

Treasure islands, real jobs?

The impact of reforming an EU low-tax jurisdiction*

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Abstract

In recent years, jurisdictions characterized by low/zero corporate tax rates have introduced economic substance requirements, which aim at ensuring that companies incorporated there maintain a minimum level of employment and real operations. These policies, advocated by entities like the OECD and EU institutions, seek to establish a fair playing field, free from uncompetitive tax avoidance practices. The impact of these policies is largely unexplored, in part due to data opacity. Focusing on a leading jurisdiction to set up employment requirements - Zona Franca da Madeira (ZFM) - this paper takes a first step in filling that gap. Originally approved by the EU as a State Aid program to stimulate regional development, the ZFM underwent a reform in 2012 that established substance requirements. For incumbent workers, we uncover evidence of an increased likelihood of part-time employment, a rise in the number of firms for which each worker simultaneously works, and an increase in overall wages larger than 10% after the introduction of employment requirements. For new employees who moved to ZFM after the reform, we find evidence that they may have been attracted by reduced workloads rather than higher monthly wages.

Keywords: substance requirements; low-tax jurisdictions; corporate tax avoidance; matched employer-employee data

JEL Codes: J08, H26, F23, J31, J38, J48, H30

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1 Introduction

In recent years, international tax avoidance activities of firms have received a great deal of attention. In the media, various leaks such as the Panama Papers, Paradise Papers, and Luxembourg Leaks have exposed the widespread use of low or no tax jurisdictions by a multitude of multinational firms. In the economics and accounting literatures, several studies have provided attempts to quantify this phenomenon, showing that its global proportion is far bigger than nearly anyone had imagined.¹ On the policy-making front, several international institutions, including the OECD and the EU, have been at the forefront of significant efforts to counter international tax avoidance and evasion.

In response to international initiatives to prevent harmful tax practices, and in order to avoid being deemed non-cooperative or harmful by entities such as the EU or the OECD, no/low-tax jurisdictions such as the Cayman Islands, the Bahamas, Barbados, or Bermuda, have recently introduced economic substance rules. These rules are designed to ensure that companies incorporated in these jurisdictions maintain a minimum level of economic substance, placing restrictions on entities with low economic substance operating there. For instance, one of the key requirements that firms must meet is having an adequate number of employees who are physically present in the jurisdiction. In a way, these policies, typically enacted from 2019 onwards, often require that what were before essentially mailboxes evolve into genuine headquarters, with real operations and jobs.

To our knowledge, the impact of policies introducing substance requirements is to date unexplored, likely because low-tax jurisdictions tend to be characterized by a high level of secrecy and low transparency, making data on their operations and workforce difficult to access. This paper is a first step to filling that gap.

We use a novel combination of administrative data sources and focus on a leading jurisdiction to set up economic substance requirements – *Zona Franca da Madeira* (ZFM), a low-tax area located in a Portuguese island (Madeira). The ZFM scheme was originally approved by the European Commission as a State Aid program to stimulate regional development and offset challenges associated with structural handicaps of the island, including its remoteness and small size, difficult topography and climate, and dependence on few economic sectors. Before 2012, the scheme was essentially used by thinly staffed multinational firms with large volumes of sales, benefiting both from a zero corporate income tax rate and from exemp-

¹For instance, Wier and Zucman (2022) document a remarkable increase in profit shifting to tax havens since 1975, with close to \$1 trillion of multinational profits registered in those locations in 2019, resulting in a global loss of 10% of corporate tax revenues.

tions from withholding taxes on the distribution of dividends and payments of royalties and interest. In 2012, while Portugal was in the middle of an economic adjustment program, most firms were forced to meet employment requirements to be able to continue to benefit from a reduced corporate tax rate, which was slightly increased to 4-5%. We study how firms reacted to this reform and its repercussions on incumbent workers. Simultaneously, we assess to what extent movers to the ZFM after the reform benefited from a wage premium in their transition. All of this is possible by the availability of an extremely rich linked employer-employee dataset covering the universe of workers in Portugal, merged, for the first time, with an exhaustive novel list with information for all firms in ZFM provided by the Portuguese office for national statistics.

We start our analysis by characterizing the firms located in ZFM, which are clearly distinct from those in the rest of Madeira and the rest of Portugal. Our descriptive statistics underscore that the ZFM regime was essentially used by multinational firms, with very few employees, and large sales. “Labour productivity” proxied by sales by employee was several orders of magnitude higher than for other firms in the rest of Portugal, including the rest of Madeira. In the year of the reform, several firms left ZFM, but the number of firms with at least one employee increased meaningfully from around 300 firms to around 600.

We then provide comprehensive descriptive evidence about the workers employed by ZFM firms. To our knowledge, this evidence offers, for the first time, a highly detailed picture of the labor market of a low-tax jurisdiction. We show that the workers in ZFM have distinct attributes when compared to those in the rest of Madeira and Portugal. They have a relatively high level of education and perform relatively specialized tasks. We also show that prior to the reform, the percentage of workers with part-time contracts was relatively low when compared to the rest of Portugal. However, following the reform, the share of part-time work experienced a substantial increase alongside an increase in the share of part-time workers with multiple jobs. On the wages of the workers employed in ZFM, the average remuneration stands out as high both before and after the reform, when compared to the remuneration of workers in the rest of Portugal. This wage gap is still present when we control for rich vectors of observable characteristics, both at the worker-, firm-, sector- and regional-levels. On average, over the sample period, we find a wage gap which is higher than 15%.

We then investigate formally the impact of the reform on incumbent workers, i.e., on workers of firms located in the ZFM before the reform. To identify causal effects on those workers, we first use a matching algorithm using pre-reform characteristics to find a suitable comparison

group in the rest of Portugal. We then implement an event-study differences-in-differences approach.

We find evidence consistent with an increased relative monthly wage following the reform, by more than 10%, on average, for incumbent workers that remained in the Portuguese labor market. Although these workers did not increase their monthly working hours, they started to be employed by more firms at the same time and concurrently experienced a significant increase in the probability of having at least one part-time contract. Taken together, these findings suggest that incumbents started to split their time across several firms, and benefited from a higher total wage. This division may have been a pragmatic strategy to meet the employment requirements as several firms in ZFM shared exactly the same address and/or owners. Conceptually, this premium may have resulted from a higher bargaining power of workers amid the employment requirements.

For workers that moved to ZFM after the reform, we find that the wage growth in the transition was not significantly different from that of other workers changing jobs between private firms in the rest of the Portuguese labour market. When employment requirements started to be more strictly monitored by the European Commission, we find evidence of a large influx of workers that benefited from a lower overall workload in the transition. These findings imply that ZFM firms might have attracted new employees to fulfill employment criteria by offering reduced workloads rather than higher monthly wages.

Our work contributes to the understanding of the impact of introducing substance requirements in zero/low-tax jurisdictions, so far unexplored in the empirical literature, to the best of our knowledge. By providing empirical evidence on how firms responded to those requirements and the repercussions on workers, our work also informs the discussion on how to best design them.

