be useful to further contextualise the role that these firms have on job quality and inclusiveness.

5.4 Data

5.4.1 Data description

This section describes the data sources used for France and Portugal. It first focuses on the characteristics of the data in the two countries. It then provides further information about the variables available that are



(a) 2001 (b) 2004

(c) 2007 (d) 2012

Figure 23: Average growth of cohorts of entrants over different time horizons, services

relevant for the analysis, as well as any key differences between the information reported for each country.

5.4.1.1 France

The empirical analysis done for France is based on LEED covering a random sample of $1/12^{th}$ of the universe of French private sector employees.[10] Besides the obvious benefit of allowing an investigation of the firm dimension for job quality and inclusiveness, the LEED used in this paper are based on administrative records, ensuring on the one hand high quality, and on the other hand a comprehensive coverage of firms in the economy.

The main data source used is the Déclarations Administratives de Données Sociales (DADS) panel complied by the French Statistical Institute (INSEE), recording information from the social contribution

[10]This allows to significantly extend preliminary findings based on the workers' universe cross-section for one year only (2015), reported in the initial scoping draft of this project (Calvino & Scholl, 2019).

declarations provided by firms.[11] The "DADS Panel" dataset covers workers born in the month of October, corresponding to $1/12^{th}$ of the population of workers, summing up to over 1 million individuals per year in the estimation sample. Due to a number of breaks in the data series before 2002, the results presented in this paper rely on the time period from 2002-2017.[12] The resulting sample contains between 15 and 18 million observations, depending on the specification and control variables.

5.4.1.2 Portugal

The main data source used is the QP, a LEED collected by the MTSSS . It provides information on workers in all Portuguese firms, except for the central administration, regional and local, as well as public institutions; and employers of workers of domestic service. The available data include information on workers' formal education, age, gender, occupation, monthly wage, hours of work and the type of labour contract, from 1985 to 2021, reporting information on around 3 million workers per year. Due to changes in classifications of key variables, such as occupations and industry, only use data from 2010 to 2021 is used.[13] [14]

5.4.1.3 Key variables and comparability across data sources

The main outcome variable is a monetary measure of job quality, defined here as the gross hourly wage (pre-tax and before the deduction of social security contributions). It comprises commissions, bonuses, extra pay, stock options, and premia (including in-kind) for the French data. Similarly, for the Portuguese workers, it comprises extra pray and bonuses. Social security contributions paid by the employer are not included.[15]

The last part of this paper also considers a non-monetary measure of job quality, focusing on job security provided by different types of employment contracts. The analysis investigates whether the contracts offered by young firms are more or less secure than those provided by older firms, using information on open-ended versus other types of contracts which have a fixed end date. This information is available from 2006 onwards for the French data.

In this paper, young firms are defined as those aged 5 years or less, as it is commonly done in the literature. However, this cut-off is not guided by theory and is arbitrary to a certain degree. Depending

[11] This data is combined with information from fiscal data (FICUS/FARE) and the SIRENE business registry, containing records of firms' birth year, which is required for the construction of the firm age variable upon which the classification of firms into young and older classes is based.

[12] However, a number of variables are referring to worker characteristics preceding the sample period, such as tenure at the firm or labour market experience.

[13] Robustness checks with data from 2000 to 2021 for selected specifications confirm the results present in this paper.

[14] For robustness checks, the analysis also controls for firm ownership status, i.e., if the firm is controlled by foreign capital, using information from the SCIE dataset. The SCIE contains firm-level administrative data, including balance sheet and other account data. These are available every year for the population of firms in the private sector, except for the financial sector, from 2006 to 2021, reporting information on around 400 thousand firms per year.

[15] In the case of France, in order to arrive at a single worker-firm observation per year, the same criteria used by the data provider when picking amongst multi-establishment employment at the same firm are applied to determine which firm to keep. Details are documented in the appendix C, which provides further information on data cleaning.

on the research question, some papers find heterogeneous effects by firm age.[16] Different alternative age cut-offs are therefore tested, including employing more than one cut-off at a time, with no qualitative impact on the results obtained.

Arguably the most important firm-level control variable, firm size is highly correlated with firm age because young firms are typically small. Larger firms also tend to pay higher wages, thus, it is important to disentangle firm age from firm size. Firm size is measured as the numbers of workers at a firm at the end of the year and enters in logged form.[17] Another key firm-level control variable is industry, which is also aggregated into macro sectors (defined according to the national accounts A7 classification), for which a separate analysis is also carried out for manufacturing and market services. Analysis at the economy level include industry information, according to the national account A38 classification.

Further control variables relate to job attributes and include working time arrangements, which are either full- or part-time. This variable tends to be particularly relevant for analyses relating to gender pay gaps, as women – more often than men – are employed on part-time contracts, which typically pay lower hourly wages.[18] Another important control variable, occupation is also highly relevant for gender pay gaps due to the well-documented self-selection of women into low-paying occupations. The French DADS distinguish between 32 job types, including qualified and unqualified work in different industries as well as administrative, technical, artistic, scientific, agricultural, clerical, and managerial and executive positions, among others. The Portuguese QP contains occupation information according to the ISCO-08, containing 40 occupations at the two-digit level. Finally, both datasets provide information on the date of entry of a worker into the firm, even when that date precedes the time period covered by the dataset, allowing the construction of a precise tenure variable that is not truncated. This variable is particularly important for the analysis, as it allows to control for the fact that workers at young firms have, by construction, lower average tenure, hence addressing an important source of omitted variable bias.[19] Additional to tenure at the firm, years of private-sector labour market experience is also calculated for each worker. This is defined for French workers as the difference in years between 2002 and the year of entry into the current job. For Portuguese workers, labour market experience is defined as the rolling sum of years of employment between 2002 and 2021.

The main worker characteristics available in the data included as control variables are age, gender,

[16] For example, Brixy and Murmann (2016) find countercyclical hiring patterns only at very young firms less than 1.5 years old. Heyman (2007), instead of distinguishing new from incumbent firms through an age cut-off, estimates a piecewise linear model as a function of age on Swedish LEED. This analysis finds that the age effect on wages is strongest for young (<6 years) and old (>10 years) firms, and negative for the age group in the middle.

[17] Other functional forms, such as the introduction of different size categories, have been tested, without substantial changes to the results for the variables of interest.

[18] While contract type is considered a job quality outcome in itself, it can also be transmission channel of wages and is therefore not included as a separate control variable in the preferred specification of the wage regressions. Robustness of the main results to the inclusion of the contract type variable is, tested, with results changing only marginally.

[19] This information can also be used to calculate an – imperfect and truncated – proxy for the time of entry into the labour market. The younger the worker at the time of appearing in the dataset, the higher the likelihood that the first recorded job is also the first employment of the worker. This information is, however, only relevant in a cross-sectional context given that the point of entry into the labour market is fixed over time for a worker, and hence included in the worker fixed effects in a panel data model.

and place of birth. Gender and place of birth are also used for defining disadvantaged groups. Unfortunately, the French DADS do not provide further information on nationality or place of birth for foreign-born individuals. Therefore, a more detailed analysis using subsamples of foreign workers is only done for Portugal.[20]

5.4.2 Descriptive statistics

5.4.2.1 France

Before presenting the results from the econometric approach introduced in the next section, a first descriptive glimpse into the data provides some interesting insights. Table 13 shows that young firms account for a substantial share of firms in France (26.6%) and employ around 16% of employees in the sample. The difference in shares between the number of firms and the number of employees implies a substantial difference in firm size, with young firms counting on average 14 employees, as opposed to 44 employees in older firms.

Wages in young firms in France are on average lower than in young firms: the average gross hourly wage (henceforth referred to as wage) paid by young firms is about €14.4, compared to €16.6 at older firms. This implies a wage gap of around 9% at young firms. This "unconditional" wage gap hides significant heterogeneity across workers and firms and reduces substantially when a number of factors are accounted for, as explored in section 5.6 below.

Around 85.6% of workers in young firms are active in (non-financial market) services (for simplicity, henceforth referred to as services), as opposed to 78.5% of workers in old firms (see Table 13), and young firms account for 17% of the workforce in services compared to 11% in manufacturing. Given that manufacturing hourly wages (€17.32) are, on average, almost two Euros higher than in services (€15.48), the sectoral dimension can explain part of the observed wage difference between young and old firms. This is confirmed in a multivariate context in section 5.6 below, taking into account differences across more detailed sectors of activity.

There are also important differences in the workforce composition and the wages paid to women and foreigners, the two disadvantaged groups of workers considered in this paper, discussed in section 5.6 below. Although young firms employ a similar share of women as older firms, they employ more foreigners and labour market entrants compared to older firms.

Finally, young firms present a workforce younger than incumbent firms, with the workforce exhibiting on average 35.7 years of age, compared to 37.2 years of age for incumbents. In line with previous

[20] For workers born in France, it is possible to distinguish those born in continental France from those born in the Départements et Régions d'Outre-Mer (DROM), the French overseas departments. Separating the DROM-born workers from those born in France is important because their labour market outcomes turn out to be significantly different (and often worse) than those of French-born employees. Treating them as a homogeneous group would therefore dilute the results for the reference group. While this finding would warrant a separate investigation of workers born in DROM, there are too few individuals to obtain statistically significant effects for this group.

Table 13: Descriptive statistics of the data on France

	YF (0-5 years)		OF (6 years +)		All firms	
N (firms)	1,246,414		3,434,266		4,680,680	
% share (firms)	26.63		73.37		100	
N (workers)	2,614,892		13,487,822		16,102,714	
% share (workers)	16.24		83.76		100	
age (worker)	35.7		37.18		36.9	
% share (entrants)	12.1		6.7		7.6	
% part-time work	27		23		23	
% fixed-term	29		25		26	
tenure (years)	1.15		5.00		4.39	
mean firm size	14.27		44.15		36.22	
hourly wage	14.36		16.58		16.22	
	Men	Women	Men	Women	Men	Women
% share (workers)	60.7	39.3	59.3	40.7	59.50	40.51
age (worker)	36.0	35.23	37.5	36.7	37.3	36.5
% part-time work	19	40	14	35	15	36
% fixed-term	28	29	23	28	24	28
tenure (years)	1.20	1.18	5.29	4.69	4.61	4.13
hourly wage	15.33	12.86	17.87	14.71	17.45	14.42
	French	Foreign	French	Foreign	French	Foreign
% share (workers)	81.1	18.9	86.4	13.6	85.5	14.5
age (worker)	35.2	36.7	36.8	38.0	36.5	39.4
% part-time work	26	23	22	31	23	29
% fixed-term	28	31	24	30	25	30
tenure (years)	1.2	3.7	5.2	1.0	4.6	3.4
hourly wage	14.50	13.84	16.72	14.69	16.38	15.46
	Manuf.	Serv.	Manuf.	Serv.	Manuf.	Serv.
% share (firms)	13.0	87.0	20.3	79.7	18.4	81.6
% share (workers)	14.4	85.6	21.5	78.5	20.4	79.6
age (worker)	39.3	34.8	40.1	36.1	40.0	35.9
% part-time work	15	32	11	28	11	29
% fixed-term	12	33	9	32	10	33
tenure (years)	1.6	1.1	7.6	4.1	7.0	3.6
hourly wage	15.03	14.02	17.61	15.78	17.32	15.48

Notes: Numbers of subcategories do not always add up to exactly to those at a higher level of aggregation due to missing information of individual observations on some of the subcategory values. Note that there are sectors other than Manufacturing and Services in the sample. Numbers are 2002-2017 averages, with the exception of the number of firms and workers which are cumulative values. 'YF' stands for Young firm. 'OF' stands for Old firm. 'Manuf.' stands for Manufacturing. 'Serv.' stands for Services.
Source: Authors' calculations based on DADS, FARE.

literature (Criscuolo et al., 2014), this suggests that young firms play an important role in being an entry point into the labour market.

5.4.2.2 Portugal

Table 14 reports similar statistics for the Portuguese economy. Young firms account for around 27% of all firms and employ 12% of the workforce. In terms of worker composition, young firms have a younger workforce, with a higher composition of labour market entrants and less tenured workers. Young firms also employ on average more part-time and fixed-term contract, with only 7.2% and 6.3% workers being under a part-time contract in young and incumbent firms, respectively; and 47.4% and 29.4% of workers under a fixed-term contract in young and incumbent firms, respectively. In terms of firm size, measured by the average number of workers, young firms are smaller than incumbents, with incumbents being around two times larger. Finally, the wages paid by young firms are lower, with an "unconditional" wage gap of around 19%.

In terms of gender composition, young firms employ a higher share of men than incumbent firms. In fact, incumbent firms are almost at a parity level with 52% men and 48% women, while this division of the workforce sits at 55/45 for young firms. Looking at nationality, young firms have a higher share of foreign workers, at 11% versus 5% in incumbent firms.

Focusing on the sectoral decomposition between manufacturing and services, young firms are more concentrated in the services sector, both in terms of number of firms and share of employment. The services sector captures 86% of new firms, opposed to around 81% of incumbents. In terms of employment, new firms capture around 77% of employment, while incumbents' share is 67%. Furthermore, although having a higher share of labour market entrants, more part-time contracts and fixed-term contracts, average wages are higher in the services sector, both for young firms and old firms, when comparing to the manufacturing sector.

Overall, both economies present a similar relation between young and incumbent firms, with the exception of the composition of the workforce by gender. The gap between young and incumbent firms also appears to be larger in the Portuguese economy, in particularly in terms of the "unconditional" wage gap and the difference in average size.

5.5 Empirical strategy

The job quality difference between young and older firms is investigated empirically through the regression model presented in equation 5.1. Equation 5.1 is estimated for each country separately. For wages, the coefficient on the binary "young firm" variable represents the wage penalty (or premium), i.e., the extent to which young firms pay lower or higher wages with respect to older ones. For contract types, it can be interpreted as the difference in the percentage points of workers in open- compared to fixed-term contracts. This model can be applied to both cross-sectional and a panel data. Panel data models are, however, clearly preferable for identifying differences net of worker's unobserved characteristics. However, the impact of several characteristics that are constant over time and that are of interest (most importantly in this context, gender and nationality) can only be estimated with a cross-sectional approach or applying

Table 14: Descriptive statistics of the data on Portugal

	YF (0-5 years)		OF (6 years +)		All firms	
N (firms)	824,770		2,210,715		3,035,485	
% share (firms)	27.17		72.83		100.00	
N (workers)	3,698,310		26,277,975		29,976,285	
% share (workers)	12.34		87.66		100.00	
age (worker)	37.48		40.07		39.75	
% share (entrants)	11.47		4.85		5.67	
% part-time work	7.18		6.29		6.40	
% fixed-term	47.36		29.45		31.63	
tenure (year)	1.12		7.75		6.93	
mean firm size	5.66		13.27		11.20	
hourly wage	4.51		5.38		5.27	
	Men	Women	Men	Women	Men	Women
% share (workers)	55.13	44.87	51.91	48.09	52.31	47.69
age (worker)	37.90	36.97	40.21	39.92	39.91	39.58
% share (entrants)	11.69	11.20	4.74	4.97	5.64	5.69
% part-time work	4.67	10.25	3.67	9.13	3.80	9.26
% fixed-term	49.42	44.83	29.85	29.02	32.36	30.83
tenure (year)	1.07	1.18	7.73	7.77	6.87	7.00
hourly wage	4.75	4.20	5.78	4.92	5.65	4.84
	POR	Foreign	POR	Foreign	POR	Foreign
% share (workers)	89.04	10.96	95.06	4.94	94.31	5.69
age (worker)	37.73	35.46	40.19	37.91	39.90	37.33
% share (entrants)	9.25	29.48	4.25	16.41	4.83	19.52
% part-time work	7.23	6.72	6.15	9.14	6.27	8.57
% fixed-term	44.63	69.44	28.07	55.93	29.97	59.12
tenure (year)	1.18	0.64	7.99	3.11	7.20	2.53
hourly wage	4.55	4.15	5.39	5.02	5.30	4.81
	Manuf.	Serv.	Manuf.	Serv.	Manuf.	Serv.
% share (firms)	14.34	85.66	19.31	80.69	17.93	82.07
% share (workers)	22.67	77.33	32.38	67.62	31.19	68.81
age (worker)	38.98	36.45	40.75	38.68	40.59	38.37
% share (entrants)	6.36	12.69	2.71	6.45	3.04	7.31
% part-time work	2.15	9.57	1.05	9.99	1.15	9.93
% fixed-term	37.59	48.83	22.57	33.75	23.89	35.81
tenure (year)	1.35	1.06	9.96	6.37	9.19	5.64
hourly wage	4.04	4.63	5.02	5.22	4.93	5.14

Notes: Numbers of subcategories do not always add up to exactly to those at a higher level of aggregation due to missing information of individual observations on some of the subcategory values. Note that there are sectors other than Manufacturing and Services in the sample. Numbers are 2010-2021 averages, with the exception of the number of firms and workers which are cumulative values. 'POR' stands for Portuguese. 'YF' stands for Young firm. 'OF' stands for Old firm. 'Manuf.' stands for Manufacturing. 'Serv.' stands for Services.
Source: Authors' calculations based on Quadros de Pessoal.

a multiple linear regression model by Ordinary least squares (OLS) (not exploiting the panel dimension of the data). A set of results from a OLS model, pooling all available years, is therefore estimated first, before moving to a panel data setting.[21] [22]

The econometric model estimates job quality of worker i, working in firm j, at time t, as a function of a set of individual-level and firm-level characteristics, X and Z, respectively:

$$\begin{aligned} \text{Job Quality}_{\text{i,j,t}} = &\alpha + \rho\ \text{YoungFirm}_{\text{j,t}} + \beta\ \text{Disadvantaged}_{\text{i}} \\ &+ \gamma\ \text{YoungFirm}_{\text{j,t}} * \ \text{Disadvantaged}_{\text{i}} + \sum_{\text{k}} \delta_{\text{k}} X_{\text{i,t,k}} \\ &+ \sum_{\text{m}} \sigma_m Z_{\text{j,t,m}} + \mu_{\text{i}} + \theta_j + \lambda_{\text{t}} + \varepsilon_{\text{i,j,t}} \end{aligned} \tag{5.1}$$

To estimate the effect of working at a young firm on job quality in terms of wages, the dependent variable (gross hourly wages) enters in logarithmic form so that all coefficients can be interpreted as approximate percentage changes. "YoungFirm" and "Disadvantaged" are the main variables of interest for the analysis and are both coded as binary variables. Their coefficients can therefore be read as an approximation to the percentage difference in wages earned between the omitted reference category (e.g., older incumbent firms, male workers, native workers) and the estimated category (i.e., young firms, female workers, foreign workers, respectively).

Individual fixed effects μ_{i}, firm fixed effects θ_j, and time dummies λ_{t} can be added to the model flexibly. Finally, $\varepsilon_{\text{i,j,t}}$ denotes the usual error term. This has important implications for identification of the variables of interest. Importantly, the inclusion of a worker fixed effect implies that the "Young Firm" coefficient is identified through comparing the same worker working at firms of different age groups at different points in time during the observation period. Because there may be other factors changing with time, it is important to include a number of relevant time-variant worker characteristics (denoted "X" in the model above).

Important time-varying X variables at the individual level include employee's age and tenure at the firm; as well as job characteristics, including occupation and working time arrangements (full- vs. part-time work).

In addition to these time-varying variables, there are other characteristics that are time-fixed (and will therefore not be identified when the model contains worker fixed effects), including gender and place of birth. Worker fixed effects control for a number of additional (unobserved) time-constant characteristics such as point of entry in the labour market, risk aversion and innate ability, which are likely to influence both wages and (self-)selection into different types of firms and therefore might potentially bias the estimated young firm effect.[23]

[21] Focusing on France, initial analysis by Calvino and Scholl (2019) employs a cross-sectional approach, reaching similar results to the OLS estimates in this paper.

[22] Even though panel data methods, and in particular the addition of worker fixed effects, represents a significant improvement over OLS analyses in isolating the effects of working in a young firm from other influencing factors on job quality, some challenges to causal identification still remain. These are discussed more in detail after the presentation of the empirical model.

[23] Another approach to account for selection bias sometimes adopted in the literature, especially when only cross-sectional

Time-varying variables Z at the firm level include firm size (measured as the number of employees), which, apart from being an important confounder of firm age, has been shown to have a separate influence on certain aspects of job quality (Litwin & Phan, 2013). Firm variables which are inherently time-fixed (or constructed to be so in the preparation of the dataset) are industry groups.[24] To some degree, and depending on the time frame considered, the firm's age group (young versus older incumbent status) exhibits limited within-firm variation over time, which only comes from ageing of firms in the young group that become older incumbents. Firm fixed effects capture all time-invariant firm-specific characteristics or characteristics associated with firms across a distinct generation.[25]

To sum up, apart from when explicitly stated in each regression table for the purpose of analysing the sensitivity of the coefficients of interest, the full list of control variables is firm size, worker age, gender, nationality, part-time contracts, tenure, labour market experience, occupation, industry and time are used for both countries. Additionally, for regressions specific to Portugal, controls also include NUTSII regions and years of formal education.

One challenge of a model containing both firm and individual fixed effects is that estimation can quickly become computationally demanding in large datasets. Abowd et al. (1999) provide a detailed discussion of the interrelationships between estimated coefficients of fixed effects, and the computational difficulties involved. Because fixed effects absorb all time-constant variables of the respective unit, this reduces the set of control variables Z (for firms) and X (for workers) to those that vary over the time period considered.

As discussed, for disadvantaged groups on the labour market (women and foreign-born workers), the "Disadvantaged" variable is defined according to a time-fixed characteristic (sex and place of birth), and therefore absorbed by the worker fixed effect. Although the "unconditional" effect (that is, the average effect on wages accruing across all types of firms) being disadvantaged is not identified in a model with individual fixed effects, the interaction with the "YoungFirm" dummy can be estimated. Effectively, identification in this case stems from workers switching firms – i.e., workers moving from an incumbent to a young firm, or vice versa.[26]

When firm fixed effects are included, the identification of the "YoungFirm" effect stems from firms reaching six years of age during the period of observation. Because firms switch categories in a discrete manner around an age threshold that is both artificial and, to a certain degree, arbitrary, the introduction of alternative age thresholds, as well as additional intermediate firm age categories (ranging, e.g., from ages 6-10), is tested to mitigate this issue and ensure results are not driven by the choice of a particular age

data is available, is matching (e.g., Schnabel et al., 2009). However, matching requires a minimum richness of individual-level information on which workers working in different firms – and having differential disadvantaged group status – can be matched (such as, e.g., education and detailed employment history), which is not available in the datasets at hand.

[24] For the analysis, firms are not allowed to switch the industry they are active in. In the case of industry switches in the data, the firm is classified into the industry it was active the longest (and in case of a tie, more recently).

[25] E.g., to some degree path-dependent organisational routines – see Becker (2004) –, which may be also linked with sticky productivity differences across firms, as well as patterns related to location or sector of activity (e.g. high-tech sectors or more urban areas may be paying higher wages and also have a more dynamic start-up environment with more young firms).

[26] For workers staying at the same firm throughout the observation period, both variables in the interaction exhibit the same variation (that is, no variation) and will be absorbed by the worker fixed effect.

threshold. The literature also suggests that surviving firms pay higher wages ex-ante, further motivating the inclusion of firm fixed effects to ensure results are not due to particular types of young firms only.[27]

The use of both worker-and firm fixed effects implies that the identification of the coefficients of interest is based on a subset of observations that differs from that of the full sample of workers on which the OLS estimates rely. Specifically, while worker fixed effects imply that identification of the "Young Firm" variable relies on workers employed at firms of different age groups over the observed time period, the use of firm fixed effects requires the firm to "grow old" – i.e., cross the chosen age cut-off – over the same period. Combined, the use of both worker and firm fixed effects means the identification of the "Young Firm" effect relies only on workers who switch from and to firms that grow old over the sample period (or are employed at a firm while it crosses the age threshold).[28]

Previous findings from the literature suggest that firm fixed effects are of limited importance for explaining variation in wages across the firm-age dimension. While Adrjan (2018) finds in his UK sample that adding firm fixed effects to the model greatly increases the explanatory power, it does not qualitatively change the result that young firms pay a wage premium – in fact, the estimated premium is larger when fixed effects are included. Babina et al. (2019) come to the same conclusion using LEED from the United States. These considerations, along with the limitations on the underlying worker and firm population for the two-way fixed effects model, motivate the focus in this paper on the worker fixed effects model as the preferred specification. Other models are included as robustness checks and the preferred models are tested on the restrictive population subset when different results emerge.

By contrast, tenure at the firm has been shown to be a key factor in explaining the reversal of the sign in the young firm wage effect in the literature, from a wage penalty to a wage premium (e.g., Adrjan, 2018; Babina et al., 2019). Work experience within the firm is positively associated with wages, and because tenure is, by definition, shorter at young firms (tenure can only be as long as the firm is old), omitting tenure from the set of control variables means that the estimated wage gap would be biased upwards. The inclusion of several versions of tenure, also in combination with worker fixed effects, therefore represents an important advantage that can be exploited with these LEED datasets.

5.6 Results and discussion

The empirical analysis presented in the following proceeds in several steps. It first focuses on the wage levels provided by young firms, investigating whether wages paid by young firms are lower or higher compared to older firms), and addressing potential omitted variable bias through a number of strategies, including focusing on a specific group of workers (new hires). After that, heterogeneities between sectors

[27] Accounting for heterogeneity among young firms, Adrjan (2018) differentiates young firms by their ex-post success, measured by firm survival or sales per worker.

[28] Firms that do not grow old (either because they disappear before reaching 6 years of age or because they are born less than 5 years before the end of the observation period – in this case, after 2012 for France and 2016 for Portugal) do not contribute to identification of the estimated coefficients; and neither do workers who work at these firms, or at firms more than 6 years old at the beginning of the sample period (i.e., born before 1997 and 2005 for France and Portugal, respectively).

(manufacturing versus services are explored, before moving to inclusiveness and differences in labour market outcomes for those parts of the population that are typically at a disadvantage on the labour market, focusing first on women, and second on foreign workers. The last section investigates one aspect of job security, focusing on the share of open-ended contracts in a firm, providing some exploratory results on a non-monetary dimension of job quality.

5.7 Job quality at young firms in France and Portugal

A set of regression results on job quality in young firms for France and Portugal is shown in Table 15 and, Table 16, respectively. This first specification does not take into account the panel structure of the data, excluding worker or firm fixed effects.[29] This specification aims to gauge how much of the wage gap between young and older firms and the variation in wages can be explained by the observable factors included in the model, before the addition of fixed effects to also account for some unobserved factors. Adding control variables in a stepwise manner allows to assess how much the added factors matter for the difference in wages at young firms. For example, a higher propensity of young firms to employ disadvantaged workers, who typically earn lower wages, can explain part of a wage gap.

The first column, containing only the young firm indicator variable and a set of year fixed effects, finds a wage differential of about 10% in France and 12% in Portugal, between old and young firms. This wage gap reduces significantly with the stepwise inclusion of further control variables in columns (2) through (9). Both the size of the coefficient as well as the low explanatory power of the model are in line with previous findings (Adrjan (2018) for example finds an unconditional wage gap of 13.5% in the UK).

[29] Job Quality $_{ijt} = \alpha + \rho$ YoungFirm $_{jt} + \beta$ Disadvantaged $_{i} + \sum_{k} \delta_{k} X_{i,t,k} + \sum_{m} \sigma_{m} Z_{j,t,m} + \lambda_{t} + \varepsilon_{i,j,t}$.

Table 15: Job quality in young firms, step-by-step inclusion of controls – France

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Young firm	-0.0981***	-0.0639***	-0.0571***	-0.0339***	-0.0241***	-0.0240***	-0.0170***	0.0057***	0.0056***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0003)
Firm size			0.0199***	0.0171***	0.0188***	0.0187***	0.0121***	0.0116***	0.0180***
			(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Age					0.0327***	0.0335***	0.0153***	0.0114***	0.0277***
					(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0001)
Age^2					-0.0003***	-0.0003***	-0.0001***	-0.0001***	-0.0003***
					(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Female						-0.1280***	-0.0950***	-0.0951***	-0.1260***
						(0.0002)	(0.0002)	(0.0002)	(0.0002)
Foreigner						-0.0596***	-0.0134***	-0.0039***	-0.0453***
						(0.0003)	(0.0002)	(0.0002)	(0.0003)
DROM						-0.0652***	-0.0155***	-0.0069***	-0.0527***
						(0.0009)	(0.0006)	(0.0006)	(0.0008)
Part-time							0.0181***	0.0148***	
							(0.0002)	(0.0002)	
Experience								0.0011***	0.0020***
								(0.0000)	(0.0000)
Tenure								0.0111***	0.0143***
								(0.0000)	(0.0000)
$Tenure^2$								-0.0003***	-0.0004***
								(0.0000)	(0.0000)
Industry FE	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Occupation FE	No	No	No	No	No	No	Yes	Yes	No
N	16102714	16102714	15809130	15809130	15809130	15809130	15804372	15804372	15809130
R-squared	0.06	0.22	0.08	0.20	0.29	0.31	0.61	0.61	0.32

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. Experience stands for total labour market experience.
Source: Authors' calculations based on DADS, FARE.

Table 16: Job quality in young firms, step-by-step inclusion of controls – Portugal

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Young firm	-0.1184***	-0.0966***	-0.0641***	-0.0427***	-0.0299***	-0.0282***	-0.0196***	0.0232***	0.0273***
	(0.0062)	(0.0040)	(0.0044)	(0.0043)	(0.0042)	(0.0032)	(0.0025)	(0.0032)	(0.0040)
Log(N workers)			0.0314***	0.0357***	0.0399***	0.0324***	0.0385***	0.0371***	0.0312***
			(0.0051)	(0.0050)	(0.0050)	(0.0036)	(0.0029)	(0.0029)	(0.0036)
Log(Age)					0.2029***	0.4293***	0.3145***	0.1887***	0.2747***
					(0.0074)	(0.0063)	(0.0051)	(0.0041)	(0.0051)
Female						-0.1465***	-0.1180***	-0.1176***	-0.1450***
						(0.0027)	(0.0023)	(0.0023)	(0.0028)
Foreign						-0.0627***	-0.0255***	0.0019	-0.0260***
						(0.0043)	(0.0038)	(0.0036)	(0.0040)
Log(Years of education)						0.4545***	0.2259***	0.2418***	0.4583***
						(0.0057)	(0.0039)	(0.0039)	(0.0055)
Part-time							-0.0323***	-0.0121**	
							(0.0063)	(0.0061)	
Experience								0.0051***	0.0052***
								(0.0002)	(0.0002)
Tenure								0.0126***	0.0161***
								(0.0006)	(0.0006)
Tenure^2								-0.0003***	-0.0003***
								(0.0000)	(0.0000)
Industry FE	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Occupation FE	No	No	No	No	No	No	Yes	Yes	No
N	23624001	23624001	23624001	23624001	23624001	23624001	23624001	23624001	23624001
R squared	0.02	0.16	0.05	0.19	0.20	0.36	0.49	0.51	0.39

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Experience stands for total labour market experience.
Source: Authors' calculations based on Quadros de Pessoal.

To better assess the role of sectoral differences discussed above, industry fixed effects (at the 2-digit level of aggregation, see Table 61 in the Appendix C for a detailed description of the sectors) are added to the model in a first step.[30] The stepwise addition of the explanatory variables sheds light not only on the role of the explanatory factor itself, but also on how it affects the firm age wage gap. The impact of including industry fixed effects on the Young firm coefficient is substantial, leading to a reduction of the young firm wage gap by around 3.4 and 2.1 percentage points in France and Portugal, respectively.

Firm size is added next (column 4), reducing the young firm wage penalty to around 4% for both countries. As firms grow larger as they evolve over time, this is an important conflating factor of the separate effect of firm age.[31] The inclusion of worker age in column (5) leads to a further decrease in the wage gap to under 3%. This indicates that young firms hire younger workers, in line with the descriptive evidence in Table 13 and Table 14, showing that workers in young firms are an average 1.5 and 2.5 years younger than those in old firms, for France and Portugal, respectively.

Somewhat surprisingly, the addition of individual characteristics, including the disadvantaged group variables, changes the wage gap very little (column 6). The analyses for Portugal also includes the number of years of formal education in log form. The results in both countries are very similar. The change in the wage penalty by young firms is very limited, and wage penalties for women and foreign are of similar sizes in each country. Given that the coefficients on the disadvantaged group variables indicate that women and foreigners do indeed earn lower wages, the lack of an impact on the young firm wage gap can have one of two reasons: either young firms hire equally from those groups as old firms, or they hire more (less) but pay lower (higher) wages to these groups of workers. Subsection 5.7.1 is dedicated to exploring these questions in more detail and finds that the answer differs depending on the group considered.

Next, the inclusion of job characteristics (occupation and a part-time indicator) in column (7) has almost no further impact on the young firm wage effect. The fact that the wage gap between old and young firms is affected very little by inclusion of occupation fixed effects further suggests that there are no occupation-specific pay differences between young and older firms driving average pay differences. Another noteworthy effect of the occupation variable is the reduction of the wage gap for foreigners, which diminishes to around 1% in France and 2.5% in Portugal. This indicates that foreigners work in different, lower-paying, occupations. The same is true also for women, but the effect is much less pronounced, with occupation inducing only a three percentage point drop in the gender wage gap coefficient, to around 9.5% in France and 12% in Portugal.

Finally, a set of control variables, recording separately tenure at the firm and years of private-sector labour market experience is added to the model. Previous findings from the literature (e.g., Adrjan, 2018) indicate that accounting for tenure can change the results radically, inducing a change in the estimated coefficient of the young firm wage gap from a penalty to a premium. Indeed, adding tenure flips the sign

[30] These are more detailed than the broad sectoral classification into manufacturing and services presented in Table 19 and Table 20, as there may be heterogeneity also within these broad macrosectors.

[31] Because there are significant size differences across sectors, with manufacturing firms typically being much larger than service firms (Berlingieri et al., 2018), the additional impact of adding firm size when industry is included is smaller than its separate addition would be (see column 3 of Table 15 and Table 16).

of the coefficient, to a value of around 0.5% in France and 2.3% in Portugal (column 8). It also confirms that the role of tenure is indeed as hypothesised: as tenure at young firms is, by definition, restricted to the age of the firm and is positively related to wages, differences in tenure explain a sizeable fraction of the observed young firm wage gap.

To sum up, the cross-sectional findings suggest that while young firms appear to pay lower wages when simple averages are compared, there is no such difference in hourly pay once workers of the same age, gender, foreign status, labour market experience and experience at the firm, working in the same industry and occupation at equally-sized firms on similar contracts (part- vs. full-time) in the same year are compared. If anything, young firms pay a (small) wage premium for comparable workers and firms.

Next, the panel structure of the dataset, linking both employees and firms over time, is exploited by adding first individual, and then firm fixed effects. The panel data analysis builds on the most comprehensive specification of the cross-section just discussed (i.e., column (8) of Table 15 and Table 16, containing all worker-, job-, and firm-level control variables) and first includes only worker fixed effects, then only firm fixed effects, and in a third step implements a two-way fixed effects model. To better highlight the role of the tenure control variables, the worker and firm fixed effects specifications are estimated first without and then with tenure in Table 17 and Table 18. For the purpose of interpretation of the results, the worker fixed-effects specification is considered the preferred specification, as it accounts for worker unobserved heterogeneity. Furthermore, firm fixed-effects specifications require firms to change from being a young to old firm, and the two-way fixed-effects is severely restrictive in terms of which observations contribute to identification.

The results are broadly in line with those from the cross-sectional specification, but indicate a smaller baseline negative wage gap, which is 1.1% at the highest estimate across all specifications. Adding tenure controls again plays a crucial role for reducing omitted variable bias, conflating the relationship between firm age and wages. It induces the coefficient in the worker fixed effects models (columns 1 and 2) to flip to a positive value very close to zero, suggesting that there is no economically meaningful difference in pay between young and old firms for the same workers once their level of experience and firm tenure are accounted for.

A similar picture emerges from the models using only firm fixed effects (columns 3 and 4): when adding tenure as a control, the small but negative and significant coefficient for young firms flips sign in the case of France, while in Portugal it becomes insignificant. This is broadly in line with the findings from the worker fixed effects model.

Finally, when both worker and firm fixed effects as well as tenure control variables are included (column 6), the coefficient on the young firm variable remains positive, but only significant in the case of France, indicating that French young firms pay around 0.8% higher wages. For the Portuguese case, this specification shows that young and old firms pay similar wages. Given the small size of the estimate and the restrictive identification strategy, this coefficient should be interpreted more as a confirmation of the similarity of wages between young and older firms once a large set of confounding factors are taken into account (if anything, a small, statistically significant wage premium emerges). These results hold

Table 17: Job quality on young firms, panel estimates – France

	(1)	(2)	(3)	(4)	(5)	(6)
	Worker FE		Firm FE		2-way FE	
Young firm	-0.0113***	0.0037***	-0.0039***	0.0072***	0.0005*	0.0077***
	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Firm size	0.0078***	0.0076***	-0.0006***	0.0022***	-0.0010***	0.0008***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Female			-0.0882***	-0.0885***		
			(0.0002)	(0.0002)		
Foreigner			-0.0215***	-0.0141***		
			(0.0002)	(0.0002)		
Part-time	-0.0290***	-0.0284***	-0.0136***	-0.0150***	-0.0488***	-0.0479***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
N	15804372	15804372	15588122	15588122	15247471	15247471
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	Yes	Yes	No	No	Yes	Yes
Firm FE	No	No	Yes	Yes	Yes	Yes

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. FE stands for fixed-effects.

Source: Authors' calculations based on DADS, FARE.

Table 18: Job quality on young firms, panel estimates – Portugal

	(1)	(2)	(3)	(4)	(5)	(6)
	Worker FE		Firm FE		2-way FE	
Young firm	-0.0008	0.0082***	-0.0131***	-0.0009	-0.0042***	0.0020
	(0.0010)	(0.0011)	(0.0017)	(0.0017)	(0.0014)	(0.0015)
Firm size	0.0179***	0.0181***	0.0140***	0.0265***	0.0337***	0.0332***
	(0.0012)	(0.0012)	(0.0016)	(0.0016)	(0.0015)	(0.0014)
Female			-0.0865***	-0.0882***		
			(0.0014)	(0.0014)		
Foreign			-0.0063**	0.0109***		
			(0.0025)	(0.0024)		
Part-time	0.0344***	0.0360***	0.0023	0.0210***	0.0435***	0.0456***
	(0.0031)	(0.0031)	(0.0061)	(0.0057)	(0.0026)	(0.0027)
N	23624001	23624001	23624001	23624001	23624001	23624001
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	Yes	Yes	No	No	Yes	Yes
Firm FE	No	No	Yes	Yes	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects.

Source: Authors' calculations based on Quadros de Pessoal.

Table 19: Job quality on young firms, by macro sector – France

	(1)	(2)	(3)	(4)	(5)	(6)
	Manufacturing			Services		
	OLS	Worker FE	2-way FE	OLS	Worker FE	2-way FE
Young firm	0.0223***	0.0146***	0.0094***	0.0033***	0.0017***	0.0031***
	(0.0005)	(0.0007)	(0.0006)	(0.0002)	(0.0003)	(0.0003)
Firm size	0.0320***	0.0174***	0.0063***	0.0084***	0.0057***	-0.0001
	(0.0001)	(0.0003)	(0.0003)	(0.0000)	(0.0001)	(0.0001)
Female	-0.1340***			-0.0800***		
	(0.0004)			(0.0002)		
Foreigner	-0.1340***			-0.0050***		
	(0.0004)			(0.0002)		
N	2827834	2827834	2679467	10893720	10893720	10357319
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	No	Yes	Yes	No	Yes	Yes
Firm FE	No	No	Yes	No	No	Yes

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. FE stands for fixed-effects.

Source: Authors' calculations based on DADS, FARE.

throughout a number of robustness checks, including a restriction of the sample to workers with a maximum of five years of tenure (to ensure common statistical support for both firm age groups), to firms with a maximum of 10 years of age (to compare the same time span for both firm age groups), to omitting new firms (i.e., restricting firm age to 2 years or more), and to restricting the sample to surviving firms only.

Summing up, the estimates of the wage difference between young and older firms after controlling for a wide range of observed and unobserved confounding factors yield a very small average wage premium for young firms. Given the apparent differences across industrial sectors and worker groups identified in Table 13, the estimation of a single average across these different groups might mask important differences in the wages young firms pay to these groups, or in different sectors. The next subsection focuses therefore on the analysis of subsectors of the economy, followed by focusing more closely on disadvantaged groups.

5.7.0.1 Sectoral differences in job quality at young firms

Table 19 and Table 20 explores whether there are sectoral differences in the wage gaps between young and old firms. Differentiating between two macro-sectors (manufacturing and services), the results indicate that young firms pay more than their older counterparts in both sectors, with these results being valid for France and Portugal. Although we find similar wage premiums for both sectors in the Portuguese economy, of almost 1%, we find significant differences in the French macro sectors, with young firms in the manufacturing sector offering a wage premium of around 1.5% versus 0.2% in the services sector.

Table 20: Job quality on young firms, by macro sector – Portugal

	(1)	(2)	(3)	(4)	(5)	(6)
	Manufacturing			Services		
	OLS	Worker FE	2-way FE	OLS	Worker FE	2-way FE
Young firm	0.0344***	0.0078***	0.0048**	0.0262***	0.0083***	-0.0023
	(0.0049)	(0.0017)	(0.0022)	(0.0050)	(0.0015)	(0.0022)
Firm size	0.0565***	0.0286***	0.0453***	0.0277***	0.0136***	0.0332***
	(0.0043)	(0.0009)	(0.0020)	(0.0032)	(0.0013)	(0.0024)
Female	-0.1641***			-0.0973***		
	(0.0039)			(0.0028)		
Foreign	-0.0100			0.0018		
	(0.0067)			(0.0040)		
Part-time	0.0415***	0.0928***	0.1024***	-0.0331***	0.0274***	0.0322***
	(0.0105)	(0.0066)	(0.0070)	(0.0070)	(0.0031)	(0.0028)
N	4945753	4945753	4945753	11969723	11969723	11969723
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	No	Yes	Yes	No	Yes	Yes
Firm FE	No	No	Yes	No	No	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects.

Source: Authors' calculations based on Quadros de Pessoal.

Additional unreported analysis shows that within manufacturing, there is a positive wage premium for young firms in most industries. By contrast, in services, there is more heterogeneity, although in most services industries there is no robust difference in wages between young and older firms. Further exploratory analysis on trends over time suggests that the young firm wage premia tend to decline over time in services, explaining the smaller overall coefficient in the services sector.

5.7.0.2 Additional analysis: focusing on new hires

This subsection focuses on subsamples considering only new hires, defined as workers appearing in any given firm for the first time. This approach is an alternative way of removing the bias arising from comparing workers with different tenure at young and older firms, and has been implemented frequently in the literature, e.g. in Adrjan (2018) or Burton et al. (2017).

The results, shown in Table 21 and Table 22, confirm the findings obtained when controlling directly for tenure: there seems to be a small positive wage premium associated with working at a young firm, with young firms paying between 0.2% and 0.7% more than incumbents (columns 2). More detailed sectoral results confirm that this pattern can be observed in both manufacturing and services (results in the Table 46 and 47), with young firms paying around 1.5% and 0.5% for France and Portugal, respectively, more in the manufacturing sector. In the services sector, French young firms pay about the same as their older

Table 21: Job quality on young firms, new hires – France

	(1)	(2)	(3)	(4)
	OLS	Worker FE	Firm FE	2-way FE
Young firm	0.0042***	0.0024***	0.0061***	0.0054***
	(0.0004)	(0.0005)	(0.0008)	(0.0012)
Firm size	0.0103***	0.0079***	0.0019***	0.0010**
	(0.0001)	(0.0001)	(0.0003)	(0.0005)
Female	-0.0785***		-0.0711***	
	(0.0004)		(0.0004)	
Foreigner	-0.0115***		-0.0152***	
	(0.0005)		(0.0005)	
N	2693009	2693009	2336346	1328771
Controls	Yes	Yes	Yes	Yes
Worker FE	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. FE stands for fixed-effects.

Source: Authors' calculations based on DADS, FARE.

counterparts, while in Portugal they offer a wage premium of around 1%.

Because workers' labour market experience is imperfectly measured in the data at hand, there may be still undetected differences in the hiring patterns of young compared to old firms with regards to the previous work experience of newly hired employees.[32] Adding worker fixed effects when focusing on new hires addresses work experience accumulated before the sample period, but differences may still arise from work experience gained later in a worker's career. Omitted variable bias can thus arise not only from experience at the firm, but also from experience on the labour market more generally, as more experience is rewarded with higher wages. As an additional robustness test, a time-varying variable, recording accumulated years of work experience observed during the data period, is therefore added to specifications present in columns 2.[33] Results indicate a smaller, but still positive and significant wage premium for newly hired workers at young firms, thus corroborating the findings.[34]

[32] As explained in section 5.4, only the date of entry into the first observed job in the dataset is known and previous jobs at other firms or outside the private sector, as well as periods of self-employment are not recorded. Labour market experience is thus underestimated on average, especially for older workers and early years of the sample as work experience outside the private sector, as well as periods of unemployment or self-employment are not part of the data and cannot be controlled for.

[33] This variable is highly collinear with worker's age, especially when there are no gaps in the panel for a worker and is thus not retained in the default set of control variables.

[34] Another way to address this could have been focusing on a restrictive sample of young labour market entrants without data gaps, e.g., who are 25 years or younger when they first appear in the sample. These individuals could then be followed over time as they progress in their careers, and switch between firms. However, because the sample period is only around 15 years for France and 12 for Portugal, the maximum age of a worker who would qualify as part of such sample of entrants would be around 40 years. It would thus be impossible to disentangle the effect of focusing on younger workers and the effect

Table 22: Job quality on young firms, new hires – Portugal

	(1)	(2)	(3)	(4)
	OLS	Worker FE	Firm FE	2-way FE
Young firm	0.0100***	0.0066***	0.0004	-0.0049**
	(0.0030)	(0.0016)	(0.0039)	(0.0024)
Firm size	0.0171***	0.0129***	0.0064***	0.0169***
	(0.0024)	(0.0014)	(0.0024)	(0.0018)
Female	-0.0797***		-0.0557***	
	(0.0026)		(0.0016)	
Foreign	-0.0140***		-0.0025	
	(0.0030)		(0.0016)	
Part-time	-0.0130*	0.0216***	0.0086*	0.0281***
	(0.0067)	(0.0033)	(0.0046)	(0.0026)
N	4576573	4576573	4576573	4576573
Controls	Yes	Yes	Yes	Yes
Worker FE	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects.

Source: Authors' calculations based on Quadros de Pessoal.

5.7.1 Inclusiveness of jobs at young firms

Having analysed overall average differences in job quality between young and older firms, this section investigates the inclusiveness of these jobs for specific groups of workers. Specifically, it analyses whether the wage difference between young and older firms is different for disadvantaged groups. As discussed in section 5.2, differences can arise e.g., because certain groups can have more difficulties accessing the labour market and hence demand lower wages, and young firms are more likely to hire from this pool of workers. The analysis focuses first on gender, and then on foreign workers.

5.7.1.1 Gender

As shown in Table 13, the gender balance in employment in French firms appears to be similar in young and older firms (with both employing around 40% women) and a gender pay gap can be observed in both types of firms. However, the size of the gap seems to differ between young and older firms, as illustrated in Figure 24. Hourly wages earned by men and women are shown by firm type, with the gender pay gap appearing to be smaller at young firms, both in absolute and relative terms. In old firms, women's hourly wage is 82.3% of what men make on average, whereas in young firms, it is 83.9%. This corresponds to a

of focusing on entrants. In fact, exploratory analysis restricting the sample to young workers in other specifications (e.g., new hires) suggests that similarly to foreigners, young workers experience slightly higher wage gaps at young firms (results available upon request).