Leveraging on rich employer-employee data, our work also sheds new light on how labour markets operate in low-tax jurisdictions and on the link between international tax avoidance and employees' pay. To our knowledge, only two papers investigate explicitly the consequences of international corporate tax avoidance on individual wages using employer-employee data. Alstadsæter et al. (2022) show that profit-shifting firms in Norway pay higher wages, especially in the service sector. They also find significant within-firm heterogeneity with high-skill workers earning higher wage premiums. Souillard (2022) focus on US top executives and finds that those executives receive higher wages subsequent to their firm's entry into tax havens. These studies examine how international corporate tax avoidance ac-

tivities impact individual wages of workers located in high-tax countries. Differently, our analyses focuses on the workers employed in the other side of the tax avoidance strategies: the low-tax location.

More generally, we also expand upon the literature examining international corporate tax avoidance. We refer to Hines Jr (2010), Zucman (2014), Riedel (2018), Beer et al. (2020) for comprehensive surveys. A key focus of this literature has been the quantification of the amount of profits shifted to tax havens and of the amount of tax revenues that are drained from high-tax countries as a consequence (e.g. Bilicka, 2019, Tørsløv et al., 2022, Wier and Zucman, 2022). Another strand investigates instead the strategies used by multinational firms to shift profits (e.g. Buettner and Wamser, 2013, Cristea and Nguyen, 2016, Davies et al., 2018, Garcia, 2023). Our analysis is more closely related to the strand of this literature addressing the consequences of international corporate tax avoidance that go beyond its impact on tax revenues. Besides the previously mentioned contributions on the effect on wages on high-tax countries, this literature has addressed the consequences of international tax avoidance activities on investment, employment, innovation, industry concentration, and macroeconomic statistics (e.g. Suárez Serrato, 2018, Li et al., 2021, Martin et al., 2022, Guvenen et al., 2022). This literature is generally interested in the effects on high-tax countries, rather than on the low-tax locations, as in our analysis. One exception is Lafitte (2022) which shows that becoming a tax haven generates GDP per capita gains.

The remaining of the paper is organized as follows. Section 2 describes briefly the ZFM scheme. Section 3 presents the data sources and descriptive statistics on the labor market of the ZFM. Section 4 evaluates the impact of the reform on incumbent workers, while Section 5 examines the impact on movers to ZFM after the reform. Finally, Section 6 concludes.

2 The ZFM scheme: institutional background

Madeira is a Portuguese archipelago situated in the North Atlantic Ocean, which includes the islands of Madeira, Porto Santo, and the Desertas. Officially denominated as the Autonomous Region of Madeira (*Região Autónoma da Madeira* in Portuguese), the archipelago is an integral part of the European Union as an outermost region. According to the Portuguese census, in 2011 its population was equal to 267 394. In 2021, it was equal to 252 693.²

²Source: Statistics Portugal, resident population by region.

Since the late 1980's, the Madeira island offers a scheme – the ZFM scheme (*Zona Franca da Madeira* in Portuguese), which consists of a set of incentives, mainly of a tax nature, granted to licensed firms, which was implemented with the objective of attracting foreign investment and creating jobs in the region. Specifically, the ZFM scheme was designed to compensate the structural handicaps that firms face in an outermost region of Europe, including remoteness, insularity, small size, difficult topography and climate, and economic dependence on a few sectors.

Until the end of 2011, firms with licenses issued until 2000, benefited from an exemption from corporate income tax on the income derived from transactions with no residents, as well as exemption from withholding taxes on dividend remittances, capital gains, and on payments of royalties, interest, and services. According to the public list of firms located in ZFM in 2009, 98% of the firms had been licensed before 2000, and therefore were benefiting from those highly advantageous tax conditions.³

Such advantageous regime was fully authorized by the European Commission until the end of 2011. While local policymakers hoped that it would be renovated after that year, in May 2011 the Portuguese Government signed a Memorandum of Understanding with the Troika of European Commission, ECB, and IMF, starting an Economic Adjustment Programme, that prevented the negotiation of its extension.⁴ Multinational firms facing a 0% tax rate for several years had to choose between leaving the jurisdiction, facing a tax rate increase to around 20%, or facing a reduced corporate tax rate of 5% together with employment creation requirements. In particular, after the reform, the reduced tax rate became only applicable up to a ceiling placed upon the annual taxable income, which varies according to the number of employees of the firms, as detailed in Table 1.

Table 1: Job creation requirements after ZFM's reform in 2012

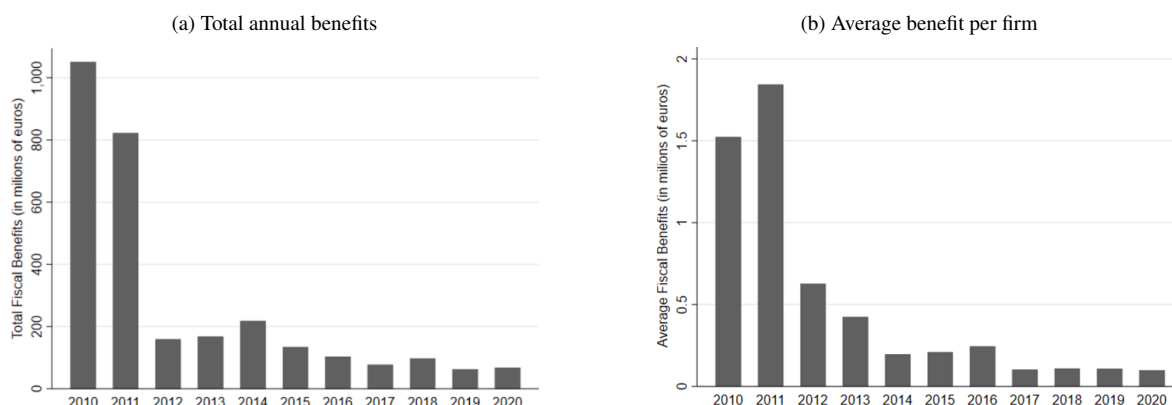
Jobs	Taxable Income Ceiling
1-2	2 000 000 €
3-5	2 600 000 €
6-30	16 000 000 €
31-50	26 000 000 €
51-100	40 000 000 €
>100	150 000 000 €

³The remaining firms, which obtained their licenses after that date, were subject to a positive yet low tax rate, of 3% or 4%, depending on the year of their license.

⁴The Memorandum of Understanding introduced a standstill rule to all tax benefits, blocking the creation of new items of tax benefits and the enlargement of existing items. The rule applied to all kinds of tax benefits, of a temporary or permanent nature, at the central, regional, or local level.

Before 2012, the fiscal benefits conceded in the ZFM regime were substantial (Figure 1). Official data publicly available from the Tax Authority shows that they exceeded 1 billion euros in 2010. These benefits declined sharply after the imposition of substance requirements in 2012.