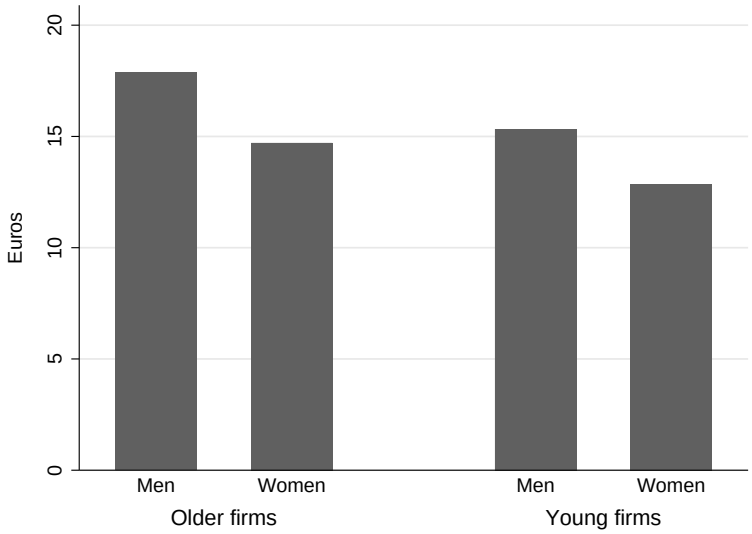


Figure 24: Gender wage gaps in young and older firms – France

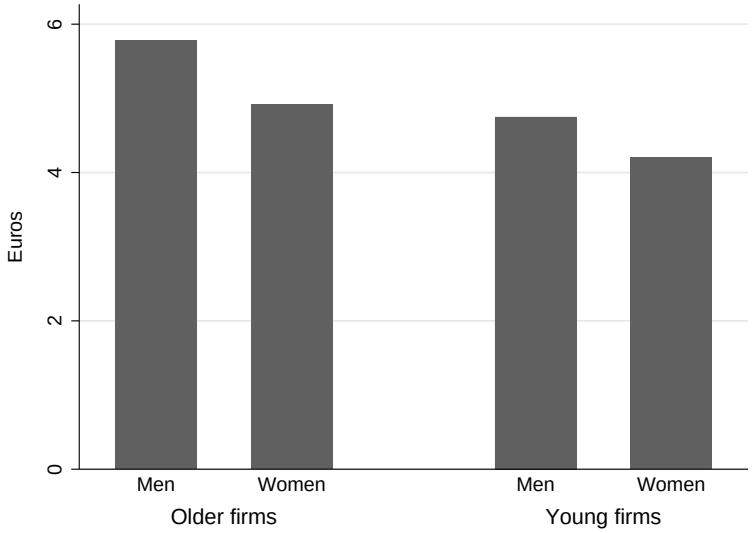


Figure 25: Gender wage gaps in young and older firms – Portugal

gender wage gap of 17.7% in old firms and 16.1% in young firms, meaning the gender wage gap is around 1.6 percentage points lower at young firms.

Descriptive statistics in Table 14 for Portugal show that young firms employ relatively less women than older firms, with a composition of 55% men and 45% women in young firms, and around 52% men and 48% women in older firms. As in the case for the French labour market, different sized gender wage gaps are observable in both groups of firms, as is shown in Figure 25. From a statistical point of view, the gender wage gap for the Portuguese economy is around 11.6% in young firms and 14.8% in older firms, resulting in a difference of 3.2 percentage points.

This stylised fact is explored further in a multivariate setting, accounting for additional factors such occupational choice and working time arrangements that typically explain large parts of the gender wage

Table 23: Job quality on young firms - gender – France

	(1)	(2)	(3)	(4)
	OLS	Worker FE	Firm FE	2-way FE
Young firm	-0.0102***	0.0023***	0.0054***	0.0081***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Female X Young firm	0.0010***	0.0037***	0.0046***	-0.0009**
	(0.0004)	(0.0005)	(0.0004)	(0.0004)
Female	-0.0949***		-0.0891***	
	(0.0002)		(0.0002)	
Firm size	0.0114***	0.0076***	0.0022***	0.0008***
	(0.0000)	(0.0005)	(0.0001)	(0.0001)
N	15719566	15804372	15588122	15247471
Controls	Yes	Yes	Yes	Yes
Worker FE	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. FE stands for fixed-effects.

Source: Authors' calculations based on DADS, FARE.

gap due to self-selection of women into part-time work and lower-paying occupations.

The average unconditional within-industry gender wage gap (that is, not controlling for confounding factors other than industry fixed effects, firm size and worker age) is around 13% and 15% (column 6 of Table 15 and Table 16) in France and Portugal, respectively. This means that, within the same industry and firms of equal size, women's gross hourly wages are about 13% to 15% lower on average than those of men. Further controlling for observable worker and job characteristics reduces the gender wage gap: adding job variables – occupation and a part-time – makes the estimate of the gender wage gap shrink by around 3 percentage points, to about 9.5% and 11.8% (column 8), respectively.

Whether the identified gender wage gap is lower or higher in young firms when other worker (and firm) characteristics are accounted for is explored by interacting the gender and firm age characteristics.[35] Table 23 and Table 24 report the estimates of four different estimation strategies: an OLS estimation, and three different panel set-ups: worker fixed effects (the preferred specification), firm fixed effects, and both worker and firm fixed effects (this specification imposes significant restrictions in terms of identification, as discussed earlier), in columns 1-4, respectively.

The main specifications in Table 23 and Table 24 (column 2) finds similar results for France and Portugal. Results in Table 23 show that the gender pay gap is lower at French young firms, as indicated by a positive and statistically significant coefficient on the interaction term (Female × Young firm). Therefore, while women still experience an overall gender pay gap (of around 9%, identified in columns 1 and 3

[35]This corresponds to the full specification presented in equation 5.1. The main coefficient of interest is now given by γ.

Table 24: Job quality on young firms - gender – Portugal

	(1)	(2)	(3)	(4)
	OLS	Worker FE	Firm FE	2-way FE
Young firm	0.0095**	0.0050***	-0.0106***	-0.0030*
	(0.0037)	(0.0013)	(0.0019)	(0.0016)
Firm size	0.0372***	0.0181***	0.0265***	0.0332***
	(0.0029)	(0.0012)	(0.0016)	(0.0014)
Female	-0.1217***		-0.0906***	
	(0.0025)		(0.0016)	
Female X Young firm	0.0306***	0.0072***	0.0211***	0.0107***
	(0.0034)	(0.0013)	(0.0019)	(0.0013)
N	23624001	23624001	23624001	23624001
Controls	Yes	Yes	Yes	Yes
Worker FE	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects.

Source: Authors' calculations based on Quadros de Pessoal.

focusing on the Female coefficient), the gap is relatively lower at young firms at around 0.4% in France. As with the overall wage difference at young firms, this association is very small – arguably too small to be of any real economic significance.[36] Contrary to the descriptive statistics presented in Table 14, results in Table 24 show that the gender pay gap is lower at Portuguese young firms at around 0.7% in comparison to older firms.

The aggregate results mask important sectoral differences, which also explain for France the switch to a negative (yet less precisely estimated, and very close to zero) sign in the most restrictive specification (column 4, Table 23).[37] Results by macro sector for France (results reported in Table 48 show that not only is the gender pay gap much smaller in services (around 7.5%, compared to 12.5% in manufacturing), but women also appear to experience an additional pay premium at young service firms. In manufacturing, instead, women seem to be slightly worse off in relative terms, although the difference is again too small to be of any real economic significance (with the gender wage gap being 0.3 percentage points lower in young firms). For Portugal, a significance difference in the size of the gender wage gap is also found between the two sectors, with women receiving a wage penalty of around 7.4% and 13.5% in the services

[36] These results are qualitatively confirmed also in a specification focusing exclusively on new hires (results available upon request). In the models using individual fixed effects (that is, accounting also for many of the unobserved characteristics that are associated with gender), the gender pay gap is either equal, or slightly smaller, at young firms. A small positive effect also arises when focusing on contract types as a dimension of job security, as explained in section 5.7.2. Women appear to be slightly better off at young compared to older firms in terms of contract types, as they are more likely to receive an open-term contract. However, as with wages, this result disappears in a 2-way fixed effects specification. Additional discussion about this change in sign is provided below.

[37] Indeed, a negative and significant coefficient in the two-way fixed effects model arises only in manufacturing.

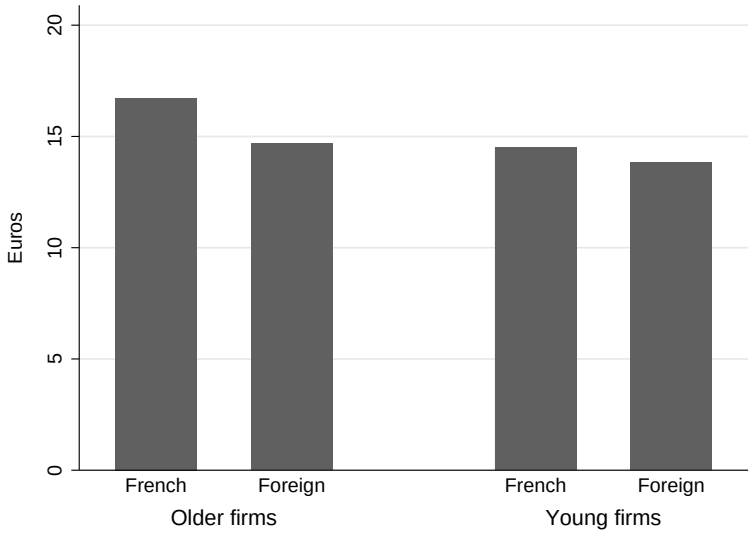


Figure 26: Foreigner wage gaps in young and older firms – France

and manufacturing sectors, respectively (see Table 49). However, the results found in Table 24 hold for both macro sectors.

5.7.1.2 Foreigners

Focusing on a different group of disadvantaged workers, a first glimpse at the tabulations for foreign-born employees in Table 13 and Table 14 already indicates that they are relatively more often employed by young firms. Foreign-born workers make up 18.5% and 11% in the French and Portuguese labour markets, respectively, of the workforce at young firms, whereas they account for only 12.9% and 4.9%, respectively, of workers in older firms. This is in line with findings from the literature, discussed in section 5.2.

From a descriptive point of view, the results for both countries are aligned – see Figure 26 and Figure 27. The wage gap for foreigners is smaller than for women, both in young and older firms. Contrary to the results obtained for gender, foreign-born workers seem experience a wage penalty in young firms that is of similar absolute, and even higher in relative size compared to the penalty they experience at older firms.

This is confirmed in a multivariate context, with results indicating that the overall unconditional within-industry wage penalty for foreign-born workers vis-à-vis those born in the country of analysis is around 6% for both countries (column 6 of Table 15 and Table 16).[38] Controlling for observable worker and job characteristics almost eliminates the wage gap for foreign workers (column 8). Specifically, lower accumulated years of work experience by foreigners are a major explanatory factor for wage gaps. Given that, by nature, tenure at young firms is lower for all workers – foreign and domestic –, it is particularly interesting to investigate the foreigner wage gap at young firms.

[38] As the French data do not provide information on nationality, heterogeneity of these effects among foreign-born workers from different countries or regions are only investigated for Portugal (see Section 5.7.1.3).

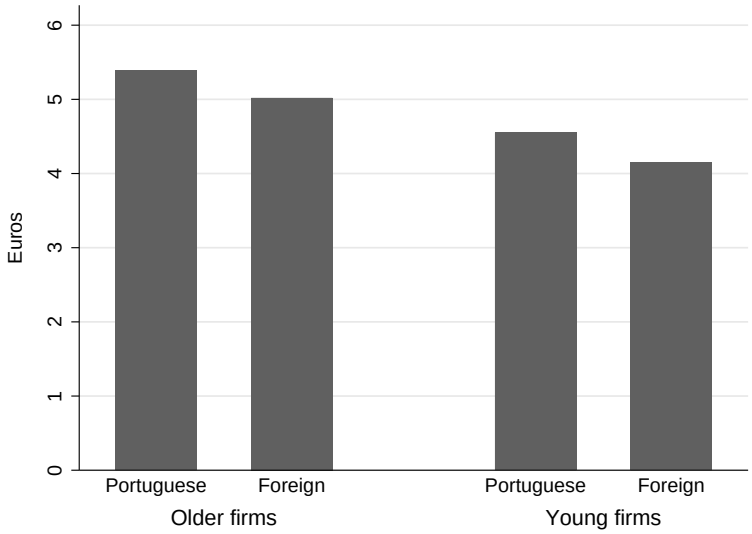


Figure 27: Foreigner wage gaps in young and older firms – Portugal

Table 25 and Table 26 estimates the pay difference of foreign-born workers in young firms in a panel context, controlling for further time-fixed worker and firm characteristics. Results (focusing on the Foreigner × Young firm coefficients) suggest that the wage penalty for foreign-born workers is slightly higher at young firms of both countries (around 1% in the preferred specification in column 2).[39] Further analysis by macro sector is reported in Table 50 and Table 51).

A tentative interpretation of these results is that there could be a quality effect for gender, and a quantity effect for foreign-born workers at young firms. While the share of women is roughly similar between firm types, the gender wage gap appears lower in young firms. The share of foreign-born worker is instead higher in young firms, but this group of workers seem to experience on average a more substantial wage gap compared to workers born in France.

A possible explanation for these findings is that because hiring patterns for women are already relatively balanced across firm types, new firms cannot attract female employees at wages that are much lower than those of men given that the average wage that these firms offer is already lower. Immigrants on the other hand may face greater difficulties entering the labour market at established firms, enabling young firms to hire from this group at lower wages, inducing them to hire relatively more foreign-born workers.

[39] Results are confirmed also in a specification focusing exclusively on new hires, which finds an additional wage penalty for foreigners in young firms of around 1% (results available upon request). Results using contract types as a measure of job quality (as explained in section 5.7.2) also confirm that foreigners experience worse job quality outcomes at younger firms, with a small but significantly higher share of fixed-term contracts of just under one percentage point.

Table 25: Job quality on young firms - Foreigners – France

	(1)	(2)	(3)	(4)
	OLS	Worker FE	Firm FE	2-way FE
Young firm	0.0007***	0.0055***	0.0077***	0.0079***
	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Foreigner X Young firm	-0.0225***	-0.0114***	-0.0034***	-0.0013**
	(0.0005)	(0.0007)	(0.0005)	(0.0006)
Foreigner	0.0012***		-0.0136***	
	(0.0002)		(0.0002)	
Firm size	0.0123***	0.0076***	0.0022***	0.0008***
	(0.0000)	(0.0001)	(0.0001)	(0.0001)
N	18518643	15804372	15588122	15247471
Controls	Yes	Yes	Yes	Yes
Worker FE	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. FE stands for fixed-effects.

Source: Authors' calculations based on DADS, FARE.

Table 26: Job quality on young firms - Foreigners – Portugal

	(1)	(2)	(3)	(4)
	OLS	Worker FE	Firm FE	2-way FE
Young firm	0.0241***	0.0088***	-0.0008	0.0022
	(0.0032)	(0.0011)	(0.0017)	(0.0015)
Firm size	0.0371***	0.0181***	0.0265***	0.0332***
	(0.0029)	(0.0012)	(0.0016)	(0.0014)
Foreign	0.0043		0.0112***	
	(0.0041)		(0.0027)	
Foreign X Young firm	-0.0110**	-0.0081***	-0.0019	-0.0042***
	(0.0047)	(0.0020)	(0.0029)	(0.0016)
N	23624001	23624001	23624001	23624001
Controls	Yes	Yes	Yes	Yes
Worker FE	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects.

Source: Authors' calculations based on Quadros de Pessoal.

5.7.1.3 A deeper look into young firms and foreign workers in the Portuguese labour market

The QP dataset for the Portuguese labour market contains information on the nationality of each worker, identifying 216 different nationalities across more than 3.2 million workers in 2021. In that year, 7.4% of the workforce reported in the QP were foreign workers, with Brazil (32.4%), India (7.9%), Cabo Verde (6.3%), Ukraine (5.4%) and Nepal (4.8%) accounting as the main countries of origin.

Despite the freedom of movement and work, none of the main countries of origin are from the European Union. The analysis evaluates the role of new firms on job quality, measured by wages, on five different groups: foreign workers with nationality from a European Union country; foreign workers with nationality from a Eurozone country; foreign workers with nationality from an OECD country; foreign workers from developed countries; and foreign workers from Portuguese-speaking countries.

First, workers from the Eurozone and from OECD countries have the highest wage premia, at around 14% in relation to all other workers. These are followed by workers from developed and European Union countries, with a premium of 9% and 8%, respectively. Finally, workers from Portuguese-speaking countries earn about the same as all other workers.

In terms of the role of young firms, new firms pay about the same as older firms for workers from OECD, Euro Zone, European Union and developed countries. Workers from Portuguese speaking countries are the only subgroup that faces a penalty from working in a young firm, of about 0.5%.[40]

5.7.2 Job Security at young firms

In a final exploratory analysis, this paper investigates a non-monetary dimension of job quality. Contract types, divided into open-ended versus fixed-term, are used as a proxy of job security.[41] Tables 27 and 28 below presents results from the same type of analysis conducted for wages, but with contract type as the dependent variable, recording whether a worker's contract is fixed term (i.e., providing a less secure job) or open ended.

In line with the descriptive statistics, using a simple OLS analysis (column 1 of Table 27 and Table 28) young firms seem to offer a higher share of fixed-term contracts, and therefore less secure jobs. However, this simple comparison masks the fact that young firms employ, by construction, a higher share of newly hired workers. New hires have a higher tendency to be under a fixed-term contract than workers who have been with their firm for a longer time. A fixed-term employment at the beginning of a job appointment is increasingly likely to be converted into an open-term one the longer the worker stays with the firm (or

[40] Developed countries classification is from OECD, Climate Finance Provided and Mobilised by Developed Countries in 2013-18, Annex C. Country groupings. Portuguese-speaking countries are countries that have Portuguese as an official language. A specification with firm fixed effects and worker observed characteristics is considered to infer if foreign workers from a subgroup have a wage penalty or premium in relation to all other workers. A specification with worker fixed effects is used to infer the role of young firms. Full tables with results can be found in the Tables 54, 55, 56, 57, and 58. Source: Authors' calculations based on Quadros de Pessoal.

[41] Even though job security is inherently lower at young firms due to higher exit rates, the findings in this section also apply when the analysis is restricted to surviving firms only (results available upon request).

even required to be converted by law, as the number of consecutive fixed-term contracts is limited). Again, taking into account tenure at the firm is crucial to disentangle these two effects. The results in column 2 confirm that once workers with similar years of tenure are compared, young firms do not offer less secure contracts. In fact, being employed at a young firm appears to increase the probability of having an open-ended contract by around 6 and 7 percentage points in France and Portugal, respectively, than in older firms.

Focusing directly on new hires (column 3), this conclusion is supported, with this probability increasing to 7 percentage points in France but decreasing to around 4 percentage points in Portugal. Controlling for unobserved worker characteristics (columns 4-6), results indicate for both groups that young firms are more likely to offer open-ended contracts (with estimates ranging between 3.5 and 4.5 percentage points for both countries), implying that the security of jobs provided by young firms is higher.

These results support the finding that, once similar workers are compared, young firms do not offer less secure jobs than their older counterparts, not only when job quality is assessed in monetary terms but also when it is measured in terms of job security.

5.7.2.1 The role of COVID-19 on the type of contracts offered in Portugal

This section further explores, focusing on Portugal, how the COVID-19 pandemic affected the type of contract offered by firms using a differences-in-differences approach. In 2020, the COVID-19 pandemic initially caused an almost complete stop of the economy, with different sectors being affected asymmetrically. This period was characterised by a high degree of uncertainty, which is particularly relevant when discussing firms' decisions to offer workers a more permanent contract or not.

Results for the economy as a whole show that, before the pandemic, workers in young firms had a lower likelihood of being under a fixed-term contract by around 4 percentage points, a result similar to the one presented in Table 28. This result holds for both macro sectors, although this relation was slightly stronger in the services sector than in the manufacturing one.

During the pandemic the, the likelihood of being under a fixed-term contract decreased by around 2 to 8 percentage points, with similar magnitudes found in both the manufacturing and services sector. Relevantly, this exploratory analysis does not test if this is driven by firms going into a hiring freeze and releasing workers under a fixed-term contract, or if firms did in fact shift their hiring policy into an open-ended contract base. Finally, looking at how young firms behaved in relation to older firms after pandemic, results show that the gap between young firms and incumbents had decreased from around 4 to around 2.5 percentage points. This result was mostly driven by the manufacturing sector, as the gap was smaller and presented the largest convergence.

In conclusion, this exploratory analysis suggests that young firms tended to be less likely to offer fixed-term contracts to their workforce than incumbent firms, especially in the services sector. After the pandemic, this relation continued to be true, although a convergence between young and incumbent firms

Table 27: Job security: share of fixed-term contracts – France

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS			Worker FE		
	W/o t.	W/ t.	New hires	W/o t.	W/ t.	New hires
Young firm	0.0138***	-0.0612***	-0.0731***	-0.0097***	-0.0404***	-0.0465***
	(0.0004)	(0.0003)	(0.0006)	(0.0004)	(0.0004)	(0.0010)
Firm size	0.0082***	0.0017***	0.0009***	0.0057***	0.0061***	0.0060***
	(0.0001)	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Female	-0.0520***	-0.0158***	-0.0018***			
	(0.0003)	(0.0002)	(0.0006)			
Foreigner	0.0113***	-0.0045***	0.0006			
	(0.0004)	(0.0003)	(0.0007)			
DROM	0.0160***	-0.0060***	-0.0034			
	(0.0012)	(0.0009)	(0.0023)			
Part-time	-0.0908***	-0.0678***	-0.0623***	-0.0270***	-0.0285***	-0.0393***
	(0.0004)	(0.0003)	(0.0007)	(0.0004)	(0.0004)	(0.0012)
Experience		-0.0020***	-0.0022***			
		(0.0000)	(0.0001)			
N	13498184	13498184	2273056	13498184	13498184	2273056
Sample	Full	Full	New hires	Full	Full	New hires
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	No	No	No	Yes	Yes	Yes
Firm FE	No	No	No	No	No	No

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. FE stands for fixed-effects. Experience stands for total labour market experience. W/ t. stands for With tenure. W/o t. stands for Without tenure.

Source: Authors' calculations based on DADS, FARE.

occurred.[42]

5.7.2.2 Additional analysis: temporary extensions of fixed-term contracts in Portugal

As part of the financial assistance program from the European Union, the European Central Bank and the International Monetary Fund signed in April 2011, several labour market reforms were introduced in Portugal, including changes to open-ended and fixed-term contracts (see OECD (2017) for detailed analysis of the reforms introduced).

On the side of open-ended contracts, the reforms reduced the severance pay from 30 days of base wage and tenure-based increments for every full year of tenure, to 12 days for every year of tenure. A

[42] See equation 5.2 in the subsection bellow for a presentation of the econometric specification used, although with the dependent variable is the same as in equation 5.1. Analysis considers only the period 2019-2020. Robustness checks considering only new hires confirm the results discussed. Source: Authors' calculations based on Quadros de Pessoal. Results can be found in Table 59.

Table 28: Job security: share of fixed-term contracts – Portugal

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS			Worker FE		
	W/o t.	W/ t.	New hires	W/o t.	W/ t.	New hires
Young firm	0.1043***	-0.0680***	-0.0493***	0.0447***	-0.0434***	-0.0353***
	(0.0033)	(0.0034)	(0.0048)	(0.0020)	(0.0022)	(0.0031)
Firm size	0.0039	0.0062***	0.0249***	0.0127***	0.0108***	0.0199***
	(0.0025)	(0.0019)	(0.0018)	(0.0015)	(0.0014)	(0.0013)
Female	-0.0005	0.0038**	0.0136***			
	(0.0025)	(0.0017)	(0.0023)			
Foreign	0.1287***	0.0631***	0.0517***	0.0000		
	(0.0044)	(0.0035)	(0.0034)	(0.0000)		(
Part-time	0.1026***	0.0325***	0.0004	0.0683***	0.0507***	0.0128**
	(0.0148)	(0.0118)	(0.0090)	(0.0074)	(0.0072)	(0.0052)
Experience		-0.0055***			0.0036***	
		(0.0002)			(0.0004)	
Log(Age)	-0.3280***	-0.0241***	-0.0564***	-1.2302***	-0.7252***	-0.3770***
	(0.0061)	(0.0039)	(0.0049)	(0.0389)	(0.0309)	(0.0438)
N	23624001	23624001	4500372	23624001	23624001	4470985
Sample	Full	Full	New hires	Full	Full	New hires
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	No	No	No	Yes	Yes	Yes
Firm FE	No	No	No	No	No	No

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects. Experience stands for total labour market experience. W/ t. stands for With tenure. W/o t. stands for Without tenure.