Figure 1: Fiscal benefits granted to firms in ZFM



Source: Tax Authority. Notes: The annual series of the tax benefits associated with the ZFM are available at the website of the Tax Authority (https://info.portaldasfinancas.gov.pt/pt/dgci/divulgacao/Area_Beneficios_Fiscais). Only taxpayers who claimed annual tax benefits equal to or greater than €1000 are included in the list. The tax benefit is calculated using the revenue foregone method, i.e., it is based on a comparison between existing legislation and legislation without the tax break. It corresponds to a static analysis, as it assumes unchanged behaviour by economic agents and ignores possible interaction with other taxes. Thus, it may not represent an accurate estimate of the revenue generated if the tax benefit was eliminated.

3 The labour market in ZFM

3.1 Data

Our empirical analysis benefits from micro data provided by the Portuguese National Statistical Office (Statistics Portugal). The main database is *Quadros de Pessoal* (QP, Personnel Records), an administrative dataset covering employees and firms based in Portugal, including their unique and time-invariant identifiers and the firm-worker match. The QP is an annual mandatory employment survey conducted by the Ministry of Employment that includes all firms with at least one employee. Civil servants, self-employed, and household employees are not covered. For manufacturing and the services private sector of the economy, the survey covers virtually the entire population of workers and firms.

Information on the firms available in QP includes sector of activity, region, ownership type, and size (turnover and employment). Moreover, QP provides a large number of worker characteristics (gender, age, education, occupation, tenure) and detailed information on monthly wages. The reference month regarding employee data is October of each year.

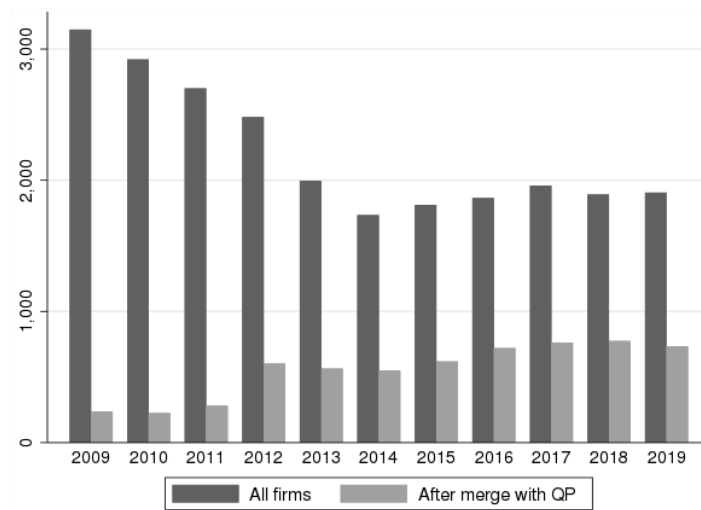
We merge QP with an exhaustive list of all firms operating in ZFM from 2009 to 2020, which was for the first time made available to researchers. This list is based on the registration of firms in the Institute of Registries and Notary (IRN).⁵ The list was merged with the QP database using a common anonymised firm identifier. We use the data until 2019 to avoid the pandemic period.

The unit of observation of QP in each year is at the match firm-worker level. For the worker-level analysis that we conduct, these data were aggregated to keep only one observation per worker in each year. Considering that some workers work in several firms, as detailed in descriptive statistics below, we sum the wages of the worker in the different firms and obtain an aggregate monthly wage.

3.2 Number of firms, workers and jobs

Figure 2 shows the number of firms included in the ZFM list, before and after the merge with QP. It is clear from the difference between the two series that the vast majority of firms registered in ZFM before the 2012 reform are not present in the QP records. Given that all firms with at least one employee had to fill the QP survey, this indicates that a large proportion of firms have zero employees. Even after the imposition of job requirements, more than half of the firms registered in ZFM do not appear in QP. These firms are naturally excluded from our analysis, which focuses on the impact of the reform on workers.

Figure 2: Number of firms in ZFM

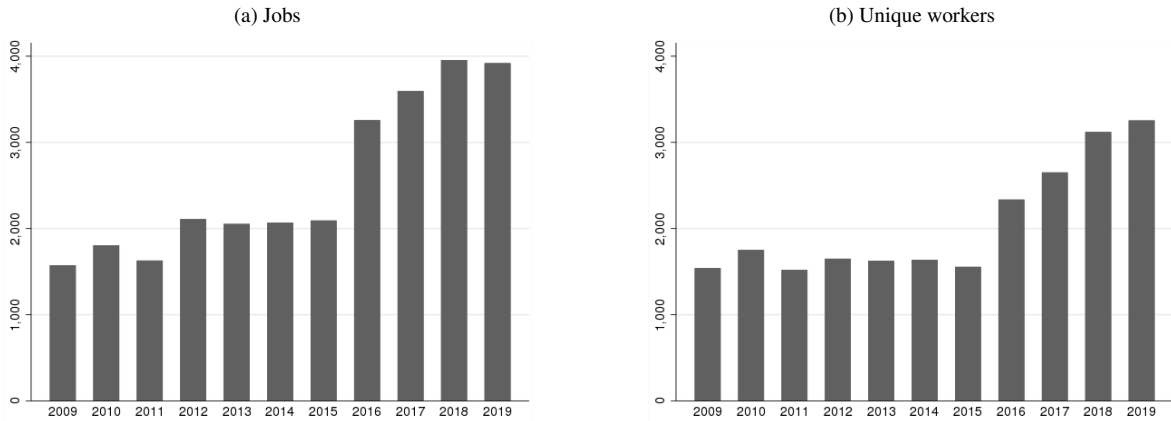


Considering only firms operating in ZFM that are included in the QP dataset, and thus have

⁵IRN is the government agency that provides nationwide civil identification, nationality, and passport services and also civil, land, vehicle, ship, commercial, and legal persons register services.

at least one employee, Figure 3 shows the number of jobs in panel (a) and unique workers in these firms, from 2009 to 2019, in panel (b). By comparing the two, one can see that the number of jobs is higher than the number of workers, especially after 2012, when the reform was implemented. In other words, some individuals employed in the ZFM work for more than one ZFM firm, especially after the reform.

Figure 3: Number of jobs and workers in ZFM

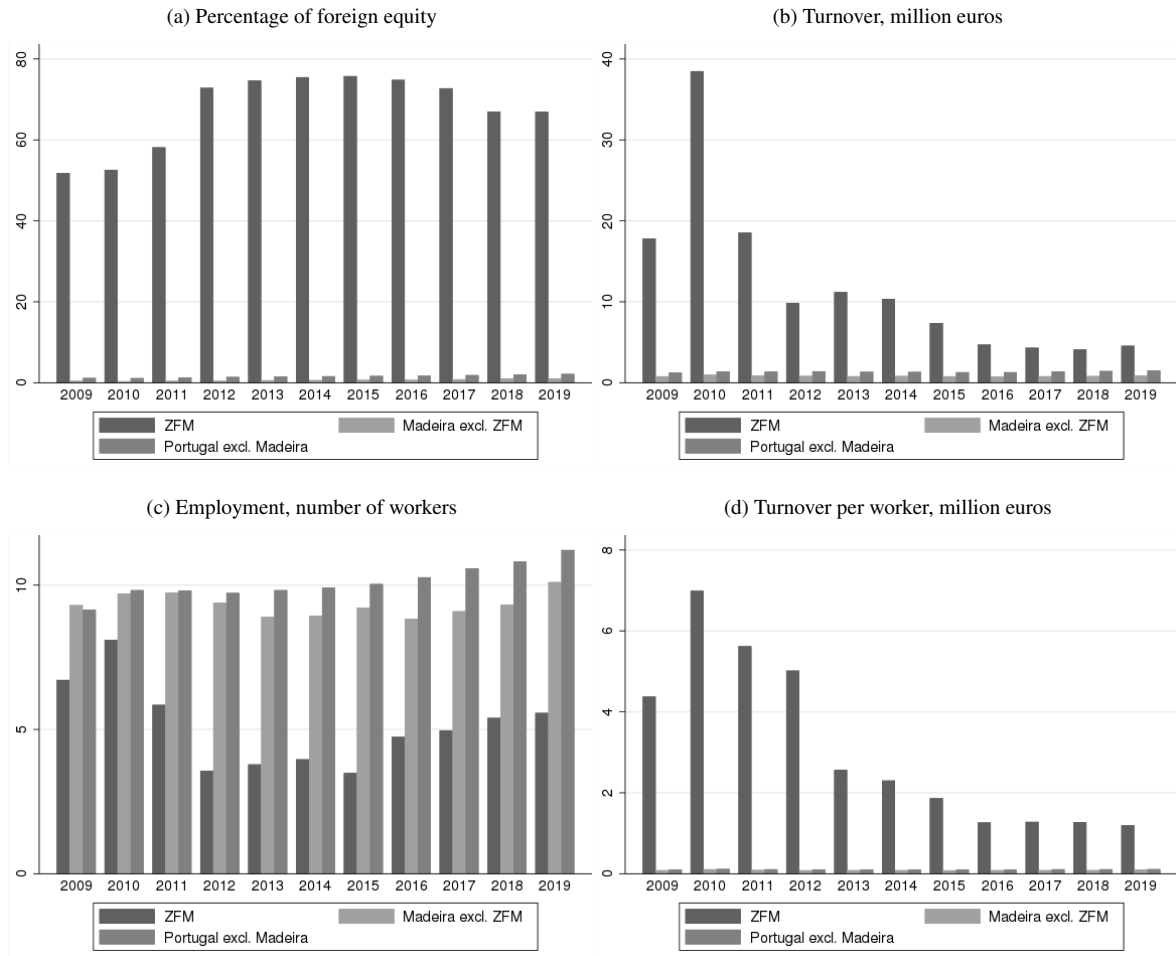


3.3 The specialness of ZFM's firms

Tables A.1 provides descriptive statistics for the sample of firms in ZFM, comparing their attributes to those of other firms located in Madeira excluding ZFM, and in the rest of Portugal (excluding Madeira) in the period 2009-2019. Figure 4 depicts the evolution of these variables over time.

There are important differences between ZFM and non-ZFM firms. The first important difference is the percentage of foreign capital. ZFM appears to be a preferential location for foreign (i.e. non-Portuguese) firms, with close to 80% of firms being 100% foreign-owned and an average percentage of foreign equity around 70%. Second, the average and median number of workers in firms that have at least one worker is lower in ZFM than in the rest of Madeira and in the rest of Portugal. On average, there are 5 workers in ZFM's firms, which compares with 9 workers in firms in the rest of Madeira and 10 workers in the rest of Portugal. While they have on average less workers, firms in ZFM show average levels of turnover that are more than 6 times higher than those of other firms in Portugal. As a result, the ratio of turnover per worker is abnormally large. The substantially larger average turnover in ZFM than in the rest of Madeira and Portugal is driven by firms with highest turnover, as the median is largely similar. The abnormal levels of turnover declined over time, even if still

Figure 4: Selected firms' characteristics over time



remaining several orders of magnitude above the country average.

The sectoral distribution of firms in ZFM is also distinct from that of non-ZFM firms. In terms of number of firms, the five main sectors of economic activity in ZFM are: activities of head offices, management consultancy activities, CAE 70 (24.5%); wholesale trade, CAE 46 (23.4%); legal and accounting activities, CAE 69 (10.8%); water transport, CAE 50 (7.2%); administrative and business support activities, CAE 82 (4.8%).⁶ Of these sectors, only one (wholesale trade) overlaps with the five most important activities both in the rest of Madeira and in the rest of the country excluding Madeira.

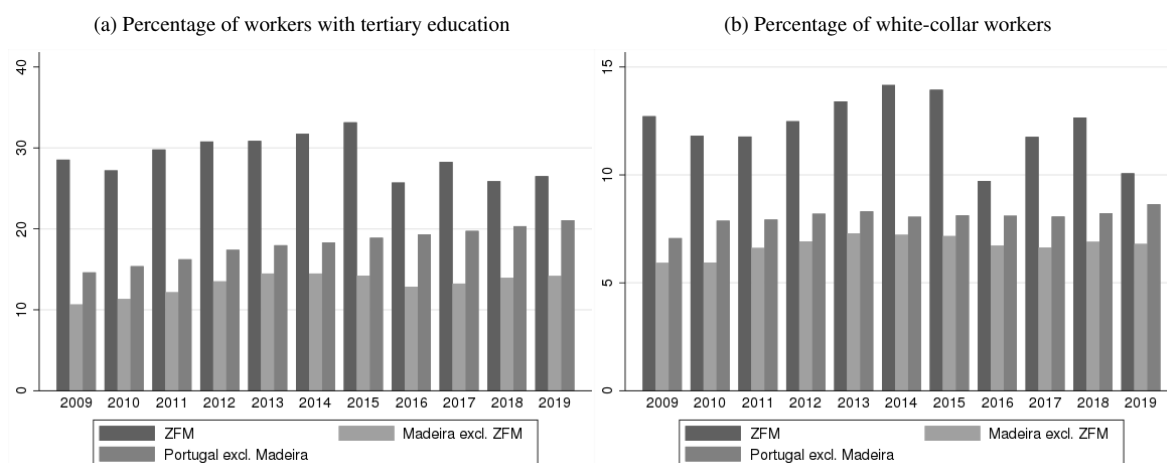
⁶CAE refers to the Portuguese industrial classification Revision 3 – *Classificação Portuguesa das Actividades Económicas* in Portuguese.

3.4 The specialness of ZFM’s workers

Individuals employed in the ZFM present several distinct attributes when compared to those employed in the rest of Portugal (Table 2). The share of workers with tertiary education and in leadership positions is greater in the ZFM throughout the whole period (Figure 5). The proportion of workers with permanent contracts is smaller in ZFM than in the rest of the country, with around half of workers in ZFM having temporary contracts, and with the share of temporary contracts increasing over time (Figure A.1). The percentage of male workers in ZFM is also higher than in the rest of Portugal and has increased over time (Figure A.1).