Source: Authors' calculations based on Quadros de Pessoal.

minimum of three months of severance pay was also removed, as well as the introduction of severance pay ceilings. These new severance pay rules apply mostly to new contracts. Regarding fixed-term contracts, the severance pay was also reduced but to a lower extent and depending on the duration of the contract. In addition to these labour market reforms, exceptional renewals of temporary contracts were allowed on top of the usual three years maximum. The first exceptional extension came into effect on the 11st of January 2012 and allowed two additional renewals (not exceeding 18 months) of all fixed-term contracts that were set to reach their maximum duration by the end of June 2013. A second exceptional extension came into effect on the 8st of November 2013, allowing two additional renewals (not exceeding 12 months) affecting contracts that would reach their maximum by the 7th of November 2015. The renewal of contracts under this law expired on the 31st of December 2016.

The additional analysis carried out in this section explores how these temporary reforms affected the probability of workers having their contracts converted into an open-ended contract, particularly focusing on the patterns of young firms. The main identification challenge is related to opposite shocks occurring at

the same time. The first is the labour market reform, which by significantly reducing the severance pay of open-ended contracts made them more attractive, thus incentivising firms to convert contracts from fixed-term to open-ended ones. The second is the introduction of exceptional renewals of fixed-term contracts, removing the legal obligation of contracts reaching their maximum duration to be converted or terminated. This identification issue is partially addressed by considering only workers that have a temporary contract in 2011.

The work done by Damas de Matos and Parent (2016) for the Portuguese economy shows that new firms both have a higher share of fixed-term employment and create more fixed-term than open-ended employment. They also show that more recent cohorts of new firms are increasingly responsible for the rise in fixed-term contracts.

Our empirical analysis follows the following strategy:

$$\begin{aligned} Switch_{i,j,t} = \zeta \text{ Young Firm }_{j,t} + \eta After2012_t + \text{ Young Firm }_{j,t} \times After2012_t \\ + \sum_{\mathrm{k}} \delta_{\mathrm{k}} X_{\mathrm{i,t,k}} + \sum_{\mathrm{m}} \sigma_m Z_{\mathrm{j,t,m}} + \mu_{\mathrm{i}} + \theta_j + \lambda_{\mathrm{t}} + \varepsilon_{\mathrm{i,j,t}} \end{aligned} \tag{5.2}$$

Equation 5.2 follows a classical differences-in-differences approach and is estimated using a linear probability model. The variable Switch takes the values of 0 in case a worker remains with the same contract type and the value of 1 if the worker has a contract switch from fixed-term to open-ended. The variable *After2012* is a dummy variable taking the value of 0 for the year 2011 and the value of 1 for the year 2012. *YoungFirm* and *After2012* are the main variables of interest, as they capture the difference in probability of a worker having a contract conversion in young firms versus older firms, and the difference between the two periods (before and after the introduction of the exceptional renewals) for all workers. The interaction term between *YoungFirm* and *After2012* provides insights into possible changes in strategy by young firms as response to the temporary renewals in comparison to older firms. The remaining of the model is the same as in equation 5.1.

Table 29 reports the results from equation 5.2. As in the previous sections, the preferred specification uses worker fixed-effects and is presented in column (3). With the exception of the results present in column (1), where the coefficient is extremely small, corresponding to a simple OLS regression without any controls, all specifications are consistent with young firms having the same likelihood of converting fixed-term contracts as incumbents. After the introduction of the labour market reforms and temporary fixed-term contracts extensions, all specifications point towards the likelihood of contracts being converted having increase between 13 percentage points and 16 percentage points, an effect with a very large magnitude. The interaction term, statistically significant in most specifications at the 10% level, points towards young firms having converted more contracts of their workforce than incumbents by around 3 percentage points. Finally, focusing the analysis at the sector level, estimations present in Table 60 reveal that firms in the manufacturing sector behaved similarly to incumbents before and after the reforms, while in the services sector young firms converted more contracts after the reforms, thus driving the overall results present in Table 29.

Table 29: Contract switches in young firms – Portugal

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	Worker FE	Firm FE	2-way FE
Young firm	-0.0000***	0.0042	-0.0102	-0.0134	-0.0102
	(0.0000)	(0.0036)	(0.0174)	(0.0173)	(0.0174)
After 2012	0.1672***	0.1661***	0.1340***	0.1599***	0.1340***
	(0.0046)	(0.0046)	(0.0149)	(0.0048)	(0.0149)
Young firm × After 2012	0.0333*	0.0328**	0.0312*	0.0324*	0.0312*
	(0.0171)	(0.0164)	(0.0164)	(0.0169)	(0.0164)
N	372310	372310	372310	372310	372310
Controls	No	Yes	Yes	Yes	Yes
Worker FE	No	No	Yes	No	Yes
Firm FE	No	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects.

Source: Authors' calculations based on Quadros de Pessoal.

The results present in Table 29 show that young firms are similar to incumbents in terms of how likely they are to convert fixed-term contracts to open-ended contacts, but only before the reforms. There appears to be a change in behaviour by firms after the introduction of the reforms, with the probability of a worker having their contract converted significantly increased. The interpretation of this initial results should be done carefully, as there are a large number of factors unaccounted for. For example, although the number of contract conversions increases in 2012, a previous step taken by firms, that is, the decision to hire a worker in the first place, is not controlled for. This results should, therefore, be interpreted as simple correlations, and further analysis would be needed to explore those more in detail.

5.8 Concluding remarks and next steps

This paper is among the first to simultaneously investigate the quality and inclusiveness of jobs in young versus older firms. The topic is of high policy relevance in the light of the recent surge in interest in job quality, as well as in fostering entrepreneurship and ensuring inclusive labour markets. The analysis is based on linked employer-employee data for France and Portugal, which allow addressing a number of challenges to the identification of causal effects, such as e.g. self-sorting of workers into young firms due to risk preferences or innate ability, as well as omitted variable bias from differing levels of employee tenure and experience. Furthermore, they offer insights into two different economies with differences in economic structure, dynamism, size and income level.

The paper first provides an overview of previous findings and identifies a gap in the understanding of job quality of young vs. old firms and of the inclusiveness of these firms with respect to disadvantaged groups of workers. To fill this gap, the paper then implements a flexible empirical framework, which is

applied to two different types of LEED , focusing on different groups of workers, and different measures of job quality. Finally, the analysis further explores the role of young firms on job security during a period of increasing unemployment and the COVID-19 pandemic, in Portugal.

The main findings about the role of young firms for job quality and inclusiveness are overall aligned between the countries analysed. Findings on job quality suggest that: (a) young firms do not have a negative wage gap relative to older ones. Workers with similar characteristics receive equal, or even higher, pay at young firms; (b) a negative wage gap appears only if tenure at the firm is not accounted for. Different ways of controlling for tenure as well as labour market experience show that the young firm wage gap disappears once workers with similar years of work experience at their firm are compared; (c) young firms tend to provide more job security in terms of open-term contracts. Depending on the type of worker considered, young firms employ between 1% and 8% more of their workers on open-term contracts.

In terms of inclusiveness, findings suggest that: (a) although a significant gender wage gap is observed in both groups of firms, of around 9%, this wage gap is smaller in young firms by around 0.5% and 2% in France and Portugal, respectively;[43] (b) foreign workers have a wage penalty in France of around 1.3% and a wage premium of around 1.1% in Portugal, and young firms pay less than incumbents to foreigners, aggravating this penalty in France and nullifying this premium in Portugal. Focusing on the two macro sectors analysed, results show French young firms pay the same as incumbents in both macro sectors, while Portuguese young firms pay less, with this penalty being larger in the manufacturing sector; (c) young firms employ a significantly larger share of foreign workers, in both countries, suggesting that this firms are an important entry way into the labour market for this disadvantaged group.

The findings of this paper suggests that young firms play a key role, not only on job creation as noted in the literature, but as well as by providing jobs that – once controlling for several confounding factors – are equally paid and more secure. Furthermore, young firms appear to contribute to the reduction of gender wage gaps. In terms of the impact on foreign workers, the role of young firms seems to be more related as an entry point to the labour market, although paying lower wages than incumbents. Focusing on Portugal, this result is however driven by workers from Portuguese-speaking countries. Furthermore, during COVID19 young firms continued to offer more secure contracts than incumbents, although a convergence between these groups of firms was observed. In this context, policy makers should ensure that young firms have the necessary business environment to compete with incumbent firms, resulting in a better business dynamism and possibly supporting the growth of wages and accelerating the reduction in wage gaps.

Future research on this topic may be focused on several different avenues. Different disadvantaged groups, such as workers returning to the labour market after an unemployment spell, or specific age groups, could be considered. Additionally, the analysis can be extended to different subgroups of young firms (e.g., based on their post-entry performance). The opposing findings regarding the role of young firms on the wage gap for the two main disadvantaged groups of workers, gender and foreign, also warrants

[43] At the sectoral level, French young firms only offer a wage premium in the services sector, while Portuguese young firms offer a wage premium in both, with this premium being larger in the manufacturing sector.

further investigation. Furthermore, a long-term perspective of the role young firms on workers' careers would also be particularly important, as current literature analysing longer time spans seems to point towards a considerable wage penalty across lifetime earnings from working at a young firm.

6

Enhancing University–Industry collaboration: the role of intermediary organizations

6.1 Introduction

It is now generally accepted that U-I links are a critical strategic response to global competition Hall et al. (2001) and particularly important to regional growth, where systems of small- and medium-sized firms are located Cunningham et al. (2019); Jaffe et al. (1993).[1] Therefore, technology transfer has become a high priority for national governments and the European Commission alike Antonelli (2019).

In order to succeed in the so-called third mission, universities have been developing several strategies to facilitate knowledge transfer between academia and firms. Alongside with changes in organization and intellectual property appropriation modes, universities have institutionalized intermediary organizations such as TTOs, CRCs, incubators and science parks Perkmann et al. (2013); Teixeira and Mota (2012); Wright et al. (2008).

Intermediary organizations, also referred as 'interface institutions' Lundvall (1992), 'hybrid organizations' Etzkowitz and Leydesdorff (2000) or 'fourth pillar organizations' Johnson (2009) are one of the key elements of the National System of Innovation Nelson and Rosenberg (1993). The intermediaries' main purpose is to avoid systemic failures by establishing linkages among actors of the innovation system – universities, firms and government agencies. It has been widely acknowledged that these actors have very distinct cognitive, cultural and organizational characteristics, which can create barriers to communication, and therefore to the transfer of knowledge. Another important role played by intermediaries in the support of knowledge transfer is reducing firms' transactions costs, guaranteeing appropriability conditions and building trust Etzkowitz and Klofsten (2005); De Wit-de Vries et al. (2019).

The view that cultural and cognitive differences are the main barriers in the U-I relationship has been challenged by some scholars Lam (2011); Y. S. Lee (2000). Their argument is that university and industry researchers' motivations for collaboration in R&D are not necessarily in conflict, and, when contradictory,

[1] This chapter is co-authored with Fernando Alexandre, Ana Paula Faria and Miguel Portela, and is published as Alexandre, Costa, et al. (2022).

they can often be reconciled into a collaborative project with specific aims.

Another less clear result regarding intermediaries' role is the kind of firm they support. The general view is that intermediary organizations are particularly important to small sized firms as barriers to the technology transfer tend to be more severe among these firms. However, previous evidence has shown that in the US TTOs appear to do a better job serving the needs of large than small-sized firms Siegel et al. (2007). Moreover, recent evidence García-Vega and Vicente-Chirivella (2020); Spanos (2021) shows that small-sized firms benefit more from collaboration with universities than large firms. In addition, some evidence shows that small-sized firms prefer personal contacts, while large firms prefer institutional interaction mediated by the university through its administrative structures, such as departments or dedicated units such as TTOs Freitas et al. (2013).

A possible explanation for these opposing views could be the fact that different intermediaries may address different issues in the U-I collaboration Mignon and Kanda (2018); Villani et al. (2017); Wright et al. (2008). Some evidence shows that Italian TTOs focus more on improving cognitive and organizational differences, whereas CRCs and incubators tend to contribute more to reduce social and geographic barriers Villani et al. (2017). However, this evidence does not provide any information regarding the type of firm that they reach out.

While there is vast evidence on the firms' determinants to collaborate with universities and on their interaction channel – e.g., R&D collaboration, contract R&D, problem solving, human capital hiring -, there is still a lack of evidence regarding firms' choices with respect to the institutional interaction mode, i.e., via intermediaries or directly with university's departments. The purpose of this paper is to examine the role played by intermediary organizations in U-I interactions by exploring firms' differences across two institutional modes of interaction. We focus on one type of U-I interaction channel – formal joint R&D, therefore on a more similar type of knowledge being exchanged, which should allow for the effect of intermediaries to become apparent.

Our study builds on industrial organization and proximity approach literatures to examine firm-specific characteristics as well as motives, benefits from and barriers that underly U-I interactions. These literatures complement each other, and thereby allow us to have a richer theoretical framework to analyse a phenomenon that is inherently complex and context-dependent Wright et al. (2008) than a single theoretical approach.

We employ original U-I R&D collaboration data collected from a mid-range university located in Northern Portugal for the period 2009–2016,[2] which we combine with different data sources—census data, survey data and interviews. With these we should be able to draw conclusions generalizable to the entire economy, as well as to obtain deeper insights regarding drivers, benefits and barriers of U-I links. We also

[2]University of Minho was founded in 1973 and is a research-based higher schooling institution. It has more than 19,000 FTE students, out of which 33% are master and PhD students and 13% are international students. According to the Times Higher Education ranking, University of Minho is ranked 151-200th in the Young University Rankings 2019 and 83rd in the University Impact Ranking 2019. In the Shangai ranking it has an Institutional Ranking of 401–500.

expect that this paper will provide evidence, so far lacking, from mid-level universities and regions, particularly regarding U-I links, as much of existing literature focuses on strong research universities situated in developed high-tech entrepreneurial environments Wright et al. (2008). Lastly, from a policy point of view it is relevant to assess U-I joint R&D since this form of interaction has the highest impact on long-term benefits De Fuentes and Dutrénit (2012), and previous research has shown that regional innovation performance is highly dependent on formal knowledge (R&D) as well as on public–private interactions and partnerships Faria et al. (2019).

This paper is organized as follows. Section 6.2 describes the theoretical framework. Section 6.3 describes the data and the research strategy. Section 6.4 presents the empirical results. Section 6.5 presents the conclusions and policy prescriptions.

6.2 Linking universities, firms and intermediaries

6.2.1 Drivers of U-I joint R&D among firms

The starting theoretical framework to understand firms' motivations to engage in U-I collaboration are studies on R&D cooperation. These studies have their roots in industrial organization (IO) literature-the transaction cost and intellectual property theories of the firm, and in the resource-based-view (RBV) theory of the firm Cassiman and Veugelers (2002). IO literature sees R&D collaboration as a mode for firms to internalise spillovers, share costs and risks, and access resources and knowledge. According to the RBV theory, firms have different resource endowments, hence different innovation-related resources and capabilities, which determines firms' necessities to collaborate. Despite the benefits, R&D collaboration also entails risks and problems, notably related to hidden costs, management difficulties, appropriability and opportunistic behaviour. This implies that firms select to collaborate if the expected benefits outweigh the costs.

So far, the literature has thoroughly investigated a set of firm characteristics that are important determinants of firms' decisions to collaborate in R&D, namely firm size, R&D and knowledge capabilities and technology openness. Empirical evidence consistently shows that R&D collaboration with universities is mostly used by large-sized firms that vertically integrate R&D activities. As stronger investors in R&D, larger firms are more prone to have absorptive capabilities, more capable at combining both internal and external knowledge and interact with universities Aristei et al. (2016); Bekkers and Freitas (2008); Cassiman and Veugelers (2002); W. M. Cohen et al. (2002); Fontana et al. (2006).

Nevertheless, small firms also seek R&D collaboration with universities. Cost sharing is a particularly important determinant among SMEs, which do not always have enough internal funds or collaterals to support their innovative activities. Recent evidence has shown that technology transfers from universities is particularly beneficial for small-sized and resource-constrained firms García-Vega and Vicente-Chirivella (2020); Spanos (2021), casting doubt on the role of size as a driver to U-I joint R&D.

Another relevant characteristic is firms' knowledge endowments or capabilities. Specifically, the absorptive capacity, i.e., the capacity to identify, interpret and exploit knowledge of other actors W. M. Cohen and Levinthal (1990). R&D intensive firms are more likely to collaborate in R&D and to explore this knowledge. Likewise, the stock of well-educated employees may be a precondition for the engagement of firms in innovative activities Blundell et al. (2005). Through formal education, workers develop problem-solving competencies usually associated with creativity and innovative business ideas. The formal education of managers is also relevant for firms to engage in U-I collaborations Koellinger (2008).

Other firm-specific characteristics that may also influence firms' decision to collaborate in R&D is the degree of technology openness Freitas et al. (2013); Colombo and Delmastro (2002). Firms which rely more on technology sourcing from external sources (via licensing of IP, etc.) are more likely to collaborate with external knowledge providers and engage in U-I joint R&D. International competition and interacting with foreign counterparts favours firms with learning advantages and early adoption of technologies that allows them to introduce product innovation Caloghirou et al. (2021). Also, exposition to international markets usually implies some level of organizational change and adaption Colombo and Delmastro (2002), thereby making it easier to interact with other organizations, such as universities.

Geographic proximity is also important to understand U-I linkages in addition to firm level characteristics Jaffe et al. (1993); Feldman (1994). Geographic proximity favours the relationship particularly when face-to-face contact is most needed to exchange knowledge. This is common when the firm needs support to problem solving. Likewise, geographic distance is less likely to be a barrier when firms seek mostly codified knowledge, i.e., publications and patents Arundel and Geuna (2004); Bishop et al. (2011). There is evidence Hewitt-Dundas (2013); Laursen et al. (2011) showing that larger firms and high-research intensive firms appear to give preference to the research quality of the university partner over geographical closeness. Likewise, small-sized firms tend to seek support in problem solving and prefer geographically close universities or research centres Bishop et al. (2011).

Though knowledge transfer is strongly related to geographic proximity, other forms of non-spatial proximity such as cognitive, organizational and social have been also been considered as relevant explanation for U-I linkages since they are crucial drivers for agents to connect and exchange knowledge Boschma (2005). The underlying idea is that proximate actors will interact more easily. Cognitive proximity refers to how actors perceive and interpret the world in similar ways. Organizational proximity assume that actors have similar routines and rules. Culture proximity relates to values, norms, and beliefs commonly shared by members of a social group Adler (2002). In innovation literature, researchers tend to assume that universities and firms have a low degree of organizational and cultural proximity, given that the former are more open to exchange knowledge with others, while firms want to keep knowledge away from competitors. Social proximity means that actors have developed trust and social ties Broekel and Boschma (2012); Villani et al. (2017). Despite the importance of various dimensions of proximity to knowledge exchange, Boschma and Frenken (2010) introduced what they describe as the so-called proximity paradox. While proximity may be a driver for agents to connect and exchange knowledge, too much proximity between these agents on any of the dimensions does not necessarily increase their innovative performance.

6.2.2 U-I links and intermediaries

Whereas a number of organizations and individuals may perform the intermediary role between universities and industry, there are two main governance modes—the institutional and the personal, that co-exist and have their particular characteristics and advantages Geuna and Muscio (2009). The latter is based upon personal contractual interactions between university researchers and firms, usually results of the participation of university and industry researchers and engineers in the same social and professional networks Colyvas et al. (2002). The former is mediated through university units such as departments, or by intermediary organizations such as TTOs, CRCs, incubators or science parks.

Intermediaries are organizations that act as an agent or broker in any aspect of the innovation process between two or more parties Howells (2006). Those intermediaries that are set up by universities can be classified as internal or external intermediaries to the university and they tend to be different in their scope of action. For instance, TTOs are internal intermediaries and manage the university's intellectual property, communicate scientific knowledge to industry, and communicate the industrys' requirements to university scientists. University incubators and science parks are also internal intermediaries, and they are designed to support academic spinoffs or other technology-based start-ups. CRCs are usually external to the university, and are set up for the benefit of firms, particularly small, from a specific sector through mutual collaboration Wright et al. (2008).

Recently, Mignon and Kanda (2018) proposed a typology of intermediaries based upon sources of funding, scope of action and recipients of support. In this typology, both universities' internal and external intermediaries can be seen as an example of a cluster organization Laursen et al. (2011). This refers to a concentration of interconnected firms and organizations that cooperate in different economic activities, including technology and markets. Cluster organizations work actively in fostering networking, partnerships and collaboration projects between different types of actors (e.g., firms and universities), among other activities.

It has been acknowledged that the coexistence of different governance structures implies that firms' engagement in interactions with universities under one or the other governance mode involves different decision-making processes Freitas et al. (2013). Therefore, firms with different characteristics may be more or less likely to engage in different forms of interaction with the university to address their specific objectives of building competencies or problem solving in core and non-core technological areas (e.g., Aristei et al. (2016); Bekkers and Freitas (2008); Bishop et al. (2011); Santoro and Chakrabarti (2002).

Previous research has extensively investigated the determinants of firm's choices regarding the two governance modes – the institutional and the personal. Empirical evidence shows that institutional interactions are mostly used by large firms that vertically integrate R&D activities while personal contractual interactions are used relatively more by small firms Siegel et al. (2007); Motohashi (2005); Fontana et al. (2006); Bekkers and Freitas (2008); Freitas et al. (2013); Aristei et al. (2016). In addition, empirical evidence reports that larger firms primarily use collaborations for joint research project, while a higher percentage of SMEs use technical consulting and take part in joint R&D projects targeted to the final

product stage Motohashi (2005).

However, only a few studies – mostly based on case-study evidence, have analysed the role of intermediaries in facilitating technology transfer from universities to industry. The general view from these studies is that intermediaries' key role is to overcome relational barriers and are better suited to help small firms than large. Intermediaries were found to be important 'trust builders' Giaretta (2014) particularly to small-sized firms, and help in mitigating geographic distance and non-spatial barriers between academia and industry Villani et al. (2017). For example, in the Andalusia region of Spain, intermediary organizations have been found to contribute to the effective transfer of knowledge Fernández-Esquinas et al. (2016).

6.3 Research design and data

We follow a strategy of analysis based on three steps. In the first step, we identify the characteristics of firms involved in U-I links, using data from reports and census data. In the second step, we use survey data to analyse firms' perspectives on key drivers, benefits and barriers in U-I partnerships. Finally, using information from semi-structured interviews with the directors of the intermediary organizations we discuss the barriers and outcomes in the U-I interactions.

6.3.1 Profiling firms in U-I links

In the first step of our analysis, we identify the firms' characteristics by estimating a set of probit models. In Section 6.3.1.1, we describe the data. In Section 6.3.1.2, we describe the dependent and explanatory variables and the empirical strategy.

6.3.1.1 Data

The starting point of our study is the profiling of firms that have joint R&D projects with the University of Minho or its intermediary organizations. We collected data for the period 2009–2016. The intermediaries include the university's TTO and three CRCs all of them are non-profit associations that were founded by the University of Minho in partnership with other regional and national stakeholders, such as municipalities, firms, entrepreneurial associations, higher education institutions and non-profit associations. All intermediaries are based in the University of Minho's campus.

From those reports we were able to collect information on 282 university–industry R&D projects. These projects include a total of 397 partners, 354 of which are firms and 185 are based in Portugal. There were 157 R&D projects executed directly by the University of Minho and 125 R&D projects executed through the intermediary organizations, corresponding to 162 million euros and 22 million euros R&D investment, respectively. It should be pointed out that the former took place over the 2009–2016 period, whereas the latter only took place in 2016. In order to profile firms' key structural characteristics and proximity dimensions that may shape their engagement in U-I R&D collaborations, described in Section 6.2.1, we

use firm-level data that combined information from two national statistical sources. The SCIE database and the Personnel Records database QP.[3] From these datasets we collected data on firm's number of employees, turnover, exports, industry, location and labour force and management team education.

We defined three subsets of firms: firms developing R&D partnerships directly through the university's research centres (hereafter, collaborations via university), which includes 164 firms; firms developing R&D partnerships through university-based intermediary organizations (hereafter, collaborations via intermediaries), which includes 47 firms; and a comparable set of firms, that we call the 'rest of the economy' that do not participate in R&D partnerships with universities. In order to identify the subset "the rest of the economy" we used the firm's location, industry classification, turnover, gross added value, number of employees and exports as categorical variables so that all firms share all the observable characteristics of at least one firm having R&D collaboration either via university or via intermediaries. Additionally, in the subset "rest of the economy" we only consider firms with a minimum of five workers. The 'rest of the economy' comprises 4,585 firms.