Regarding the predominant occupations in ZFM, the most important are office workers (19.2%), followed by craftsmen and similar workers in the construction activities (11.6%), metallurgical and metal-mechanical workers (9%), other specialists in the intellectual and scientific professions (8%) and company directors (6.4%). Only one of these occupations (office workers) overlaps with the five most relevant occupations in both the rest of Portugal (excluding Madeira) and Madeira excluding ZFM, but with a smaller weight in those regions. Comparing only with the rest of Madeira, craftsmen and similar workers in the construction activities also appear in the top 5 occupations therein.

Figure 5: Selected workers’ characteristics over time



There is a higher incidence of part-time jobs in ZFM and Figure 6a details this aspect. Before the 2012-reform, the proportion of unique individuals working part-time in the ZFM was comparable, but below that of the rest of Portugal. After the imposition of job requirements, this proportion increased sharply, attaining a maximum of 12% in 2015. In addition, after 2012, more than half of part-time workers in the ZFM have more than one job (Figure A.2).

Table 2: Worker descriptive statistics – 2009-2019

(a) ZFM

	N	Mean	Std. dev.	p25	Median	p75
Monthly Wage	22,647	1420.77	1396.61	713.25	1021.86	1637.40
Hours	22,647	163.14	50.89	163.00	173.00	173.00
Hourly Wage	22,647	8.76	8.42	4.42	6.23	10.33
Age	22,647	40.18	10.55	32.00	40.00	48.00
Tenure (years)	22,647	5.54	8.23	0.00	2.00	7.00
Male	22,647	0.65	0.48	0.00	1.00	1.00
Portuguese nationality	22,647	0.92	0.27	1.00	1.00	1.00
University degree	22,647	0.28	0.45	0.00	0.00	1.00
White collar	22,647	0.12	0.32	0.00	0.00	0.00
Part-time contract	22,647	0.08	0.27	0.00	0.00	0.00
Permanent contract	22,647	0.53	0.50	0.00	1.00	1.00

(b) Madeira excluding ZFM

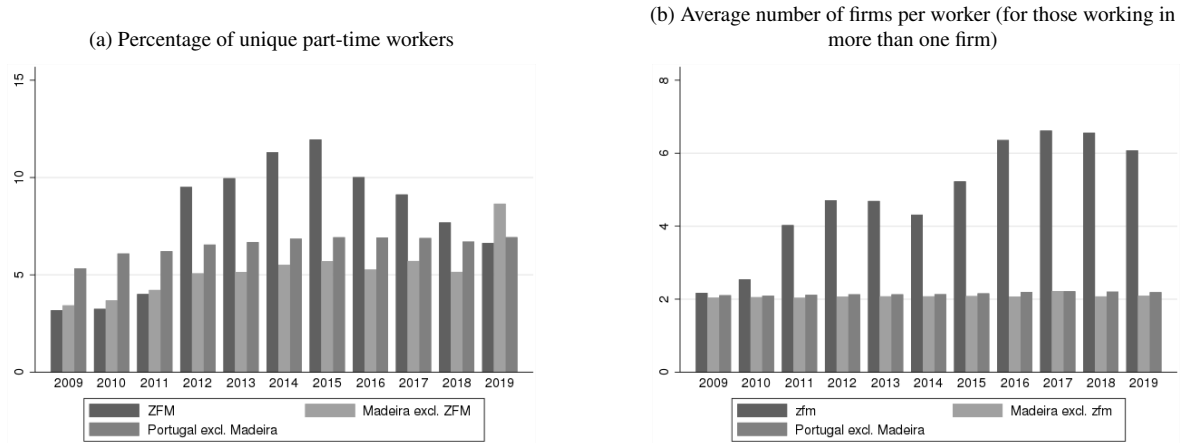
	N	Mean	Std. dev.	p25	Median	p75
Monthly Wage	513,422	977.29	797.01	622.47	769.65	1055.28
Hours	513,422	162.17	31.23	163.00	173.00	173.00
Hourly Wage	513,422	6.07	5.09	3.79	4.60	6.29
Age	513,422	39.71	10.84	31.00	39.00	48.00
Tenure (years)	513,422	8.13	8.78	1.00	5.00	12.00
Male	513,422	0.54	0.50	0.00	1.00	1.00
Portuguese nationality	513,422	0.98	0.15	1.00	1.00	1.00
University degree	513,422	0.13	0.34	0.00	0.00	0.00
White collar	513,422	0.07	0.25	0.00	0.00	0.00
Part-time contract	513,422	0.05	0.22	0.00	0.00	0.00
Permanent contract	513,422	0.68	0.47	0.00	1.00	1.00

(c) Rest of Portugal, excluding Madeira

	N	Mean	Std. dev.	p25	Median	p75
Monthly Wage	27,778,999	998.62	1099.58	589.20	739.74	1092.34
Hours	27,778,999	160.62	33.40	163.00	173.00	173.00
Base Hourly Wage	27,778,999	6.23	7.04	3.60	4.44	6.55
Age	27,778,999	39.84	11.18	31.00	39.00	48.00
Tenure (years)	27,778,999	7.55	8.69	1.00	4.00	12.00
Male	27,778,999	0.53	0.50	0.00	1.00	1.00
Portuguese nationality	27,778,999	0.95	0.21	1.00	1.00	1.00
University degree	27,778,999	0.18	0.39	0.00	0.00	0.00
White collar	27,778,999	0.08	0.27	0.00	0.00	0.00
Part-time contract	27,778,999	0.07	0.25	0.00	0.00	0.00
Permanent contract	27,778,999	0.70	0.46	0.00	1.00	1.00

If we consider only workers that are in more than one firm, before the reform was announced, their average number of firms was 2, as in the rest of Madeira and in the rest of Portugal (Figure 6b). However, after the announcement, this number increased, and as of 2016 reached values that are higher than 6. This descriptive evidence suggests that part of employment

Figure 6: Incidence of part-time jobs and average number of firms for workers in multiple firms

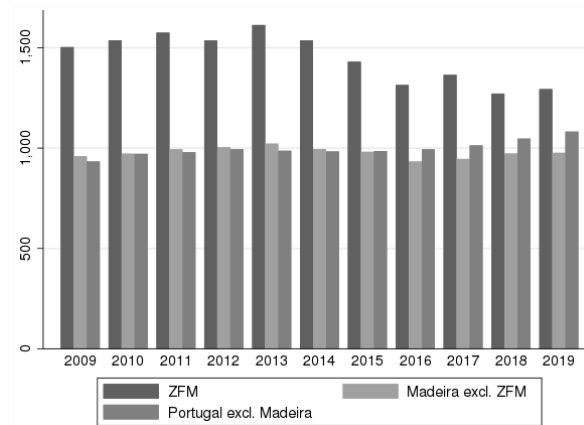


requirements were met with workers who split their time across several firms. A detailed analysis of this aspect will be provided in the causal assessment of the impact of the reform.

3.5 The wage gap of ZFM's workers

Are these different characteristics of firms and workers of the ZFM associated with higher wages? The values of Table 2 and Figure 7 show that the average monthly and hourly wages of workers in ZFM are more than 40% higher than in the rest of Portugal in 2009-2019. The average number of normal hours of work is very similar in all regions.

Figure 7: Monthly wage



Given the existence of substantial differences in the observable characteristics of firms and workers in ZFM and in the rest of Portugal, we estimated simple Mincerian equations including these attributes, as well as year and sector fixed effects. The results of Table 3 show that, controlling for different vectors of observables, at the worker-, firm-, sector-, and

regional-levels, there is an average wage gap associated with working in the ZFM which is consistently higher than 15% in the 2009-2019 period. Noteworthy, the last column indicates that this wage gap decreased somewhat (3 pp) in the years after the reform was announced.

The wage gap could arise from different sources. On the supply side of the labour market, the moral values of the individuals may play a role. Previous research has suggested that workers may be willing to accept lower wages to work in more environmentally sustainable sectors (Krueger et al., 2021) or in more meaningful jobs (Cassar and Meier, 2018); or, on the contrary, ask for a monetary compensation to work in pollution-intensive industries (Cole et al., 2009) or in more immoral jobs (Schneider et al., 2020). A worker may therefore demand a premium for collaborating on tax avoidance activities that may be perceived as immoral and unethical, by himself and/or by others. Simultaneously, through the lens of a collective bargaining model, the higher rents that firms engaging in tax avoidance achieve through low tax bills could be shared between the firm and its workers, and result on a positive wage gap. This mechanism would be akin to that of corporate tax rate reductions on wages (e.g. Fuest et al., 2018, Saez et al., 2019, Carbonnier et al., 2022).

Table 3: Mincer equation – Monthly wage (in logarithm), 2009-2019

	(1)	(2)	(3)	(4)	(5)	(6)
ZFM	0.159*** (0.010)	0.181*** (0.008)	0.201*** (0.008)	0.158*** (0.008)	0.181*** (0.008)	0.161*** (0.011)
ZFM * Post						-0.028*** (0.011)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Worker Controls	No	Yes	Yes	Yes	Yes	Yes
Firm Controls	No	No	Yes	Yes	Yes	Yes
Region FE	No	No	No	Yes	No	Yes
Observations	28,315,068	28,315,068	28,315,068	28,315,068	28,219,960	28,219,960
Adjusted R-squared	0.240	0.491	0.508	0.511	0.537	0.546

Notes: All regressions include year and sector fixed effects (at the CAE 2-digits level comprising 86 sectors). The dependent variable is the logarithm of the monthly wage. Worker-level controls comprise age and its quadratic term, tenure and its quadratic term, gender, education (3 distinct education levels), dummy variables for foreign nationality, white-collar jobs, part-time jobs, and permanent contract. Firm-level controls comprise the logarithm of employment and a dummy variable measuring if the firm has at least 50% of foreign capital. Region fixed effects are defined at the NUTS2 level, comprising 7 regions, including the Madeira region. Columns (5) and (6) include occupation dummies (at the 4-digit level) instead of the dummy variable for white-collar jobs. We harmonised the break in the 1994 and 2010 Portuguese classifications of occupations and lose some observations in that process. Post is a dummy variable equal to one from 2011 onwards. Standard errors in parenthesis are clustered at the worker level. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***)

4 The impact of the 2012 reform on incumbents

In theory, the introduction of substance requirements in a low-tax jurisdiction can yield opposite effects on the post-reform trajectory of wages for incumbent workers. On one hand, certain firms may be compelled to augment their labor demand, leading to an increased wage bill. This, together with the rise in the corporate income tax, could curtail corporate profits and result in diminished compensations for individual workers. On the other hand, the enhanced value of workers to these firms may result in intensified competition for their attraction and retention, particularly in a tight labor market, as often observed in smaller island economies.

To assess the causal impact of the reform on incumbent workers, we implement an event study difference-in-differences approach. The treated group comprises workers within the ZFM in 2010, predating the announcement and implementation of the reform. For the control group, we match these workers based on their observable characteristics in 2010, using the Coarsened Exact Matching (CEM) algorithm (Iacus et al., 2012). This method coarsens pre-treatment covariates, places each observation in a stratum, which has identical values for all the coarsened covariates, and drops observations within any stratum that does not contain at least one treated and one control worker.

We rely on rich administrative data to include several covariates in the CEM: gender, age (measured in deciles), three education levels (basic or less than basic, secondary and post-secondary, and university), a dummy that takes value if the worker is Portuguese and zero otherwise, 54 2-digit sectors of activity dummies, and the 2010 wage (measured in deciles). We restrict the sample to workers aged between 25 and 55 years old. For the control group, we only consider workers that are always outside the ZFM during the period of analysis. Using this method, we are able to match 93% (1406 of the 1507) incumbent workers in ZFM in 2010, with 183577 comparison workers.

We then conduct event study difference-in-differences regressions for worker i at firm f in year t , weighting each worker in the comparison group according to the size of their strata, as follows:

$$y_{ift} = \beta_1 ZFM_f + \sum_{t=2007, t \neq 2010}^{2019} \eta_t \times ZFM_f \times Year_t + \gamma_t + \varepsilon_{ift}, \quad (1)$$

where y_{ift} is the outcome of interest (the log of monthly wages, a part-time employment status indicator, and the log of the count of firms). The dummy variable ZFM_f equals one if the individual works in a firm of the ZFM in 2010 and zero otherwise. The parameters of interest are η_t . As CEM prunes both treated and control workers, these coefficients measure the treatment effect in the post-matching sample. γ_t are year fixed effects. The error term is ε_{ift} . Robust standard errors are clustered at the 2010 firm level (Bertrand et al., 2004, Abadie et al., 2023).

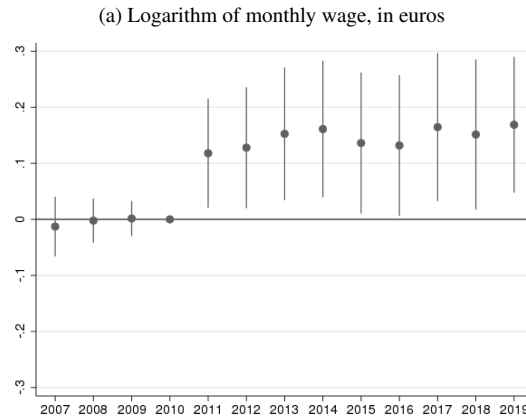
The difference-in-differences estimates rely on two main assumptions (Roth et al., 2023). The first is that there are no anticipation effects before the shock. To be conservative, we show all results setting the omitted period to 2010, before the announcement of the reform, to mitigate possible anticipation concerns that could have changed the behavior of agents. The second is that outcomes of workers in ZFM and their matched comparison group, in the absence of treatment, would evolve in a parallel trend. The event study specification allows us to report supporting evidence for this assumption (Roth, 2022).