6.3.1.2 Econometric strategy

In order to determine whether intermediary organizations play a key role in the U-I interactions, we defined two econometric models. In the first specification we use as dependent variable a dummy which assumes the value 1 if the firm has a R&D collaboration with University of Minho, either via university or via intermediaries; and 0 otherwise. We then setup an alternative specification that accounts for the type of collaboration. In this case we use as dependent variable a categorical indicator that assumes the value of 0 if a firm doesn't have a R&D collaboration with University of Minho, a value of 1 if the firm has a R&D collaboration via university, and 2 if a company has a R&D collaboration via intermediaries.

In the formulation of the econometric strategy we model the intrinsic utility of firm i when selecting decision j as:

$$U_{ij} = x'_{ij}\beta + \varepsilon_{ij} \tag{6.1}$$

where x'_{ij} represents a set of characteristics of the firm and β is a vector of parameters to be estimated.[4] Therefore, the probability of seeing choice j can be set as,

$$P\left(\text{ Choice }_{ij}\right) = P\left(U_{ij} > U_{iq}, j, q = 0, 1, \ldots, J, j \neq q\right) \tag{6.2}$$

[3] SCIE is a firm-level database, provided by the Portuguese National Statistics Institute, containing about 350,000 firms and 278 economic and financial variables. QP is a matched employer-employee dataset gathered by the Portuguese Ministry of Employment, which is based on a questionnaire that every firm is legally obliged to complete. Each year, around three million workers and more than 200,000 firms are covered. The data are available since 1986 and it include data regarding human capital education, occupation and firm's location. In our analysis we use data for the period 2009–2015, amounting to 2,166,574 observations.

[4] In this specific analysis, due to limitations in our database, it is not possible to include in the model characteristics associated with choice j.

When a company's decision is between two possible outcomes, i.e., j either assumes the values 0 or 1, Eq. 6.2 can be simplified as,

$$P(\text{ Choice } = 1 \mid x) = P\left(U_{i1} > U_{i0}\right) \tag{6.3}$$

In our empirical analysis we assume a normal distribution for the utility function defined in Eq. 6.1, so $\varepsilon_{ij} \sim N(0,1)$, and, therefore, estimate *probit* models.

The index function x'_{ij} is defined as

$$\begin{aligned} x'_{ij}\beta = & \beta 0 + \beta 1 \times \text{ Size }_{ij} + \beta 2 \times \text{ Turnover }_{ij} + \beta 3 \times R\&D_{ij} \\ & + \beta 4 \times \text{ WorkerEduc }_{ij} + \beta 5 \times \text{ ManagerEduc }_{ij} \\ & + \beta 6 \times \text{ TechOpenness }_{ij} + \beta 7 \times \text{ Export }_{ij} + \beta 8 \times \text{ Solvency }_{ij} \\ & + \beta 9 \times \text{ Region }_{ij} + \beta 10 \times \text{ Industry }_{ij} + \beta 11 \times \text{ Year }_{ij} \end{aligned} \tag{6.4}$$

This formulation of the set of firm-specific structural factors that are most likely to influence the firms' decisions follows the discussion presented in Section 6.2 on the determinants of U-I joint R&D collaboration. Firm size is a key variable that drives U-I interactions Fontana et al. (2006); De Fuentes and Dutrénit (2012); García-Vega and Vicente-Chirivella (2020). On the one hand, we expect a positive and linear relationship between firm size and R&D collaboration; on the other hand, we expect the impact of firm size to be different across interaction mode. If intermediary organizations are to play a role in facilitating U-I links this should be stronger among small-sized firms, this means that we expect small firms to interact preferably via intermediary organizations. Firm size is evaluated by the number of employees (*Size*) and by turnover (*Turnover*). *Size* is defined as a categorical variable which assumes the value 1 if a firm has less than 10 employees, micro-sized firms; 2 if a firm has between 10 and 49 employees, small-sized firms; 3 if a firm has between 50 and 249 employees, medium-sized firms; and 4 if a firm has 250 or more employees, large-sized firms. This variable enters the model as a set of dummies, where the base category is micro-sized firms. The explanatory variable *Turnover* is the logarithm of operating revenue.

Another important firm's driver of joint research and development is its knowledge endowment. We measure that dimension by three variables. First, we use a dummy variable to indicate the presence of intramural R&D activities in the firm (the variable takes the value 1 if the firm had R&D spending). R&D intensive firms are more likely to collaborate in R&D and to explore this knowledge. Second, we include employees' level of education (*WorkerEduc* and management team's level of education (*ManagerEduc*. Both are categorical variables, assuming the value 1 if average years of schooling is up to 6 years; the value of 2 if average schooling years is between 7 and 9 years; the value of 3 if average schooling years is between 10 and 12 years; and a value of 4 if average schooling years is more than 12 years. These variables can also be seen as proxies of cognitive proximity i.e., the degree of overlap between two actors concerning their knowledge bases Broekel and Boschma (2012). In addition, firms that are more open to external knowledge are also more likely to engage in joint R&D. We measure the firm's technology openness by the ratio of intangible assets to the firm's total assets (*TechOpenness* Freitas et al. (2013); Fontana et al.

(2006). We also include the ratio of firm's exports over operating revenue (*Export* to gauge the degree of firm's internationalization Autio et al. (2000); Caloghirou et al. (2021). In addition to these variables, we also control for geographic location of the firm, following the proximity approach described above Boschma (2005). Geographic proximity is measured by the region in which the firm is located (*Region*. We expect spatial proximity to be an important driver of U-I links in our case given that most firms located in the North region are small and medium-sized.

Finally, we also include as control variables the liability-based solvency ratio (*Solvency* to control for the firm's financial capabilities as less financially constrained firms are more likely to invest in R&D; industry to control for differences in appropriability regimes (*Industry*); and time dummies (*Year*). Table 62 in the Appendix D provides a description of the empirical variables.

6.3.2 Identifying firms' motives, benefits and barriers in U-I links

In our second step we use a survey aimed at all firms that participate in joint R&D with University of Minho. The questionnaire was designed to obtain data on firms' perspectives on key drivers, benefits and barriers in partnerships with University of Minho. The key advantage of the survey is that we can collect much more refined information on these dimensions, that complements census data (some data is in fact not possible to collect from census data). This case study approach has been used frequently in studies on this topic because allow for more in-depth analyses and provide the opportunity to place research into a certain context due to the selection of e.g. specific sectors, institutions, countries, etc. Cunningham et al. (2017). Data from the survey allows us to explore proximity-related factors that influence the U-I interaction and to examine the firms' motivations to collaborate, benefits from and barriers to collaboration. Therefore, the survey provided a deeper understanding of the differences in those dimensions across the two sub-groups, that is, the group of firms interacting via an intermediary organization and the group of firms interacting via the university's departments.

The questionnaire was launched between September/November 2020. Given its non-compulsory nature, the questionnaire's response rate was roughly 20%, with 41 valid responses. Firm directors or R&D department managers answered the survey. Decisions regarding the survey construction were inspired in specific studies on university–industry links Bekkers and Freitas (2008); De Fuentes and Dutrénit (2012). Firms were asked to indicate the motives for collaborating with the University of Minho from eight options, the benefits from collaborations from 12 options, and the barriers to collaboration from eight options. The questions were based on four-level scale ranging from 'no important' to 'very important' (see Appendix D with list of variables collected from the survey and descriptive statistics). With these data we performed principal components analysis in order to identify in each group of questions those factors that are most relevant to firms. The technique identifies those variables that are most uncorrelated and explain most of the variance. Notwithstanding our low response rate, it allow us to identify tendencies and it enables us to perform a multivariate technique that is better suited to analyse relationships among non-additive and multidimensional categories such as 'motivations', 'benefits' and 'barriers', than just qualitative analysis.

6.3.3 Intermediaries perspectives of the U-I links

In the third step, we did four semi-structured interviews with the directors of the intermediary organizations. The interviews' objective was to gain knowledge on the intermediary organization perspective of the U-I links. Our main focus was in finding out whether there were barriers in the interactions between academia and industry and, if so, what type of barriers. Then we also aimed to find out if the projects' outcomes were (are) attained, i.e., if the U-I links proved to be successful. The directors of the intermediary organizations were asked about the firms' profiles, particularly their size, who initiated the contact—the firm or the intermediary -, the main drivers for interactions, and the average number of ongoing R&D projects per year. Interviews took approximately 60 to 90 min by videoconferencing due to the pandemic and were recorded, which facilitated retrieval of information. Table 35 in Section 6.4.3 provides some primary data regarding the intermediaries along side with a synthesis of their answers to the interviews. Given that the questions of the interview were very objective, i.e., almost survey-type, the answers were easily interpreted and there was no need to apply data analysis software.

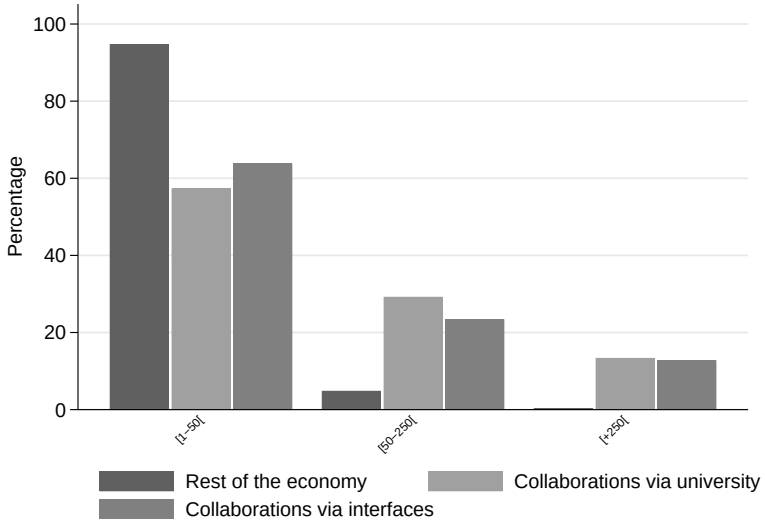


Figure 28: Distribution of firms' size by interaction mode

6.4 Results

This section presents the results of our empirical strategy. In Section 6.4.1, we characterize firms involved in U-I partnerships in terms of size, technology openness, management and workforce education, participation in international trade and location and show how these variables affect the probability of firms engaging in R&D collaboration through intermediary organizations. In Section 6.4.2, we present the results of the survey applied to firms participating in joint R&D activities concerning their motives, benefits and barriers in developing U-I links. In Section 6.4.3, we describe the approaches, barriers and

outcomes in the interaction between academia and the industry from the perspective of the intermediary organizations, making use of the answers of their directors to the semi-structured interviews.

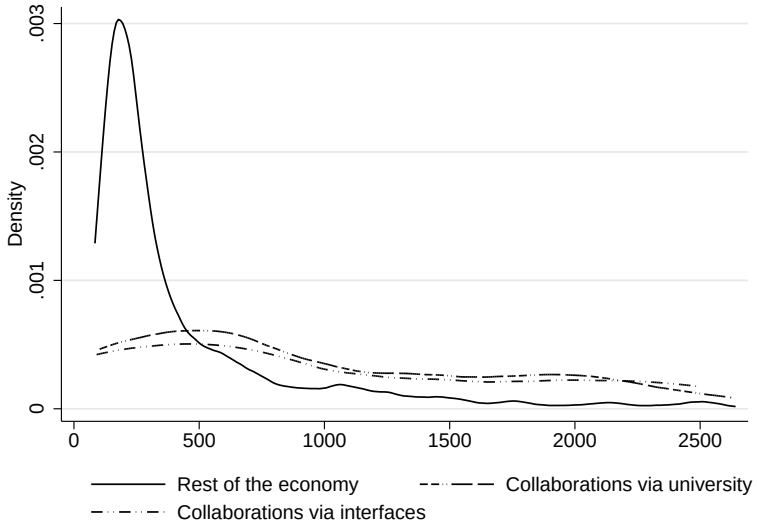


Figure 29: Kernel density of firms' turnover by interaction mode

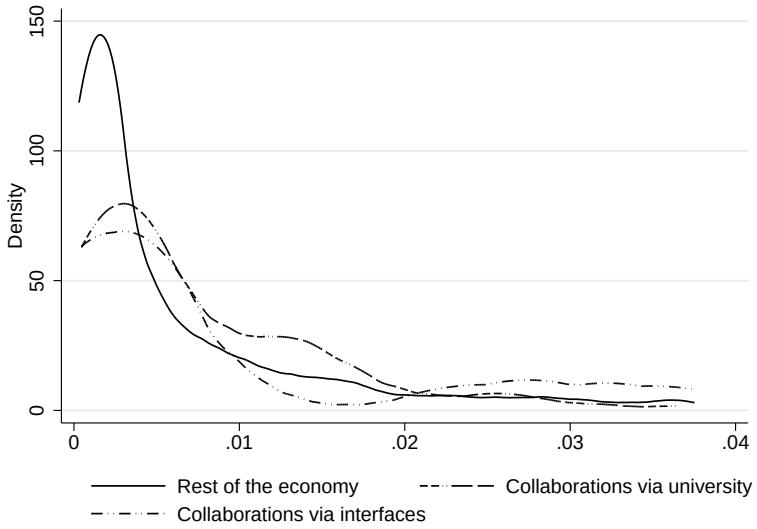


Figure 30: Kernel density distribution of firms' technology openness by interaction mode

6.4.1 Firms' profile in U-I R&D collaboration

6.4.1.1 Descriptive analysis

In this section we present the results of the statistical and econometric strategy to characterize firms involved in U-I links. We start by doing a first inspection of the data by describing some firms' characteristics and their distribution across the three sets of firms in our sample. As Fig. 28 shows, the majority

of University of Minho R&D collaborations are with small-sized firms, and the number of collaborations decreases with firm size. The data suggests a preference for interaction via intermediaries only among the small-sized firms' cohort. Medium-sized firms prefer to interact directly with University departments than via an intermediary organization. However, among large-sized firms we do not observe any difference in firms' preferences regarding the interaction mode.

Figure 29 shows the kernel density distributions for 'Turnover' that provides another firm-size measure. We observe that firms participating in collaborations via university and via intermediaries appear to have similar Kernel density distributions, although firms collaborating via university have a higher turnover than firms interacting via an intermediary.

Figure 30 shows the kernel density distributions of firms' technology openness, gauged by the weight of intangible assets on total assets. Firms of the 'rest of the economy' have considerably lower values than firms collaborating either via university or via intermediaries. We also observe that firms interacting via intermediaries exhibit higher technology openness than firms interacting via university. This could be due to the fact that small firms are more dependent on external knowledge as they have less intra-mural capabilities than large.

Figure 31 describes firms' employees education level. Firms involved in collaborations via university have a considerably higher cognitive proximity. More than 45% of firms involved in collaborations via university have a labour force with an average schooling above 12 years, whilst for the two other subsets of firms this figure is around 30%.

Figure 32 shows the distribution of firms' management team education. We observe that firms involved in collaborations via university have management teams with higher qualification level. We observe a highly negatively skewed distribution. Nearly 85% and 70% of firms collaborating via university and via intermediaries, respectively, have management teams with college degree education.

Figure 33 shows firms' exports. We find that most of the firms from the 'rest of the economy' export less than 20% of their turnover, and large number of firms involved in collaborations via university export less than 40% of their turnover. Firms collaborating via intermediaries are uniformly distributed and exhibit lower ratios than counterparts.

Figure 34 shows firms' geographic distribution. We observe that 85% of R&D collaborations with University of Minho via intermediaries are located close to the University, which is located in the Norte region. Collaborations via university, are less geographically concentrated: 51% of these R&D partnerships are located in the Norte region, and 36% in other regions in the country.

6.4.1.2 Estimation of firms' determinants to engage in U-I joint R&D and their interaction mode

Table 30 presents the probit model estimates as specified in Eq. 6.2. Column's (1) estimates show that firm's structural variables are important to determine its probability of engaging in U-I R&D collaboration.

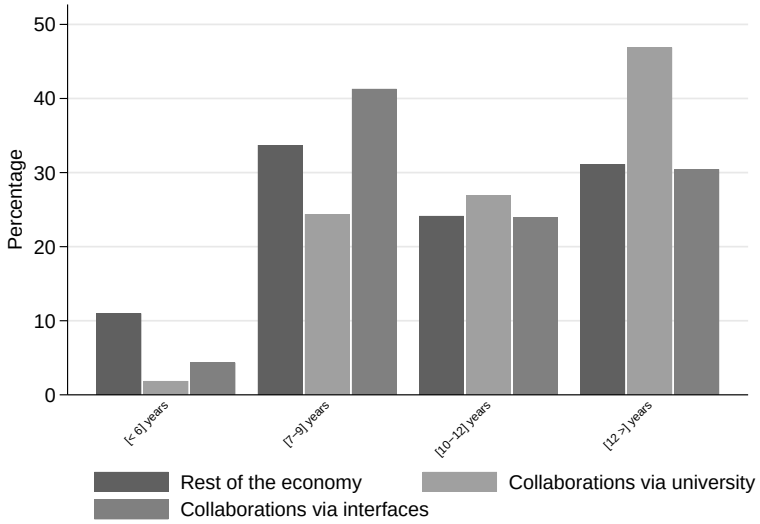


Figure 31: Distribution of firms' employees' education, by interaction mode

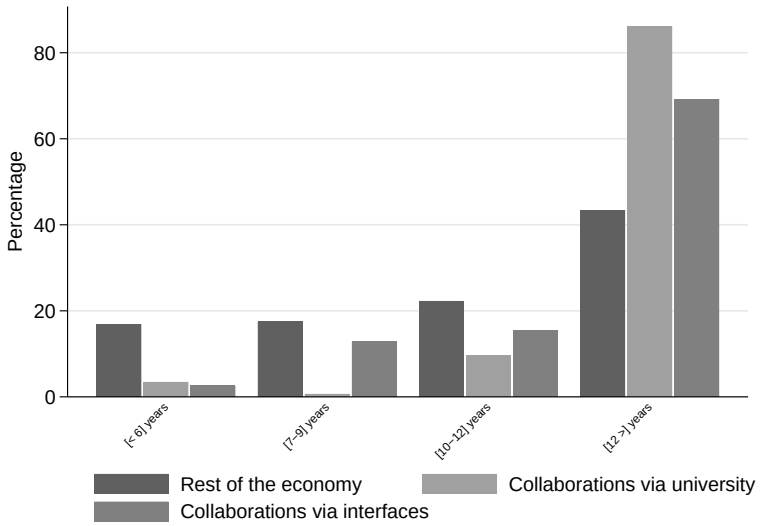


Figure 32: Distribution of firms' management team education, by interaction mode

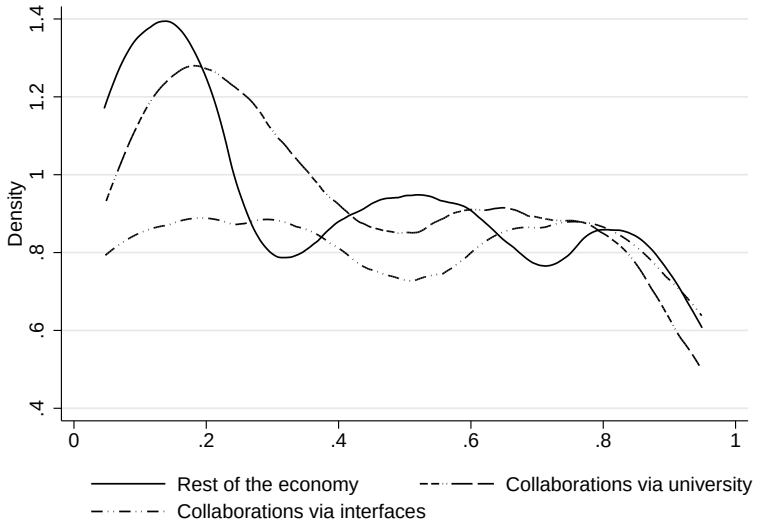


Figure 33: Kernel density distribution of firms' exports by interaction mode

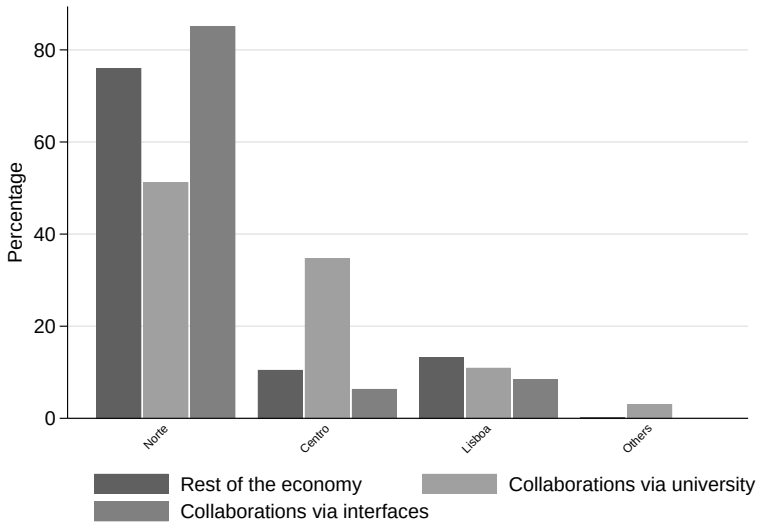


Figure 34: Geographic proximity distribution of firms by interaction mode

Table 30: Probit model estimation of probability of firms to engage on U-I joint R&D collaboration by interaction mode

Variable	Variable name	All firms (1)	Firms interacting via university (2)
Size	Small	0.007**	0.006***
		(0.001)	(0.001)
	Medium	0.029***	0.026***
		(0.003)	(0.003)
	Large	0.0745***	0.061***
		(0.014)	(0.012)
Absorptive capability	R&D	0.186***	0.147***
		(0.030)	(0.026)
Knowledge capabilities	WorkerEduc: up to 6 years	-0.037***	-0.027***
		(0.004)	(0.003)
	WorkerEduc: 7–9 years	– 0.033***	– 0.026***
		(0.004)	(0.003)
	WorkerEduc: 10–12 years	– 0.025***	– 0.020***
		(0.004)	(0.003)
	ManagerEduc: up to 6 years	– 0.015***	– 0.012***
		(0.001)	(0.001)
	ManagerEduc: 7–9 years	– 0.015***	– 0.013***
		(0.001)	(0.001)
	ManagerEduc: 10–12 years	– 0.010***	– 0.009***
		(0.001)	(0.001)
Technology openness	TechOpenness	0.036***	0.026***
		(0.005)	(0.004)
Export	Export	0.006***	0.003
		(0.002)	(0.004)
Geographic proximity	Centro region	0.001	0.003*
		(0.001)	(0.001)
	Lisboa region	– 0.008***	– 0.007***
		(0.001)	(0.001)
	Other regions	0.011**	0.018***
		(0.007)	(0.008)
Obs		49,085	48,940
Log-likelihood		-2378.775	-1894.897
Pseudo R2		0.353	0.378

Reported figures are marginal effects computed from the estimated probit models, and in parentheses standard errors. Dependent variable columns (1) and (2): 1 if firm has joint R&D collaboration with the University of Minho, 0 otherwise. Column (1) includes all firms in the sample, i.e., firms interacting via university or via intermediaries. Column (2) includes firms interacting via university only.

Significance levels: *: 10%; **: 5%; ***: 1%. The omitted category for firm size is firms with less than 10 employees. The omitted category for WorkerEduc is more than 12 years of education. The omitted category for ManagerEduc is more than 12 years of education. The omitted category for 'Region' is 'Norte'. For simplicity the variables 'Turnover', 'Solvency', 'Industry' and 'Time' are omitted from the table but were included in the estimation.

Firms' probability of doing joint R&D increases with their size, measured either by number of employees or turnover. Likewise, the more the firm's absorptive capability, knowledge capabilities, technology openness and internationalization of production the higher the probability of firm engagement in U-I collaborations. Estimates also show that the likelihood of doing U-I joint R&D increases with geographic proximity. All these results are consistent with previous studies (e.g., Bekkers and Freitas (2008); Freitas et al. (2013); Colombo and Delmastro (2002).

Results in column (2) evaluate the role of intermediaries in establishing joint R&D between firms and University of Minho. Estimates were obtained by eliminating from the sample the U-I R&D partnerships developed via intermediaries. If intermediary organizations have a strong role in enhancing university–industry R&D collaborations, after implementing that procedure we should observe a decrease in the estimates. The results corroborate that expectation, suggesting that intermediaries have an important role in closing the gap between universities and industry. The difference in the magnitude of the coefficients is particularly visible in firm size, and, above all, in absorptive capability (R&D). The higher the absorptive capability the higher the probability of engaging in U-I collaboration via university and less via intermediary organizations. Likewise, firm's knowledge capabilities (workers and managers' education) play a positive and substantial role in enhancing university–industry collaboration in all firms but the impact is stronger for firms that interact directly. Estimates indicate that firms with less knowledge capabilities have a higher chance of interacting through intermediaries than via university.

Firms located outside of Norte region have a lower probability of developing a R&D partnership with the University of Minho. This effect is only statistically relevant for collaborations via intermediaries. These results suggest that geographic distance matters to U-I links and that intermediary organizations play a significant role the regional economy Aristei et al. (2016); Jaffe et al. (1993).

Table 31 shows the estimates from the multinomial probit model, which assumes independence of the different decisions of firms concerning the mode of interaction with the University of Minho. The dependent variable now includes three distinct and independent mode decisions, i.e., no interaction at all, interactions via intermediary organization only, and interactions via university. Results confirm previous probit estimates: smaller firms, with lower levels of absorptive capacity, and geographically closer are more likely to interact through an intermediary organization than directly with the university.

6.4.2 Firm's motives, benefits and barriers in U-I joint R&D

In the second step of our analysis we seek to have a deeper insight into firms' motives, benefits from and barriers to collaboration and how these vary across firms. Tables 32, 33 and 34 present the results from the principal components analysis.[5]

Table 32 shows the factor loadings of firms' motives to collaborate in R&D with University of Minho. From an initial list of seven individual motives we identified three main factors for each group of firms that explain 73% and 74% of total variance for firms interacting via intermediary and interacting via university,

[5]We only show factors with loadings greater than 0.5 and with an eigenvalue greater than 1.0.

Table 31: Multinomial probit model estimation of U–I joint R&D collaboration by interaction mode

Variables	Variable name	Rest of the economy (1)	Via university (2)	Via intermediary (3)
Size	Small	– 0.007***	0.006***	0.001**
		(0.001)	(0.001)	(0.000)
	Medium	– 0.027***	0.023***	0.004***
		(0.003)	(0.003)	(0.001)
	Large	– 0.073***	0.063***	0.025***
		(0.013)	(0.011)	(0.006)
Absorptive capability	R&D	– 0.251***	0.204***	0.046***
		(0.029)	(0.026)	(0.013)
Knowledge capabilities	WorkerEduc: up to 6 years	0.035***	– 0.025***	– 0.010***
		(0.004)	(0.003)	(0.002)
	WorkerEduc: 7–9 years	0.031***	– 0.024***	– 0.007***
		(0.004)	(0.003)	(0.002)
	WorkerEduc: 10–12 years	0.024***	– 0.018***	– 0.006***
		(0.004)	(0.003)	(0.002)
	ManagerEduc: up to 6 years	0.015***	– 0.012***	– 0.003***
		(0.001)	(0.001)	(0.001)
	ManagerEduc: 7–9 years	0.016***	– 0.014***	– 0.003***
		(0.001)	(0.001)	(0.001)
	ManagerEduc: 10–12 years	0.010***	– 0.0091***	– 0.001
		(0.001)	(0.001)	(0.001)
Technology openness	TechOpenness	– 0.035***	0.026***	0.009***
		(0.005)	(0.004)	(0.002)
Export	Export	– 0.007***	0.004***	0.003***
		(0.002)	(0.002)	(0.001)
Geographic proximity	Other regions	0.003***	– 0.001	– 0.002***
		(0.001)	(0.001)	(0.001)
Obs		49,085	49,085	49,085
Log-likelihood		-2655.663		

Reported figures are marginal effects computed from the estimated multinomial probit models. The dependent variable in columns (1), (2) and (3) corresponds to one of the three possible outcomes U–I interaction, namely, (1), the firm doesn't have a joint R&D collaboration with University of Minho, (2), the firm has a joint R&D collaboration via university or, (3), the firm has a joint R&D collaboration via intermediary organization.
Significance levels: *: 10%; **: 5%; ***: 1%. The omitted category for firm size is firms with less than 10 employees. The omitted category for WorkerEduc is more than 12 years of education. The omitted category for ManagerEduc is more than 12 years of education. The omitted category for 'Region' is 'Norte'. For simplicity the variables 'Turnover', 'Solvency', 'Industry' and 'Time' are omitted from the table but were included in the estimation. Due to lack of variability in data Centro and Lisboa regions were omitted from the regressions.

Table 32: Factor loadings of firms' motives for U–I joint R&D collaboration, by interaction mode

Group of motives	Individual	Firms' interaction mode					
		Via intermediary			Via university		
		Factors			Factors		
		1	2	3	1	2	3
Resources	Cost sharing	0.57					
	Access to funding	0.56					
	Access to labs						0.83
Proximity	Geographic proximity			0.92			0.77
	Social proximity		0.76				
Strategic	Visibility					0.50	
Variance explained by the component		2.280	1.335	1.087	2.778	1.274	1.110
Total variance extracted by the factors		67%			74%		
Kaiser–Meyer–Olkin		0.73			0.74		
Cronbach's Alpha		0.69					
N		17			24		

Extraction method: principal components; rotation method: varimax with Kaiser normalization factor loading with absolute value >= 0.5. Cronbach's Alpha calculated for all 41 firms.

respectively. Despite the number of factors being equal, they differ across the two groups of firms. For those firms interacting via intermediary organizations the main motivations are related to (in order of importance): resources and proximity, both social and geographic. As for the group of firms interacting via university, the most relevant motive to collaborate with the university are related to (in order of importance) strategy, (increase visibility), resources (access to labs) and geographic proximity.

These results are consistent with Freitas et al. (2013) as we observe different decision-making processes between the two forms of governance. Firms interacting via intermediaries are mostly driven by the lack of resources, while firms interacting via university are motivated by the need to increase visibility. Whereas geographic proximity is an important motive for both groups of firms, the principal components analysis suggests that this motive is more important to firms interacting via intermediaries than for firms interacting via university. This confirms our previous results presented in Table 30 and is in line with previous evidence that showed that small firms interact mostly with local universities Bishop et al. (2011); Hewitt-Dundas (2013). Social proximity is only relevant to firms interacting via intermediaries, which is consistent with Etzkowitz and Klofsten (2005) and Giaretta (2014) who argue that social ties are particularly valued by small firms.

Table 33: Factor loadings of firms' benefits from University–Industry joint R&D by interaction mode

Group of benefits		Individual benefit	Firms' interaction mode									
			Via intermediary					Via university				
			Factor					Factor				
			1	2	3	4	5	1	2	3	4	5
Resources	Cost related	Cost		0.65						0.72		
		Time		0.57						0.51		
		Access to funding					0.55	0.57				
	R&D knowledge	Knowledge improvement							0.57			
		Knowledge source				0.57						
		Knowledge solving				0.60						
	Human capital	Hiring			0.66							
		Training			0.61						0.78	
Proximity		Geographic	0.66									
Performance		Innovation					0.64	0.56				
		Sales increase	0.56									0.77
Variance explained			2.360	2.021	1.972	1.956	1.732	3.152	2.398	2.004	1.527	1.319
Total variance extracted by the factors			84%					87%				
Kaiser–Meyer–Olkin			0.30					0.70				
Cronbach's Alpha			0.85									
N			17					24				

Extraction method: principal components; rotation method: varimax with Kaiser normalization factor loading with absolute value >= 0.5. Cronbach's Alpha calculated for all 41 firms.

Table 34: Factor loadings of barriers among firms in University–Industry R&D collaboration, by type of interaction mode

Group of barriers	Individual	Firms' interaction mode			
		Via intermediary		Via university	
		Factor		Factor	
		1	2	1	2
Cost	Overheads	0.511			
Cognitive	Knowledge too theoretical	0.536			0.533
	Knowledge too general				0.733
Institutional	Cultural		0.633	0.583	
	Organizational		0.521	0.537	
	Weak appropriation		0.547		
Variance explained		3.016	2.021	3.035	1.888
Total variance extracted by the two factors		72%		70%	
Kaiser–Meyer–Olkin		0.56		0.61	
Cronbach's Alpha		0.84			
N		17		24	

Extraction method: principal components; rotation method: varimax with Kaiser normalization factor loading with absolute value >= 0.5. Cronbach's Alpha calculated for all 41 firms.

Next, we analyse firms' perceptions regarding benefits from collaboration. Table 33 shows the factors loadings of firm's benefits in U-I joint R&D. From an initial list of 12 benefits, we identified five factors, which altogether explained 84% and 87% of the total variance for firms interacting via intermediaries and firms interacting via university, respectively. As before, we observe differences and similarities across the two groups. The first result to observe is that all firms experience the same main groups of benefits, except in one case. Specifically, both groups of firms experience resources - and outcome-related benefits, though they value these benefits differently (e.g., cost and time benefits are the second factor most important among firms interacting via intermediaries, whereas this benefit comes in third place among counterparts).

The second remark is that geographic proximity is a highly rated benefit for firms interacting via intermediaries. Whereas this result clearly confirms the importance of geographic proximity to knowledge exchange Boschma (2005) it also reveals that this type of proximity only seems to matter to small firms and with less R&D knowledge capabilities, in line with Bishop et al. (2011).

Another noticeable finding relates the differences in the individual benefits across groups of firms. All firms experience a positive effect of joint R&D in both sales and innovation. Yet, they experience this in different ways. Firms interacting via intermediaries benefit mostly from sales increase and counterparts benefit mainly from innovation development. This result is in line with recent evidence that shows that benefits from U-I joint R&D differ across firms of different sizes and by type of outcome Caloghirou et al.

(2021); García-Vega and Vicente-Chirivella (2020); Scandura (2016); Spanos (2021).

Table 35: Intermediary organizations' perceptions of U–I interactions

Variable	University of Minho intermediary organizations			
	Intermediary A	Intermediary B	Intermediary C	Intermediary D
Type	CRC, External	CRC, External	CRC, External	TTO, Internal
University's capital	32.1%	56.58%	36.35%	56.30%
Governance	Executive Staff External, Non-Academic	Executive Staff Internal, Academic	Executive Staff Internal, Academic	Executive Staff Internal, Non-Academic
Firm profile	Small-Medium Local, Others	Small-Medium Local, Others	Medium-Large Local, Others	All sizes Local
Contact initiative	Mostly PIEP	Mostly CVR	Mostly firms	Equally
Barriers in interaction	Do not exist	Do not exist	There are barriers	Not noticeable

Table 34 presents the factor loadings of regarding firms' barriers. These results show that barriers in the U-I interaction are mostly related to cognitive and relational distances. These results provide strong support to the literature that describes U-I links as being characterized by this type of barrier (e.g., Etzkowitz and Klofsten (2005); Villani et al. (2017). Firms interacting via university appear to suffer more from cultural and organizational barriers than firms interacting via an intermediary organization. This is a somewhat surprising result because the conventional wisdom is that these barriers are more severe among small firms. Intermediaries are possibly playing a role in diminishing these barriers, as they are in the second position among firms interacting via intermediaries. For these firms the most prominent barriers are overhead costs and knowledge related. Weak appropriability is also a barrier to firms interacting via intermediaries, which is consistent with the findings of Giaretta (2014). She also found that small firms are more sensitive to appropriability issues than large.

6.4.3 The perspective of the intermediary organizations on U-I joint R&D

Table 35 provides a summary of key findings of intermediary organizations' interviews. There are three CRCs, and one TTO. Although CRCs are located in the University's campus they are regarded as external entities Wright et al. (2008). Another way of seeing these intermediaries is by Mignon and Kanda (2018)'s typology. In this light all intermediaries are cluster organizations, including the TTO, as they are a concentration of interconnected firms and organizations that work actively in fostering networking, partnerships and collaboration projects between different types of actors (e.g., firms and universities), among other activities (see Section 6.2.2).

There are differences across intermediaries regarding the University's holding capital but they are not specific to the organization. The University of Minho predictably has more than 50% of the capital in the TTO, but this also happens in the case of intermediary B. In terms of governance, in three cases the intermediary organization's Director is internal (recruited from University staff), and in one case he/she was recruited outside the University. In two CRCs the Director is an academic and in the remaining two intermediaries the Director is non-academic.

All Directors mentioned that they deal with firms of all sizes and from other regions. However, two CRCs deal mostly with small-medium size firms, intermediary C is approached by larger firms. The TTO deals with all firm sizes. So, in terms of characteristics all these entities have similarities and their differences are not attributable to any particular aspect.

We observe more pronounced differences regarding the U-I interactions. With respect to who takes the initiative, we observe similarities and differences. In two CRCs the intermediary takes the first step most of the times, whereas in one CRCs the initiative usually comes from the firms. In the TTO case the perception is that the initiative comes from both parts. There is a clear divide in that all intermediaries, except one, have a very positive perspective of their interactions. Specifically, they consider that the project's aims are overall attained and they do not experience any barriers in their communication, whatever the type. One intermediary had a quite different perspective, saying that quite frequently the project results are not

attained and that cultural and organizational differences are indeed a barrier.

6.5 Discussion

Several important findings emerge from the analysis. We found in a robust way that firms interacting via intermediaries are structurally different from firms interacting directly with the university departments. Specifically, we found that smaller firms, with lower knowledge capabilities and geographically close to the university tend to interact via intermediaries. Thereby, our study shows that intermediaries are playing an important role in developing U-I linkages mainly through the support to small-sized, with less knowledge capabilities and local firms. Thus, our study adds to previous research such as Villani et al. (2017) by showing the type of firm that intermediaries reach out. Furthermore, our findings provide strong support to the argument that intermediaries organizations are particularly important to small-sized firms Etzkowitz and Leydesdorff (2000); Giaretta (2014); Johnson (2009); De Wit-de Vries et al. (2019), at least in the context of a mid-tier university located in a peripheral region. This is an important finding as recent contributions have highlighted that the main obstacle for knowledge transfer from universities to industry is firms' insufficient absorptive capacity Abbate et al. (2021) and that cognitive differences are hard to overcome without the presence of intermediaries De Wit-de Vries et al. (2019).

Other key findings of our study relate the barriers to communication between firms and the university and the role that intermediaries may have in lowering them. First, our evidence provides support to the argument that there are barriers to communication and that these are mostly cognitive and cultural Giaretta (2014); Villani et al. (2017); De Wit-de Vries et al. (2019). Thus our evidence does not support the argument that dismiss these barriers Lam (2011); Y. S. Lee (2000). More importantly, we found these barriers are different across the two groups of firms. While firms interacting via intermediaries – smaller ones, face mostly cognitive and cost barriers, firms interacting directly with the university departments – larger ones, face mostly cultural/organizational barriers, i.e., relational barriers. In addition, our results corroborate previous evidence suggesting that weak appropriation is a barrier to smaller firms Giaretta (2014).

Another finding of our paper is that geographic proximity is an important driver of U-I interactions, particularly for small-sized firms. This is important because it highlights the importance of mid-tier universities role in less technologically and economically advanced regions. These results are in line with recent evidence from Italy Colombelli et al. (2021); Grimaldi et al. (2021), which shows that Italian universities, namely in peripheral regions, have a strong regional focus.

Our results also add to the literature that investigates the choice of the interaction mode in U-I linkages Freitas et al. (2013) as we observed that different decision-making processes for firms still subsist when they choose among institutional modes of interaction. For instance, resources and geographic proximity are the most relevant factors for firms interacting via intermediary organizations, while increased visibility and acess to labs are the most relevant for firms collaborating directly with the university. These results highlight the importance of acknowledging firms' differences in the technology transfer process.

Indeed, we also observed that these differences relate to firms' motives to interact as well to the benefits of interaction. Specifically, firms interacting via intermediaries benefit mostly from sales increase, counterparts benefit mainly from innovation development. As such, our results are consistent with recent evidence Caloghirou et al. (2021); García-Vega and Vicente-Chirivella (2020); Spanos (2021) that found that U-I joint R&D impacts differently on firms of different characteristics, namely size and knowledge capabilities.

Finally, our findings have shown that while firms' structural characteristics are very important to understand U-I links and their impacts on firms, proximity related factors are crucial to understand its effectiveness. Hence, the combination of these two literature strands provides a richer framework to analyse the phenomenon than a single one.

6.6 Conclusions

The optimization of the interface between science and the economy has become one of the most important guidelines of technology policy. In this context it has been largely acknowledged that intermediary organizations have the important role to facilitate interaction between universities and industry. Despite the importance of these organizations to the knowledge transfer process there still is a lack of empirical evidence, particularly in the context of less technologically advanced regions and mid-tier universities. Our purpose was to examine the role of intermediaries in these interactions by focusing on one particular type of knowledge transfer – joint R&D and analysing firms' differences across their interaction mode. Firms could interact directly with the university or via an intermediary organization.

Our study provide important insights regarding the knowledge transfer process in the context of an European peripheral region that allow to enunciate some lessons for government policy makers, university administrators and business managers.

Our evidence confirms the importance of intermediary organizations in promoting U-I linkages. In particular, intermediaries are playing a role in reaching out small and less technologically advanced firms located geographically close to the University. As pointed by Grimaldi et al. (2021) the current great challenge for Italian universities is assisting small and medium-sized firms as they suffer from insufficient absorptive capacity Abbate et al. (2021). Therefore from a policy point of view, our results provide support to the recent Portuguese Interface Program, implemented by the government and supported by European Funds, that aims at supporting the creation and development of technological interface institutions and enhance U-I collaboration.

In addition, our results provide support to the importance of demand-pull innovation policies, which have been advocated in the context of Portuguese innovation systems both national and regional Laranja (2009); Almeida et al. (2011). Such policies are now part of the European Commission agenda whose innovation policy has been redirected from investment-driven to knowledge building. As argued by Almeida et al. (2011) and Faria et al. (2019) public policies should combine an inclusive view of innovation with

science push and demand-pull perspectives along with territorially embedded specificities Cunningham et al. (2019). In this regard, policies supporting the cooperation between firms and universities play a particularly important role in countries with low to medium tech industries (e.g., Segarra-Blasco and Arauzo-Carod (2008) such as Portugal.

To university administrators there is work to be done in lowering barriers. Our findings revealed there is a mismatch between the firms' and the intermediaries' perceptions w.r.t. relational barriers – cognitive and cultural. While these barriers are hard to overcome, there should be some effort dedicated to understand them. One possible avenue could be enabling academics to understand knowledge boundaries faced during engagement activities Dolmans et al. (2021). Likewise, overhead costs are an important barrier to small firms and should be taken into account when establishing joint R&D protocols. Though intermediaries' role is to contribute to lower relational barriers, business managers also have a role to play, namely by investing more in human capital. The lack of absorptive capacity that hinders knowledgetransfer can only truly be overcome by increasing firms' investment in human capital.

Finally, we should acknowledge the fact that, due to data restrictions, we are not evaluating the output of the partnerships. Furthermore, from a technical perspective, we are not able to address properly endogeneity issues that might bias the estimates discussed above. However, in face of the evidence provided, although the magnitude of the estimated effects might be smaller with respect to some explanatory variables, we believe the results would not be mitigated. As future lines of work it would be relevant to analyse the impact of intermediaries on lowering relational barriers, namely cultural and organizational, and extend the analysis to other universities and regional contexts.

7

Conclusion

The essays of this thesis explored a range of topics, mainly related to labour market institutions. In this section, we present the main findinds and policy recommendations from each chapter.

Chapter 2 evaluated the impact of significant and consecutive minimum wage increases in the Portuguese economy since 2014. These results contribute to a better understanding of the impact of minimum wage policies on firms. So far, most studies of the impact of minimum wage policies have been focused on employment and other dimensions of labor markets. This paper presents evidence that minimum wage policies may affect the financial situation of firms and their survival. Therefore, these are issues that policymakers should bear in mind when setting new floors for wages.

The assessment of minimum wage policies in Portugal, since 2014, carried out in this paper suggests that the negative impact on employment and profitability may have been compensated for the economy as a whole by the expansionary phase of the business cycle. On the other hand, our results also suggest that minimum wage policies might have had a supply side effect. The exit of lower productivity firms caused by the increase in wage costs might have worked as a cleansing mechanism, contributing to higher aggregate productivity.

Chapter 3 assesses the wage impacts of minimum wage policies on regional/occupational inequality. The central conclusion from our study is that smaller minimum-to-median wage gaps are associated with a decrease in wage inequality, with more significant impacts observed in region/occupation pairs that are more directly influenced by minimum wage policies. We also find significant differences in how the minimum wage policies affected Portuguese regions, with the Lisbon region, the region with the highest average per capita income, being considerably less affected by these policies.

These results contribute to a better understanding of the impact of minimum wage policies in dimensions not previously explored in the literature. Most studies have focused on overall country level, gender and region inequality. We pair region and occupations together to explore differences in occupational wage levels across regions due to significant regional income inequality. We also confirm the existence of significant differences in the impact of the minimum wage according to the exposure of each region to the minimum wage.

The relevance of regional and occupational heterogeneity also suggests that policymakers should

account for the impact on local labour markets when designing minimum wage policies.

Chapter 4 explores the role that the business environment and business dynamism at the sectoral level play in affecting resource allocation efficiency and productivity growth of the Portuguese economy between 2007 and 2020. The impact of the entry and exit of firms on resource allocation efficiency and productivity growth is contingent upon the institutional features of product, labour and financial markets. Although our analysis shows that the least productive firms are more likely to exit, we do not find an impact of the exit of firms on the improvement of resource allocation, gauged in our analysis by productivity dispersion, except on sectors with a high incidence of financially distressed firms.

Estimates regarding productivity growth suggest that policies that promote a more favourable business environment may contribute to fostering productivity growth by allowing *good* firms to grow and *bad* firms to exit. Namely, reducing labour market rigidity seems to contribute to sectoral productivity growth. Our estimates also suggest that the entry of new firms is particularly effective in improving productivity growth in sectors with high levels of product market concentration. Therefore, enhancing product market competition should also be a goal for policy makers. Our results also suggest that better bankruptcy legislation, aiming to accelerate financially distressed firms' exit or recovery, may improve productivity growth.

Chapter 5 investigates the quality and inclusiveness of jobs in young versus older firms. The topic is of high policy relevance in the light of the recent surge in interest in job quality, as well as in fostering entrepreneurship and ensuring inclusive labour markets.

The main findings about the role of young firms for job quality and inclusiveness are overall aligned between the countries analysed. Findings on job quality suggest that young firms do not have a negative wage gap relative to older ones. Workers with similar characteristics receive equal, or even higher, pay at young firms. Furthermore, young firms tend to provide more job security in terms of open-term contracts.

In terms of inclusiveness, findings suggest that although a significant gender wage gap is observed in both groups of firms, this wage gap is smaller in young firms in both countries. Foreign workers have a wage penalty in France and a wage premium in Portugal, and young firms pay less than incumbents to foreigners, aggravating this penalty in France and nullifying this premium in Portugal. Young firms employ a significantly larger share of foreign workers, in both countries, suggesting that this firms are an important entry way into the labour market for this disadvantaged group.

The findings of this paper suggests that young firms play a key role, not only on job creation as noted in the literature, but as well as by providing jobs that are equally paid and more secure. Furthermore, young firms appear to contribute to the reduction of gender wage gaps. In terms of the impact on foreign workers, the role of young firms seems to be more as an entry point to the labour market, although paying lower wages than incumbents. Focusing on Portugal, this result is however driven by workers from Portuguese-speaking countries. In this context, policy makers should ensure that young firms have the necessary business environment to compete with incumbent firms, resulting in a better business dynamism and possibly supporting the growth of wages and accelerating the reduction in wage gaps.

The final chapter, chapter 6 provides important insights regarding the knowledge transfer process in the context of an European peripheral region that allow to enunciate some lessons for government policy

makers, university administrators and business managers.

The optimization of the interface between science and the economy has become one of the most important guidelines of technology policy. In this context it has been largely acknowledged that intermediary organizations have the important role to facilitate interaction between universities and industry. Despite the importance of these organizations to the knowledge transfer process there still is a lack of empirical evidence, particularly in the context of less technologically advanced regions and mid-tier universities. Our purpose was to examine the role of intermediaries in these interactions by focusing on one particular type of knowledge transfer – joint R&D and analysing firms' differences across their interaction mode. Firms could interact directly with the university or via an intermediary organization.