We first present the results of estimating eq. (1) for the effect of the tax reform on incumbent workers' wages in Figure 8. Notice that, for the pre-treatment period, we present comforting evidence that the parallel trends' assumption is likely to hold. Moreover, our findings highlight that, conditional on staying employed in the private sector in Portugal, these workers witnessed their salary increase by, on average, more than 10%, *vis-à-vis* workers in the comparison group, a difference that remains persistent several years after the shock, even though, in most years, they are measured with noise.

Our results remain robust in a static difference-in-differences setting. These results are presented in Table 4. In column (1), we show that the reform in ZFM caused an increase in wages by 14.5%, on average, *vis-à-vis* workers in the comparison group. This estimate holds with the introduction of region fixed effects in column (2). We then zoom in to understand whether these findings are driven by an increase in hourly wages (in columns (3) and (4)) or by an increase in the labour supply (in columns (5) and (6)). We find that the increase in the monthly wage reflects an increase in hourly wage (of about 13-14%) rather than an increase in the total number of hours worked.

While the incumbent labour force did not increase their total hours on the job, they began to work in several firms at the same time. This finding is supported by estimating Equation 1 as illustrated in the event study results in panel (a) of Figure 9. Additionally, we observe an approximate 5 pp rise in the likelihood of having a part-time contract, on average, when

Figure 8: The reform led to a wage increase for incumbents in ZFM, conditional on staying in the Portuguese private labour market



Notes: The figure depicts the regression results of equation eq. (1). Point estimates with 90 percent confidence intervals. Standard errors are clustered at the 2010 firm level.

Table 4: The reform led to a (hourly) wage increase for incumbents in ZFM, conditional on staying in the Portuguese private labour market

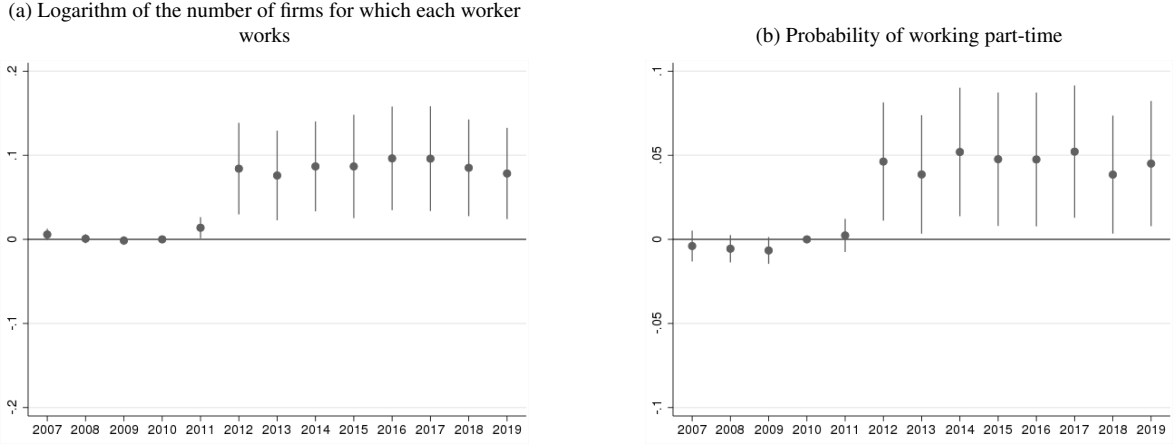
	(1)	(2)	(3)	(4)	(5)	(6)
	Wage	Wage	Hourly wage	Hourly wage	Hours	Hours
ZFM * Post	0.145** (0.066)	0.158** (0.072)	0.130** (0.065)	0.142** (0.072)	0.0156 (0.012)	0.0159 (0.012)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes	No	Yes
Observations	1,788,080	1,788,080	1,788,080	1,788,080	1,788,080	1,788,080
Adjusted R-squared	0.016	0.108	0.018	0.124	0.001	0.001

Notes: The dependent variables are the logarithm of monthly wage, hourly wage and hours worked, respectively. All regressions include a dummy ZFM, which is equal to 1 if the worker is in ZFM in 2010, and 0 otherwise. Standard errors in parenthesis are clustered at the 2010 firm level. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***)

compared with matched workers, as depicted in panel (b).

In a nutshell, our findings suggest that incumbent workers did not increase their labour supply, but started to allocate their time across several firms, concurrently adopting part-time contracts. As they did so, they benefited from an increase in their total wage. When interpreting these results, one must bear in mind the fact that several firms located in ZFM shared exactly the same address and had the same owners, before and after the reform. A practical strategy for ZFM firms to fulfill their new job requirements could then be to utilize existing workers and distribute their working hours across multiple entities. Our results align with the possibility of such a strategy being implemented by ZFM firms.

Figure 9: The reform led to an increase in part-time employment for incumbents in ZFM, conditional on staying in the Portuguese private labour market



Notes: The figure depicts the regression results of equation eq. (1). Point estimates with 90 percent confidence intervals. Standard errors are clustered at the 2010 firm level.

5 Post-reform movers

In this section, we focus on workers who transition between jobs, drawing comparisons between those who shift to ZFM from the rest of the private Portuguese labor market, and those moving between other private positions in the Portuguese labor market. This approach is guided by the empirical evidence suggesting that job changes are important drivers of wage growth (e.g. Addison et al., 2023). Thus, our goal is to understand whether there exists a premium, conditional on moving, for individuals opting to move to a low-tax jurisdiction that has introduced substance requirements.

We restrict the sample to all workers-year present in QP who change the firm (or the set of firms) in which they work on that year. Using this subsample of movers, we assess whether the wage growth experienced by movers to ZFM is higher than for other movers. To that end, we estimate the following regression:

$$\Delta \ln w_{ift} = \beta_1 \text{MoverToZFM}_{ift} + \beta_2 \Delta Z_{ift} + \gamma_s + \gamma_t + \gamma_r + \varepsilon_{ift}, \quad (2)$$

w_{ift} is the wage of worker i at firm f in year t , and therefore $\Delta \ln w_{ift}$ is (approximately) the percentage change in wage. MoverToZFM_{ift} is a dummy variable equal to 1 for a mover that moves to a firm f which is in ZFM at year t , and 0 otherwise. The change in a number of time-varying characteristics that potentially affect wage growth at the moment of transition

is included in ΔZ_{ift} . Specifically, the vector includes the change in worker's education, the change in dummy variables for white-collar jobs, part-time jobs, and permanent contract, the change in the dummy variable measuring if the firm has at least 50% of foreign capital, and the change in either the logarithm of employment (E) or turnover (T). γ_s are sector fixed effects, defined at the two-digit level. γ_t are year fixed effects. γ_r are region fixed effects, at NUTS2 level (including a dummy for Madeira archipelago). The error term is ε_{ift} . Robust standard errors are clustered at the worker-level. The sample includes the years 2012-2019, which are the post-reform years. The coefficient of interest is β_1 , which measures whether movers to ZFM experience higher wage growth than other workers in the rest of Portugal that also change firm (or firms) in the same year.