Our evidence confirms the importance of intermediary organizations in promoting U–I linkages. In particular, intermediaries are playing a role in reaching out small and less technologically advanced firms located geographically close to the University. From a policy point of view, our results provide support to the recent Portuguese Interface Program, implemented by the government and supported by European Funds, that aims at supporting the creation and development of technological interface institutions and enhance U–I collaboration.

To university administrators there is work to be done in lowering barriers. Our findings revealed there is a mismatch between the firms' and the intermediaries' perceptions with respect to relational barriers – cognitive and cultural. While these barriers are hard to overcome, there should be some effort dedicated to understand them. One possible avenue could be enabling academics to understand knowledge boundaries faced during engagement activities. Likewise, overhead costs are an important barrier to small firms and should be taken into account when establishing joint R&D protocols. Though intermediaries' role is to contribute to lower relational barriers, business managers also have a role to play, namely by investing more in human capital. The lack of absorptive capacity that hinders knowledge transfer can only truly be overcome by increasing firms' investment in human capital.

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A

Appendix to Chapter 3

Table 36: List of occupations (International Standard Classification of Occupations)

2 digit code	Description
11	Chief Executives, Senior Officials and Legislators
12	Administrative and Commercial Managers
13	Production and Specialized Services Managers
14	Hospitality, Retail and Other Services Managers
21	Science and Engineering Professionals
22	Health Professionals
23	Teaching Professionals
24	Business and Administration Professionals
25	Information and Communications Technology Professionals
26	Legal, Social and Cultural Professionals
31	Science and Engineering Associate Professionals
32	Health Associate Professionals
33	Business and Administration Associate Professionals
34	Legal, Social, Cultural and Related Associate Professionals
35	Information and Communications Technicians
41	General and Keyboard Clerks
42	Customer Services Clerks
43	Numerical and Material Recording Clerks
44	Other Clerical Support Workers
51	Personal Service Workers
52	Sales Workers
53	Personal Care Workers
54	Protective Services Workers
61	Market-oriented Skilled Agricultural Workers
62	Market-Oriented Skilled Forestry, Fishery and Hunting Workers
71	Building and Related Trades Workers (excluding Electricians)
72	Metal, Machinery and Related Trades Workers
73	Handicraft and Printing Workers
74	Electrical and Electronics Trades Workers
75	Food Processing, Woodworking, Garment and Other Craft and Related Trades Workers
81	Stationary Plant and Machine Operators
82	Assemblers
83	Drivers and Mobile Plant Operators
91	Cleaners and Helpers
92	Agricultural, Forestry and Fishery Labourers
93	Labourers in Mining, Construction, Manufacturing and Transport
94	Food Preparation Assistants
95	Street and Related Sales and Service Workers
96	Refuse Workers and Other Elementary Workers

Notes: Occupation '94 - Food Preparation Assistants' is not present in the data from 1998 to 2009. This occupation contained 41 thousands observations in 2021, corresponding to 1.3% of all observations.

B

Appendix to Chapter 4

Table 37: Regression analysis by Sector/Year – Entry and Exit

	LP	TFP	TFP ACF		
	CV	CV	CV	IQR	Growth
Panel A: Entry					
$Entry_{t-1}$	0.0074	0.0001	0.1232	0.0001	0.0005**
	(0.0062)	(0.0001)	(0.0757)	(0.0003)	(0.0003)
$Entry_{t-2}$	-0.0061	-0.0000	0.0777	0.0002	0.0002
	(0.0065)	(0.0001)	(0.0797)	(0.0002)	(0.0002)
N	4732	3561	4731	4732	4732
Panel B: Exit					
$Exit_{t-1}$	-0.0066	-0.0006	0.1808	0.0001	0.0011***
	(0.0076)	(0.0007)	(0.1243)	(0.0003)	(0.0004)
$Exit_{t-2}$					0.0002
					(0.0003)
N	5096	3834	5095	5096	4732

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. 'LP' stands for Labour Productivity. 'CV' stands for coefficient of variation. Source: authors' calculations based on QP and SCIE datasets.

Table 38: Entry flows - regression analysis by sector/year

	LP	TFP	TFP ACF		
	CV	CV	CV	IQR	Growth
Panel A: Labour market flexibility (Flex)					
$High_{t-1}$	0.0065	0.0002	0.1232	0.0000	0.0005
	(0.0099)	(0.0002)	(0.1574)	(0.0006)	(0.0005)
$High_{t-2}$	-0.0172	-0.0002	0.1459	0.0002	0.0001
	(0.0173)	(0.0004)	(0.1188)	(0.0003)	(0.0003)
Low_{t-1}	0.0081	0.0001	0.1222*	0.0001	0.0006**
	(0.0074)	(0.0001)	(0.0689)	(0.0002)	(0.0002)
Low_{t-2}	-0.0001	0.0000	0.0408	0.0002	0.0002
	(0.0024)	(0.0001)	(0.0832)	(0.0002)	(0.0002)
N	4732	3561	4731	4732	4732
Panel B: Market concentration (HHI)					
$High_{t-1}$	0.0160	0.0002	0.1053	0.0000	0.0009**
	(0.0126)	(0.0002)	(0.0948)	(0.0005)	(0.0004)
$High_{t-2}$	-0.0091	-0.0001	0.1101	0.0002	0.0000
	(0.0120)	(0.0002)	(0.0749)	(0.0003)	(0.0003)
Low_{t-1}	-0.0015	0.0001	0.1368	0.0002	0.0002
	(0.0018)	(0.0001)	(0.0980)	(0.0002)	(0.0001)
Low_{t-2}	-0.0036	0.0000	0.0436	0.0002*	0.0003
	(0.0029)	(0.0001)	(0.1114)	(0.0001)	(0.0002)
N	4732	3561	4731	4732	4732
Panel C: Financial Distressed Firms (FDF)					
$High_{t-1}$	0.0088	0.0006	0.1512	0.0013*	0.0010**
	(0.0387)	(0.0010)	(0.2646)	(0.0007)	(0.0005)
$High_{t-2}$	-0.0153	0.0024*	-0.0318	0.0010*	0.0001
	(0.0171)	(0.0014)	(0.4213)	(0.0006)	(0.0006)
Low_{t-1}	0.0077	0.0000	0.1238	-0.0000	0.0005*
	(0.0066)	(0.0001)	(0.0771)	(0.0003)	(0.0003)
Low_{t-2}	-0.0026	-0.0001	0.0627	0.0001	0.0001
	(0.0036)	(0.0001)	(0.0765)	(0.0001)	(0.0002)
N	4732	3561	4731	4732	4732

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. 'LP' stands for Labour Productivity. 'CV' stands for coefficient of variation. Source: authors' calculations based on QP and SCIE datasets.

Table 39: Exit flows - regression analysis by sector/year

	LP	TFP	TFP ACF		
	CV	CV	CV	IQR	Growth
Panel A: Labour market flexibility (Flex)					
$High_{t-1}$	-0.0173	-0.0016	0.4330	0.0001	0.0012**
	(0.0180)	(0.0019)	(0.2640)	(0.0005)	(0.0006)
$High_{t-2}$					-0.0004
					(0.0004)
Low_{t-1}	-0.0003	-0.0000	0.0324	0.0002	0.0011**
	(0.0030)	(0.0002)	(0.1081)	(0.0002)	(0.0004)
Low_{t-2}					0.0006**
					(0.0003)
N	5096	3834	5095	5096	4732
Panel B: Market concentration (HHI)					
$High_{t-1}$	-0.0087	-0.0010	0.3454**	-0.0001	0.0016***
	(0.0112)	(0.0011)	(0.1447)	(0.0004)	(0.0005)
$High_{t-2}$					-0.0003
					(0.0004)
Low_{t-1}	-0.0039	0.0000	-0.0235	0.0004*	0.0005**
	(0.0052)	(0.0002)	(0.1546)	(0.0003)	(0.0003)
Low_{t-2}					0.0009***
					(0.0002)
N	5096	3834	5095	5096	4732
Panel C: Financial Distressed Firms (FDF)					
$High_{t-1}$	-0.0323	-0.0025	0.2630	0.0016**	0.0022**
	(0.0294)	(0.0025)	(0.3521)	(0.0008)	(0.0009)
$High_{t-2}$					0.0007
					(0.0009)
Low_{t-1}	-0.0051	-0.0005	0.2173*	0.0001	0.0010***
	(0.0063)	(0.0005)	(0.1282)	(0.0002)	(0.0004)
Low_{t-2}					0.0001
					(0.0003)
N	5096	3834	5095	5096	4732

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. 'LP' stands for Labour Productivity. 'CV' stands for coefficient of variation. Source: authors' calculations based on QP and SCIE datasets.

Table 40: Regression analysis by Sector/Year – Entry and Exit. Each time period represents two years.

	Labour Productivity		TFP	
	Dispersion	Growth	Dispersion	Growth
		Panel A: Entry		
$Entry_{t-1}$	0.0001	0.0014*	0.0008	0.0013*
	(0.0010)	(0.0007)	(0.0007)	(0.0008)
$Entry_{t-2}$	-0.0029	0.0007	0.0030	0.0001
	(0.0039)	(0.0005)	(0.0025)	(0.0002)
N	1696	2322	1764	1764
		Panel B: Exit		
$Exit_{t-1}$	0.0029	0.0011	0.0005	0.0006***
	(0.0037)	(0.0009)	(0.0006)	(0.0002)
$Exit_{t-2}$		0.0001		0.0002
		(0.0007)		(0.0001)
N	2020	2322	2058	1764

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Source: authors' calculations based on QP and SCIE datasets.

Table 41: Entry flows - regression analysis by sector/year. Each time period represents two years.

	Labour Productivity		TFP	
	Dispersion	Growth	Dispersion	Growth
Panel A: Labour market flexibility (Flex)				
$High_{t-1}$	0.0007	0.0002	-0.0013	-0.0016
	(0.0033)	(0.0024)	(0.0017)	(0.0018)
$High_{t-2}$	-0.0009	0.0013*	-0.0015	-0.0007
	(0.0025)	(0.0007)	(0.0013)	(0.0009)
Low_{t-1}	0.0054	0.0017***	0.0006	0.0017
	(0.0097)	(0.0005)	(0.0006)	(0.0012)
Low_{t-2}	0.0070**	0.0005	-0.0000	0.0004
	(0.0033)	(0.0005)	(0.0003)	(0.0005)
N	1739	2322	1764	1764
Panel B: Market concentration (HHI)				
$High_{t-1}$	0.0017	0.0014	0.0009	0.0023
	(0.0049)	(0.0018)	(0.0009)	(0.0021)
$High_{t-2}$	0.0019	0.0017**	-0.0013	0.0001
	(0.0040)	(0.0008)	(0.0012)	(0.0004)
Low_{t-1}	0.0039	0.0012**	0.0002	0.0008***
	(0.0054)	(0.0006)	(0.0002)	(0.0003)
Low_{t-2}	0.0042	0.0002	0.0001	0.0001
	(0.0026)	(0.0004)	(0.0002)	(0.0002)
N	1739	2322	1764	1764
Panel C: Financial Distressed Firms (FDF)				
$High_{t-1}$	0.0190	-0.0016	0.0078	0.0054
	(0.0138)	(0.0033)	(0.0050)	(0.0047)
$High_{t-2}$	0.0189*	0.0020	0.0030*	0.0033
	(0.0111)	(0.0021)	(0.0018)	(0.0023)
Low_{t-1}	0.0017	0.0014*	0.0004	0.0012*
	(0.0035)	(0.0007)	(0.0003)	(0.0007)
Low_{t-2}	0.0022	0.0007	0.0002	0.0005
	(0.0023)	(0.0006)	(0.0002)	(0.0004)
N	1739	2322	1764	1764

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Source: authors' calculations based on QP and SCIE datasets.

Table 42: Exit flows - regression analysis by sector/year. Each time period represents two years.

	Labour Productivity		TFP	
	Dispersion	Growth	Dispersion	Growth
Panel A: Labour market flexibility (Flex)				
$High_{t-1}$	-0.0023	0.0009	-0.0007	-0.0029
	(0.0049)	(0.0016)	(0.0016)	(0.0039)
$High_{t-2}$		0.0026		0.0007
		(0.0018)		(0.0010)
Low_{t-1}	-0.0006	0.0011	0.0001	0.0008**
	(0.0107)	(0.0009)	(0.0002)	(0.0004)
Low_{t-2}		-0.0001		0.0002
		(0.0006)		(0.0001)
N	2073	2322	2058	1764
Panel B: Market concentration (HHI)				
$High_{t-1}$	-0.0065	0.0041**	0.0001	0.0007
	(0.0075)	(0.0017)	(0.0006)	(0.0007)
$High_{t-2}$		0.0026*		0.0008
		(0.0014)		(0.0008)
Low_{t-1}	0.0130	0.0007	0.0000	0.0006***
	(0.0118)	(0.0007)	(0.0002)	(0.0002)
Low_{t-2}		-0.0003		0.0001
		(0.0005)		(0.0001)
N	2073	2322	2058	1764
Panel C: Financial Distressed Firms (FDF)				
$High_{t-1}$	-0.0003	0.0080***	0.0029**	-0.0012
	(0.0123)	(0.0024)	(0.0014)	(0.0040)
$High_{t-2}$		0.0050*		0.0039*
		(0.0029)		(0.0020)
Low_{t-1}	-0.0078	0.0011	0.0000	0.0006***
	(0.0057)	(0.0009)	(0.0002)	(0.0002)
Low_{t-2}		0.0001		0.0001
		(0.0007)		(0.0001)
N	2073	2322	2058	1764

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Source: authors' calculations based on QP and SCIE datasets.

Table 43: Regression analysis by Sector/Year – Entry and Exit. Each time period represents three years.

	Labour Productivity		TFP	
	Dispersion	Growth	Dispersion	Growth
		Panel A: Entry		
$Entry_{t-1}$	0.0251	0.0017*	0.0011**	-0.0002
	(0.0185)	(0.0009)	(0.0005)	(0.0003)
$Entry_{t-2}$	0.0067	-0.0006	0.0036	-0.0026
	(0.0044)	(0.0009)	(0.0033)	(0.0023)
N	1153	1592	1211	1211
		Panel B: Exit		
$Exit_{t-1}$	0.0284	0.0021*	0.0005	0.0003
	(0.0224)	(0.0011)	(0.0006)	(0.0003)
$Exit_{t-2}$		0.0005		0.0005
		(0.0007)		(0.0006)
N	1489	1592	1516	1211

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Source: authors' calculations based on QP and SCIE datasets.

Table 44: Entry flows - regression analysis by sector/year. Each time period represents three years.

	Labour Productivity		TFP	
	Dispersion	Growth	Dispersion	Growth
Panel A: Labour market flexibility (Flex)				
$High_{t-1}$	0.0392	0.0023	-0.0000	0.0061*
	(0.0242)	(0.0052)	(0.0023)	(0.0033)
$High_{t-2}$	0.0066	-0.0031	0.0162	-0.0131
	(0.0079)	(0.0024)	(0.0137)	(0.0085)
Low_{t-1}	0.0243	0.0017***	0.0011**	-0.0004
	(0.0191)	(0.0006)	(0.0005)	(0.0003)
Low_{t-2}	0.0055	0.0001	0.0020	-0.0014*
	(0.0044)	(0.0006)	(0.0012)	(0.0008)
N	1153	1592	1211	1211
Panel B: Market concentration (HHI)				
$High_{t-1}$	0.0052	0.0021	0.0007	0.0007
	(0.0071)	(0.0018)	(0.0006)	(0.0008)
$High_{t-2}$	0.0083	-0.0004	0.0075	-0.0055
	(0.0075)	(0.0018)	(0.0071)	(0.0049)
Low_{t-1}	0.0476***	0.0014**	0.0007**	-0.0002
	(0.0136)	(0.0006)	(0.0003)	(0.0003)
Low_{t-2}	0.0060	-0.0007	0.0011*	-0.0008*
	(0.0051)	(0.0005)	(0.0006)	(0.0004)
N	1153	1592	1211	1211
Panel C: Financial Distressed Firms (FDF)				
$High_{t-1}$	0.0272	0.0033	0.0055	-0.0016
	(0.0230)	(0.0029)	(0.0045)	(0.0023)
$High_{t-2}$	-0.0038	-0.0007	0.0025	0.0003
	(0.0168)	(0.0021)	(0.0020)	(0.0008)
Low_{t-1}	0.0250	0.0014	0.0003	0.0000
	(0.0188)	(0.0010)	(0.0005)	(0.0005)
Low_{t-2}	0.0072	-0.0005	0.0038	-0.0031
	(0.0046)	(0.0009)	(0.0035)	(0.0027)
N	1153	1592	1211	1211

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Source: authors' calculations based on QP and SCIE datasets.

Table 45: Exit flows - regression analysis by sector/year. Each time period represents there years.

	Labour Productivity		TFP	
	Dispersion	Growth	Dispersion	Growth
Panel A: Labour market flexibility (Flex)				
$High_{t-1}$	0.0228	0.0056	0.0081	0.0004
	(0.0168)	(0.0053)	(0.0060)	(0.0021)
$High_{t-2}$		-0.0002		0.0081
		(0.0035)		(0.0071)
Low_{t-1}	0.0298	0.0020*	0.0002	0.0002
	(0.0246)	(0.0011)	(0.0004)	(0.0002)
Low_{t-2}		0.0005		0.0002
		(0.0006)		(0.0004)
N	1489	1592	1516	1211
Panel B: Market concentration (HHI)				
$High_{t-1}$	-0.0056	0.0064***	0.0025	0.0008
	(0.0113)	(0.0024)	(0.0028)	(0.0008)
$High_{t-2}$		0.0034		0.0033
		(0.0030)		(0.0035)
Low_{t-1}	0.0582***	0.0014**	0.0002	0.0002
	(0.0183)	(0.0007)	(0.0004)	(0.0002)
Low_{t-2}		0.0001		0.0001
		(0.0004)		(0.0002)
N	1489	1592	1516	1211
Panel C: Financial Distressed Firms (FDF)				
$High_{t-1}$	0.0192	0.0024	0.0009	0.0001
	(0.0217)	(0.0017)	(0.0013)	(0.0004)
$High_{t-2}$		0.0004		0.0005
		(0.0007)		(0.0006)
Low_{t-1}	0.0296	0.0013	-0.0004	0.0007
	(0.0230)	(0.0014)	(0.0011)	(0.0016)
Low_{t-2}		0.0006		0.0004
		(0.0012)		(0.0009)
N	1489	1592	1516	1211

Notes: Clustered standard errors at the sector level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Source: authors' calculations based on QP and SCIE datasets.

C

Appendix to Chapter 5

Table 46: New hires: results by macro sector – France

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Manufacturing				Services			
	OLS	Worker FE	Firm FE	2-way FE	OLS	Worker FE	Firm FE	2-way FE
Young firm	0.0210***	0.0155***	0.0137***	0.0101	0.0010**	0.0009	0.0026***	-0.0006
	(0.0010)	(0.0018)	(0.0024)	(0.0068)	(0.0005)	(0.0006)	(0.0008)	(0.0014)
Firm size	0.0313***	0.0183***	0.0086***	0.0018	0.0079***	0.0068***	0.0013***	0.0017***
	(0.0002)	(0.0006)	(0.0015)	(0.0030)	(0.0001)	(0.0001)	(0.0003)	(0.0005)
Age	0.0173***	0.0580***	0.0191***	0.0624***	0.0125***	0.0524***	0.0111***	0.0488***
	(0.0003)	(0.0010)	(0.0003)	(0.0013)	(0.0001)	(0.0003)	(0.0001)	(0.0004)
Age^2	-0.0001***	-0.0004***	-0.0001***	-0.0004***	-0.0001***	-0.0003***	-0.0001***	-0.0003***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Experience		-0.0020***	-0.0022***			0.0012***		0.0005***
		(0.0000)	(0.0001)			(0.0000)		(0.0001)
Female		-0.115***		-0.111***		-0.0670***		-0.0608***
		(0.0011)		(0.0012)		(0.0004)		(0.0004)
Foreigner		-0.0052***		-0.0072***		-0.0104***		-0.0148***
		(0.0015)		(0.0016)		(0.0005)		(0.0006)
DROM		-0.0277***		-0.0318***		-0.0050***		-0.0181***
		(0.0048)		(0.0051)		(0.0014)		(0.0015)
N	354859	354859	312521	72623	2028208	2028208	1784688	915116
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes	No	No	Yes	Yes

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. Experience stands for total labour market experience. FE stands for fixed-effects.

Source: Authors' calculations based on DADS, FARE.

Table 47: New hires: results by macro sector – Portugal

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Manufacturing				Services			
	OLS	Worker FE	Firm FE	2-way FE	OLS	Worker FE	Firm FE	2-way FE
Young firm	0.0085	0.0052*	-0.0001	0.0017	0.0169***	0.0112***	0.0020	-0.0062*
	(0.0058)	(0.0029)	(0.0056)	(0.0046)	(0.0044)	(0.0022)	(0.0054)	(0.0035)
Firm size	0.0369***	0.0211***	0.0125**	0.0277***	0.0093***	0.0089***	0.0001	0.0132***
	(0.0033)	(0.0011)	(0.0057)	(0.0049)	(0.0026)	(0.0016)	(0.0036)	(0.0025)
Female	-0.1201***		-0.0921***		-0.0664***		-0.0487***	
	(0.0028)		(0.0021)		(0.0029)		(0.0019)	
Foreign	-0.0352***		-0.0084**		-0.0088**		-0.0013	
	(0.0068)		(0.0037)		(0.0035)		(0.0020)	
Part-time	0.0154*	0.0415***	0.0404***	0.0490***	-0.0198***	0.0205***	-0.0050	0.0230***
	(0.0082)	(0.0069)	(0.0086)	(0.0061)	(0.0069)	(0.0034)	(0.0050)	(0.0029)
Log(Age)	0.2015***	0.7988***	0.1682***	0.6671***	0.1005***	0.8541***	0.0890***	0.6532***
	(0.0063)	(0.0303)	(0.0039)	(0.0301)	(0.0062)	(0.0305)	(0.0051)	(0.0213)
Experience	0.0032***		0.0036***		0.0059***		0.0047***	
	(0.0002)		(0.0001)		(0.0003)		(0.0002)	
N	410068	410068	410068	410068	2549548	2549548	2549548	2549548
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Experience stands for total labour market experience. FE stands for fixed-effects.

Source: Authors' calculations based on Quadros de Pessoal.

Table 48: Gender wage gaps in young firms, by macro sector – France

	(1)	(2)	(3)	(4)	(5)	(6)
	Manufacturing			Services		
	Worker FE	Firm FE	2-way FE	Worker FE	Firm FE	2-way FE
Young firm	0.0152***	0.0153***	0.0103***	0.0004	0.0004	0.0033***
	(0.0008)	(0.0008)	(0.0007)	(0.0004)	(0.0004)	(0.0004)
Female		-0.125***			-0.0756***	
		(0.0004)			(0.0002)	
F. × Y.F.	-0.0018	-0.0053***	-0.0031***	0.0030***	0.0051***	-0.0004
	(0.0013)	(0.0011)	(0.0011)	(0.0005)	(0.0005)	(0.0005)
Firm size	0.0174***	0.0040***	0.0063***	0.0057***	0.0012***	-0.0001
	(0.0003)	(0.0004)	(0.0003)	(0.0001)	(0.0001)	(0.0001)
N	2827834	2805196	2679467	10893720	10742420	10357319
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	Yes	No	Yes	Yes	No	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. F. × Y.F. stands for the interaction between Female and Young firm. FE stands for fixed-effects.

Source: Authors' calculations based on DADS, FARE.

Table 49: Gender wage gaps in young firms, by macro sector – Portugal

	(1)	(2)	(3)	(4)	(5)	(6)
	Manufacturing			Services		
	Worker FE	Firm FE	2-way FE	Worker FE	Firm FE	2-way FE
Young firm	0.0043*	-0.0078**	0.0014	0.0054***	-0.0116***	-0.0071***
	(0.0023)	(0.0031)	(0.0027)	(0.0019)	(0.0030)	(0.0025)
Female	0.0000	-0.1354***	0.0000	0.0000	-0.0744***	0.0000
	(.)	(0.0021)	(0.0000)	(0.0000)	(0.0022)	(0.0000)
F. × Y.F.	0.0076***	0.0260***	0.0070***	0.0059***	0.0198***	0.0099***
	(0.0021)	(0.0027)	(0.0021)	(0.0016)	(0.0028)	(0.0016)
Firm size	0.0285***	0.0331***	0.0453***	0.0136***	0.0234***	0.0332***
	(0.0009)	(0.0025)	(0.0020)	(0.0013)	(0.0026)	(0.0024)
N	4945753	4945753	4945753	11969723	11969723	11969723
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	Yes	No	Yes	Yes	No	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. F. × Y.F. stands for the interaction between Female and Young firm. FE stands for fixed-effects.

Source: Authors' calculations based on Quadros de Pessoal.

Table 50: Foreigners wage gaps in young firms, by macro sector – France

	(1)	(2)	(3)	(4)	(5)	(6)
	Manufacturing			Services		
	Worker FE	Firm FE	2-way FE	Worker FE	Firm FE	2-way FE
Young firm	0.0146***	0.0140***	0.0091***	0.0025***	0.0029***	0.0031***
	(0.0007)	(0.0008)	(0.0006)	(0.0003)	(0.0003)	(0.0003)
Foreigner	0.0001	-0.0037**	0.0034*	-0.0048***	-0.0016**	-0.0006
	(0.0023)	(0.0017)	(0.0018)	(0.0007)	(0.0006)	(0.0006)
F. × Y.F.	0.0092	-0.0032	0.0076	0.0020	0.0014	0.0015
	(0.0081)	(0.0064)	(0.0070)	(0.0022)	(0.0018)	(0.0019)
Firm size	0.0174***	0.0040***	0.0063***	0.0057***	0.0012***	-0.0001
	(0.0003)	(0.0004)	(0.0003)	(0.0001)	(0.0001)	(0.0001)
N	2827834	2805196	2679467	10893720	10742420	10357319
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	Yes	No	Yes	Yes	No	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. F. × Y.F. stands for the interaction between Foreign and Young firm. FE stands for fixed-effects.

Source: Authors' calculations based on DADS, FARE.

Table 51: Foreigners wage gaps in young firms, by macro sector – Portugal

	(1)	(2)	(3)	(4)	(5)	(6)
	Manufacturing			Services		
	Worker FE	Firm FE	2-way FE	Worker FE	Firm FE	2-way FE
Young firm	0.0082***	0.0039	0.0047**	0.0087***	-0.0014	-0.0017
	(0.0017)	(0.0025)	(0.0022)	(0.0015)	(0.0026)	(0.0022)
Foreign	0.0000	0.0045	0.0000	0.0000	0.0106***	0.0000
	(.)	(0.0049)	(0.0000)	(0.0000)	(0.0034)	(0.0000)
F. × Y.F.	-0.0179***	0.0152**	0.0015	-0.0053**	-0.0080**	-0.0082***
	(0.0050)	(0.0074)	(0.0043)	(0.0025)	(0.0036)	(0.0019)
Firm size	0.0286***	0.0333***	0.0453***	0.0136***	0.0235***	0.0333***
	(0.0009)	(0.0025)	(0.0020)	(0.0013)	(0.0026)	(0.0024)
N	4945753	4945753	4945753	11969723	11969723	11969723
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	Yes	No	Yes	Yes	No	Yes
Firm FE	No	Yes	Yes	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. F. × Y.F. stands for the interaction between Foreign and Young firm. FE stands for fixed-effects.

Source: Authors' calculations based on Quadros de Pessoal.

Table 52: Job security: Full results, stepwise inclusion of controls – France

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS					Panel			
Young firm	0.0271***	0.0286***	0.0162***	0.0138***	-0.0612***	-0.0097***	-0.0404***	-0.0005	-0.0258***
	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Firm size		0.0114***	0.0093***	0.0082***	0.0017***	0.0057***	0.0061***	0.0009***	-0.0062***
		(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Age			-0.0620***	-0.0498***	-0.0305***	-0.0487***	-0.0389***	-0.0384***	-0.0278***
			(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Age^2			0.0007***	0.0005***	0.0003***	0.0005***	0.0004***	0.0004***	0.0003***
			(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Female			-0.0456***	-0.0520***	-0.0158***			-0.0018***	-0.0009***
			(0.0003)	(0.0003)	(0.0002)			(0.0002)	(0.0002)
Foreigner			-0.0107***	0.0113***	-0.0045***			0.0328***	0.0140***
			(0.0004)	(0.0004)	(0.0003)			(0.0003)	(0.0003)
DROM			0.0139***	0.0160***	-0.0060***			0.0192***	0.0044***
			(0.0014)	(0.0012)	(0.0009)			(0.0008)	(0.0008)
Experience					-0.0020***			-0.0014***	
					(0.0000)			(0.0000)	
Tenure					-0.0345***		-0.0250***		-0.0311***
					(0.0000)		(0.0001)		(0.0000)
$Tenure^2$					0.0010***		0.0008***		0.0009***
					(0.0000)		(0.0000)		(0.0000)
Industry FE	No	Yes	Yes	Yes	Yes	Yes	Yes	N.A.	Yes
Occupation FE	No	No	No	Yes	Yes	Yes	N.A.	Yes	N.A.
Full controls	No	No	No	No	Yes	No	Yes	No	Yes
Worker FE	No	No	No	No	No	Yes	Yes	No	No
Firm FE	No	No	No	No	No	No	No	Yes	Yes
N	13746241	13500703	13500703	13498184	13498184	13498184	13498184	13305982	13305982

Notes: robust standard errors in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Unreported robustness checks for all specifications qualitatively confirm the main insights when standard errors are robust or clustered. 'N.A.' stands for not applicable. Experience stands for total labour market experience.
Source: Authors' calculations based on DADS, FARE.

Table 53: Job security: Full results, stepwise inclusion of controls – Portugal

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Young firm	0.1271***	0.1175***	0.1572***	0.1362***	0.1131***	0.1085***	0.1043***	-0.0680***	-0.0707***
	(0.0070)	(0.0051)	(0.0042)	(0.0037)	(0.0036)	(0.0036)	(0.0033)	(0.0034)	(0.0038)
Log(N workers)			0.0174***	0.0124***	0.0048*	0.0052**	0.0039	0.0062***	0.0063***
			(0.0047)	(0.0027)	(0.0026)	(0.0026)	(0.0025)	(0.0019)	(0.0020)
Log(Age)					-0.3651***	-0.3805***	-0.3280***	-0.0241***	-0.0509***
					(0.0075)	(0.0072)	(0.0061)	(0.0039)	(0.0050)
Female						-0.0036	-0.0005	0.0038**	-0.0028
						(0.0044)	(0.0025)	(0.0017)	(0.0036)
Foreign						0.1496***	0.1287***	0.0631***	0.0696***
						(0.0058)	(0.0044)	(0.0035)	(0.0046)
Log(Years of education)						-0.0310***	0.0420***	-0.0007	-0.0336***
						(0.0057)	(0.0037)	(0.0033)	(0.0055)
Part-time							0.1026***	0.0325***	
							(0.0148)	(0.0118)	
Experience								-0.0055***	-0.0056***
								(0.0002)	(0.0002)
Tenure								-0.0700***	-0.0715***
								(0.0007)	(0.0007)
Tenure^2								0.0019***	0.0019***
								(0.0000)	(0.0000)
Industry FE	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Occupation FE	No	No	No	No	No	No	Yes	Yes	No
N	23624001	23624001	23624001	23624001	23624001	23624001	23624001	23624001	23624001
R squared	0.01	0.05	0.02	0.06	0.10	0.11	0.14	0.32	0.31

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. Experience stands for total labour market experience.

Source: Authors' calculations based on Quadros de Pessoal.

Table 54: Job quality on young firms - Foreigners (OECD countries)

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	Worker FE	Firm FE	2-way FE
Young firm	-0.1194***	0.0229***	0.0081***	-0.0007	0.0021
	(0.0061)	(0.0032)	(0.0011)	(0.0017)	(0.0015)
Foreign	0.3609***	0.1896***	0.0000	0.1403***	0.0000
	(0.0622)	(0.0329)	(.)	(0.0105)	(0.0000)
Foreign X Young firm	0.0208	-0.0180	0.0171	-0.0514***	-0.0185***
	(0.0667)	(0.0367)	(0.0107)	(0.0127)	(0.0059)
Female		-0.1174***		-0.0881***	
		(0.0023)		(0.0014)	
Log(Age)		0.1863***	1.0310***	0.1693***	0.8683***
		(0.0040)	(0.0163)	(0.0036)	(0.0136)
Firm size		0.0369***	0.0181***	0.0263***	0.0332***
		(0.0029)	(0.0012)	(0.0017)	(0.0014)
Log(Years of education)		0.2408***	0.0311***	0.1695***	0.0199***
		(0.0039)	(0.0016)	(0.0026)	(0.0011)
Part-time		-0.0117*	0.0360***	0.0210***	0.0456***
		(0.0061)	(0.0031)	(0.0057)	(0.0027)
Experience		0.0052***	0.0005***	0.0039***	0.0009***
		(0.0002)	(0.0002)	(0.0001)	(0.0002)
Tenure		0.0126***	0.0069***	0.0121***	0.0075***
		(0.0006)	(0.0002)	(0.0003)	(0.0002)
Tenure^2		-0.0003***	-0.0002***	-0.0002***	-0.0002***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
N	23624001	23624001	23624001	23624001	23624001
Controls	No	Yes	Yes	Yes	Yes
Worker FE	No	No	Yes	No	Yes
Firm FE	No	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects. Experience stands for total labour market experience.

Source: Authors' calculations based on Quadros de Pessoal.

Table 55: Job quality on young firms - Foreigners (European Union countries)

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	Worker FE	Firm FE	2-way FE
Young firm	-0.1192***	0.0231***	0.0081***	-0.0009	0.0020
	(0.0062)	(0.0032)	(0.0011)	(0.0017)	(0.0015)
Foreign	0.1096***	0.0954***	0.0000	0.0789***	0.0000
	(0.0197)	(0.0145)	(0.0000)	(0.0061)	(0.0000)
Foreign X Young firm	0.0341	-0.0074	0.0079	-0.0183**	-0.0053
	(0.0225)	(0.0166)	(0.0066)	(0.0076)	(0.0038)
Female		-0.1176***		-0.0883***	
		(0.0023)		(0.0014)	
Log(Age)		0.1876***	1.0310***	0.1699***	0.8682***
		(0.0040)	(0.0163)	(0.0036)	(0.0136)
Firm size		0.0370***	0.0181***	0.0265***	0.0332***
		(0.0029)	(0.0012)	(0.0017)	(0.0014)
Log(Years of education)		0.2411***	0.0311***	0.1696***	0.0199***
		(0.0039)	(0.0016)	(0.0026)	(0.0011)
Part-time		-0.0116*	0.0360***	0.0210***	0.0456***
		(0.0061)	(0.0031)	(0.0057)	(0.0027)
Experience		0.0052***	0.0005***	0.0039***	0.0009***
		(0.0002)	(0.0002)	(0.0001)	(0.0002)
Tenure		0.0126***	0.0069***	0.0121***	0.0075***
		(0.0006)	(0.0002)	(0.0003)	(0.0002)
Tenure^2		-0.0003***	-0.0002***	-0.0002***	-0.0002***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
N	23624001	23624001	23624001	23624001	23624001
Controls	No	Yes	Yes	Yes	Yes
Worker FE	No	No	Yes	No	Yes
Firm FE	No	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects. Experience stands for total labour market experience.

Source: Authors' calculations based on Quadros de Pessoal.

Table 56: Job quality on young firms - Foreigners (Euro Zone countries)

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	Worker FE	Firm FE	2-way FE
Young firm	-0.1190***	0.0229***	0.0081***	-0.0009	0.0021
	(0.0061)	(0.0032)	(0.0011)	(0.0017)	(0.0015)
Foreign	0.3325***	0.1768***	0.0000	0.1410***	0.0000
	(0.0696)	(0.0373)	(.)	(0.0118)	(0.0000)
Foreign X Young firm	0.0361	-0.0062	0.0205	-0.0395***	-0.0229***
	(0.0722)	(0.0419)	(0.0129)	(0.0151)	(0.0055)
Female		-0.1174***		-0.0881***	
		(0.0023)		(0.0014)	
Log(Age)		0.1871***	1.0310***	0.1696***	0.8682***
		(0.0040)	(0.0163)	(0.0036)	(0.0136)
Firm size		0.0370***	0.0181***	0.0263***	0.0332***
		(0.0029)	(0.0012)	(0.0017)	(0.0014)
Log(Years of education)		0.2411***	0.0311***	0.1696***	0.0199***
		(0.0039)	(0.0016)	(0.0026)	(0.0011)
Part-time		-0.0117*	0.0360***	0.0210***	0.0456***
		(0.0061)	(0.0031)	(0.0057)	(0.0027)
Experience		0.0052***	0.0005***	0.0039***	0.0009***
		(0.0002)	(0.0002)	(0.0001)	(0.0002)
Tenure		0.0126***	0.0069***	0.0121***	0.0075***
		(0.0006)	(0.0002)	(0.0003)	(0.0002)
Tenure^2		-0.0003***	-0.0002***	-0.0002***	-0.0002***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
N	23624001	23624001	23624001	23624001	23624001
Controls	No	Yes	Yes	Yes	Yes
Worker FE	No	No	Yes	No	Yes
Firm FE	No	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects. Experience stands for total labour market experience.

Source: Authors' calculations based on Quadros de Pessoal.

Table 57: Job quality on young firms - Foreigners (Developed countries)

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	Worker FE	Firm FE	2-way FE
Young firm	-0.1194***	0.0231***	0.0081***	-0.0008	0.0020
	(0.0061)	(0.0032)	(0.0011)	(0.0017)	(0.0015)
Foreign	0.1494***	0.1116***	0.0000	0.0863***	0.0000
	(0.0230)	(0.0155)	(.)	(0.0062)	(0.0000)
Foreign X Young firm	0.0265	-0.0153	0.0095	-0.0253***	-0.0031
	(0.0285)	(0.0179)	(0.0065)	(0.0075)	(0.0040)
Female		-0.1176***		-0.0882***	
		(0.0023)		(0.0014)	
Log(Age)		0.1871***	1.0310***	0.1697***	0.8682***
		(0.0040)	(0.0163)	(0.0036)	(0.0136)
Firm size		0.0370***	0.0181***	0.0265***	0.0332***
		(0.0029)	(0.0012)	(0.0017)	(0.0014)
Log(Years of education)		0.2410***	0.0311***	0.1696***	0.0199***
		(0.0039)	(0.0016)	(0.0026)	(0.0011)
Part-time		-0.0116*	0.0360***	0.0210***	0.0456***
		(0.0061)	(0.0031)	(0.0057)	(0.0027)
Experience		0.0052***	0.0005***	0.0039***	0.0009***
		(0.0002)	(0.0002)	(0.0001)	(0.0002)
Tenure		0.0126***	0.0069***	0.0121***	0.0075***
		(0.0006)	(0.0002)	(0.0003)	(0.0002)
Tenure^2		-0.0003***	-0.0002***	-0.0002***	-0.0002***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
N	23624001	23624001	23624001	23624001	23624001
Controls	No	Yes	Yes	Yes	Yes
Worker FE	No	No	Yes	No	Yes
Firm FE	No	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects. Experience stands for total labour market experience.

Source: Authors' calculations based on Quadros de Pessoal.

Table 58: Job quality on young firms - Foreigners (Portuguese speaking countries)

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	Worker FE	Firm FE	2-way FE
Young firm	-0.1182***	0.0229***	0.0083***	-0.0011	0.0020
	(0.0062)	(0.0032)	(0.0011)	(0.0017)	(0.0015)
Foreign	-0.1969***	-0.0176***	0.0000	-0.0004	0.0000
	(0.0057)	(0.0036)	(.)	(0.0019)	(0.0000)
Foreign X Young firm	0.0681***	0.0108**	-0.0057***	0.0075***	-0.0020
	(0.0072)	(0.0048)	(0.0022)	(0.0029)	(0.0017)
Female		-0.1176***		-0.0882***	
		(0.0023)		(0.0014)	
Log(Age)		0.1888***	1.0310***	0.1706***	0.8682***
		(0.0041)	(0.0163)	(0.0036)	(0.0136)
Firm size		0.0371***	0.0181***	0.0266***	0.0332***
		(0.0029)	(0.0012)	(0.0016)	(0.0014)
Log(Years of education)		0.2416***	0.0311***	0.1700***	0.0199***
		(0.0039)	(0.0016)	(0.0026)	(0.0011)
Part-time		-0.0122**	0.0360***	0.0208***	0.0456***
		(0.0061)	(0.0031)	(0.0057)	(0.0027)
Experience		0.0050***	0.0005***	0.0038***	0.0009***
		(0.0002)	(0.0002)	(0.0001)	(0.0002)
Tenure		0.0126***	0.0069***	0.0121***	0.0076***
		(0.0006)	(0.0002)	(0.0003)	(0.0002)
Tenure^2		-0.0003***	-0.0002***	-0.0002***	-0.0002***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
N	23624001	23624001	23624001	23624001	23624001
Controls	No	Yes	Yes	Yes	Yes
Worker FE	No	No	Yes	No	Yes
Firm FE	No	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects. Experience stands for total labour market experience.

Source: Authors' calculations based on Quadros de Pessoal.

Table 59: Job Security: Share of Fixed-term Contracts during COVID-19

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	Worker FE	Firm FE	2-way FE
Young firm	0.1852***	-0.0498***	-0.0373***	-0.0085**	-0.0171***
	(0.0083)	(0.0064)	(0.0040)	(0.0040)	(0.0038)
After 2020	-0.0346***	-0.0210***	-0.0841***	-0.0170***	-0.0826***
	(0.0024)	(0.0020)	(0.0050)	(0.0021)	(0.0054)
Young firm × After 2020	0.0048	-0.0008	0.0141***	0.0139***	0.0228***
	(0.0054)	(0.0041)	(0.0029)	(0.0031)	(0.0032)
N	5480531	5305934	4490510	5269250	4460302
Controls	No	Yes	Yes	Yes	Yes
Worker FE	No	No	Yes	No	Yes
Firm FE	No	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%.

Source: Authors' calculations based on Quadros de Pessoal.

Table 60: Contract switches in young firms by macro sector – Portugal

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Manufacturing				Services			
	OLS	Worker FE	Firm FE	2-way FE	OLS	Worker FE	Firm FE	2-way FE
Young firm	0.0177**	0.0012	0.0120	0.0012	0.0067*	-0.0127	-0.0206	-0.0127
	(0.0088)	(0.0535)	(0.0540)	(0.0535)	(0.0038)	(0.0165)	(0.0165)	(0.0165)
After 2012	0.2025***	0.1782***	0.1957***	0.1782***	0.1632***	0.1114***	0.1552***	0.1114***
	(0.0115)	(0.0229)	(0.0131)	(0.0229)	(0.0070)	(0.0181)	(0.0071)	(0.0181)
Young firm X After 2012	-0.0374	-0.0261	-0.0455*	-0.0261	0.0267**	0.0203	0.0254**	0.0203
	(0.0240)	(0.0230)	(0.0245)	(0.0230)	(0.0126)	(0.0125)	(0.0127)	(0.0125)
N	77068	76298	77000	76298	168616	167684	168519	167684
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Worker FE	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes	No	No	Yes	Yes

Notes: clustered standard errors at worker and firm level in parentheses. Significance levels: *, 10%; **, 5%; ***, 1%. FE stands for fixed-effects.

Source: Authors' calculations based on Quadros de Pessoal.

Table 61: ISIC Rev.4 Codes, SNA A38 aggregation, and STAN A7 aggregation

ISIC Rev.4	**SNA A38 aggregation**	**STAN A7 aggregation**
01 to 03	Agriculture, Forestry and Fishing	Agriculture
05 to 09	Mining and quarrying	Mining
10 to 12	Food products, beverages and tobacco	Manufacturing
13 to 15	Textiles, wearing apparel, leather and related products	
16 to 18	Wood and paper products, and printing	
19	Coke and refined petroleum products	
20	Chemicals and chemical products	
21	Basic pharmaceutical products and pharmaceutical preparations	
22 to 23	Rubber and plastics products, and other non-metallic mineral products	
24 to 25	Basic metals and fabricated metal products, except machinery and equipment	
26	Computer, electronic and optical products	
27	Electrical equipment	
28	Machinery and equipment n.e.c.	
29 to 30	Transport equipment	
31 to 33	Furniture; other manufacturing; repair and installation of machinery and equipment	
35	Electricity, gas, steam and air conditioning supply	Utilities
36 to 39	Water supply, sewerage, waste management and remediation activities	
41 to 43	Construction	Construction
45 to 47	Wholesale and retail trade, repair of motor vehicles and motorcycles	Market Services
49 to 53	Transportation and storage	
55 to 56	Accommodation and food service activities	
58 to 60	Publishing, audiovisual and broadcasting activities	
61	Telecommunications	
62 to 63	IT and other information services	
64 to 66	Financial and Insurance activities	Finance and Insurance
68	Real Estate activities	Market Services (continued)
69 to 71	Legal and accounting activities; activities of head offices; management consultancy activities; architecture and engineering activities; technical testing and analysis	
72	Scientific research and development	
73 to 75	Advertising and market research; other professional, scientific and technical activities; veterinary activities	
77 to 82	Administrative and support service activities	
85	Education	Non Market Services
86 to 88	Human health and social work activities	
90 to 93	Arts, entertainment and recreation	
94 to 96	Other Service activities	

D

Appendix to Chapter 6

Table 62: Empirical variables of the probit and multinomial probit models

Variable	Variable name	Description
Size	*Size*	1 if a firm has less than 10 employees; a value of 2 if a firm has between 10 and 49 employees; a value of 3 if a firm has between 50 and 249 employees; and a value of 4 if a firm has 250 or more employees
	Turnover	Logarithm of operating revenue in millions of euros
Absorptive capability	*R&D*	1 if the firm had R&D spending, 0 otherwise
Knowledge capability	*WorkerEduc*	1 if employees average schooling years is up to 6 years, the value of 2 if employees average schooling years is between 7 and 9 years, the value of 3 if employees average schooling years is between 10 and 12 years, a value of 4 if employees schooling is more than 12 years
	ManagerEduc	1 if management team average schooling years is up to 6 years, the value of 2 if management team average schooling years is between 7 and 9 years, the value of 3 if management team average schooling years is between 10 and 12 years, a value of 4 if management team schooling is more than 12 years
Technology openness	*TechOpenness*	The ratio of intangible assets over total assets
Export	*Export*	The ratio of exports over operating revenue
Geographic proximity	*Region*	1 if firm is located in Norte, 2 if located in Centro, 2 if located in Lisboa, 4 if located in other Portugal NUTS2
Financial resources	*Solvency*	The liability-based solvency ratio
Industry	*Industry*	Categorical variable based on ISIC Rev. 3 Industry Classification
Time	*Year*	Categorical variable for time

Table 63: Summary statistics of the principal components variables, N = 41

Variable	Mean	SD	Min	Max
Motives to collaborate				
Cost sharing	1.561	1.266	0	3
Access to labs	2.024	1.172	0	3
Recruit human capital	2.121	0.980	0	3
Access to funding	1.512	0.978	0	3
Geographic proximity	1.780	1.084	0	3
Visibility	1.658	1.174	0	3
Social ties	2.341	0.855	0	3
Benefits from collaboration				
Improve knowledge	1.634	1.157	0	3
Knowledge source	1.732	1.119	0	3
Obtain patents	0.829	0.863	0	3
Problem solving	1.415	1.024	0	3
Recruit human capital	0.683	0.820	0	3
Training	1.244	1.261	0	3
Reduce costs	1.098	0.970	0	3
Time	1.073	0.985	0	3
Access to funding	1.122	0.954	0	3
Geographic proximity	1.122	1.030	0	3
Innovation	1.049	0.921	0	3
Increase sales	1.171	1.138	0	3
Barriers to collaboration				
Knowledge to theoretical	1.268	1.001	0	3
Knowledge too generic	1.122	0.954	0	3
Organizational differences	1.293	1.146	0	3
Cultural differences	0.805	0.980	0	3
Too costly	1.122	0.900	0	3
Weak appropriation	0.976	1.037	0	3
Overheads too high	1.122	1.053	0	3