Results are presented in Table 5. We do not find evidence of higher wage growth when movers move into ZFM than to the rest of Portugal (panel a). However, when we consider instead the hourly wage growth, we find a positive and statistically significant premium in moving to ZFM, which is consistently above 8 pp (panel b). This premium does not translate into higher monthly wage growth as movers to ZFM experience a reduced growth rate in the number of hours worked, which is close to 6 pp lower (panel c). Taken together, these results imply that ZFM firms may have attracted new employees to fulfill employment criteria by offering reduced workloads rather than higher monthly wages.

The largest inflow of workers to ZFM was observed from 2016 onwards, one year after the European Commission asked for the first time information from Portugal in view of examining whether the ZFM scheme respected the applicable rules.⁷ It is plausible that during that period, ZFM firms faced heightened demands for workers. Consequently, movers to ZFM in this period might exhibit a stronger monthly or hourly wage premium. Appendix B explores those potential differences in results between the periods 2012-2015 and 2016-2019.

Table B.1 shows that neither in 2012-15 nor in 2016-19 do ZFM movers experience a statistically different monthly wage growth *vis-a-vis* other movers. However, it is during the 2016-2019 period that ZFM movers begin to reap the benefits of an hourly wage premium as they experience a similar wage growth to other movers, but undergo a reduced growth rate in hours worked (Tables B.2 and B.3).

⁷https://ec.europa.eu/competition/state_aid/cases1/201919/275448_2063142_430_6.pdf

Table 5: Movers to ZFM might have been attracted by reduced workloads, rather than by higher monthly wages

(a) Change in log wage

	(1)	(2)	(3)	(4)	(5)	(6)
Mover to ZFM	0.00368 (0.017)	0.00692 (0.017)	0.0243 (0.018)	0.0239 (0.017)	0.0178 (0.017)	0.0215 (0.018)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	No	No	Yes	Yes	Yes	Yes
Worker Controls	No	Yes	No	Yes	Yes	Yes
Firm Controls	No	No	No	No	Yes E	Yes T
Observations	1,902,110	1,902,110	1,902,110	1,902,110	1,902,110	1,836,336
Adjusted R-squared	0.003	0.045	0.007	0.047	0.048	0.050

(b) Change in log hourly wage

	(1)	(2)	(3)	(4)	(5)	(6)
Mover to ZFM	0.0870*** (0.010)	0.0869*** (0.010)	0.0876*** (0.010)	0.0865*** (0.010)	0.0859*** (0.010)	0.0822*** (0.010)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	No	No	Yes	Yes	Yes	Yes
Worker Controls	No	Yes	No	Yes	Yes	Yes
Firm Controls	No	No	No	No	Yes E	Yes T
Observations	1,902,110	1,902,110	1,902,110	1,902,110	1,902,110	1,836,336
Adjusted R-squared	0.008	0.014	0.019	0.024	0.032	0.040

(c) Change in log hours

	(1)	(2)	(3)	(4)	(5)	(6)
Mover to ZFM	-0.0834*** (0.014)	-0.0800*** (0.014)	-0.0633*** (0.014)	-0.0627*** (0.014)	-0.0681*** (0.014)	-0.0608*** (0.014)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	No	No	Yes	Yes	Yes	Yes
Worker Controls	No	Yes	No	Yes	Yes	Yes
Firm Controls	No	No	No	No	Yes E	Yes T
Observations	1,902,110	1,902,110	1,902,110	1,902,110	1,902,110	1,836,336
Adjusted R-squared	0.001	0.046	0.002	0.047	0.047	0.046

Notes: The dependent variables are the change in logarithm of monthly wage, hourly wage, and number of hours, respectively. Worker-level controls comprise the change in education and the change in dummy variables for white-collar jobs, part-time jobs, and permanent contract. Firm-level controls comprise the change in the dummy variable measuring if the firm has at least 50% of foreign capital and the change in either the logarithm of employment (E) or turnover (T). Region fixed effects are defined at the NUTS2 level, comprising 7 regions, including the Madeira archipelago. Sector fixed effects are defined at the CAE 2-digits level comprising 86 sectors. Standard errors in parenthesis are clustered at the worker level. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***)

6 Conclusion

In this paper, we took a first step in advancing the existing knowledge about the impact of introducing employment requirements in low-tax jurisdictions. We overcame the usual

barrier of data opacity, studying the impact of a reform in ZFM, a low-tax jurisdiction located on the Portuguese archipelago of Madeira.

For incumbent workers, we found evidence of higher wages, a higher likelihood of part-time employment, and a rise on the number of firms for which each worker simultaneously works. This rise in multiple job holding indicates that part of the job creation requirements were met by incumbents. At the same time, we show that ZFM firms might have hired employees to fulfill employment criteria by providing them with reduced workloads rather than offering higher overall monthly wages.

Overall, the results presented in this paper contribute to understanding the impact of introducing substance requirements in low-tax jurisdictions, but also broaden existing knowledge about how labour markets operate in those jurisdictions, and about the relationship between international corporate tax avoidance and employees' pay. With corporate tax avoidance at the forefront of international tax policy and research agendas, more work is needed in this direction. Ascertaining the validity of the results with alternative databases would be a valuable exercise.

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Appendices

A Further descriptive statistics

Table A.1: Firm descriptive statistics – 2009-2019

(a) ZFM

	N	Mean	Std. dev.	p25	Median	p75
N° of workers	6,077	4.81	13.58	1.00	1.00	3.00
Turnover (million euros)	6,077	8.89	70.57	0.00	0.10	1.21
Percentage foreign equity	6,077	70.07	45.21	0.00	100.00	100.00
Turnover per worker (million euros)	6,077	2.45	20.69	0.00	0.05	0.40

(b) Madeira excluding ZFM

	N	Mean	Std. dev.	p25	Median	p75
N° of workers	55,609	9.34	49.01	1.00	3.00	6.00
Turnover (million euros)	55,609	0.85	6.63	0.05	0.12	0.35
Percentage foreign equity	55,609	0.68	7.91	0.00	0.00	0.00
Turnover per worker (million euros)	55,609	0.09	0.36	0.02	0.04	0.08

(c) Rest of Portugal, excluding Madeira

	N	Mean	Std. dev.	p25	Median	p75
N° of workers	2,807,450	10.10	107.55	1.00	2.00	6.00
Turnover (million euros)	2,807,450	1.38	34.74	0.05	0.13	0.37
Percentage foreign equity	2,807,450	1.62	12.30	0.00	0.00	0.00
Turnover per worker (million euros)	2,807,450	0.11	1.99	0.02	0.05	0.09

Figure A.1: Additional workers' characteristics over time

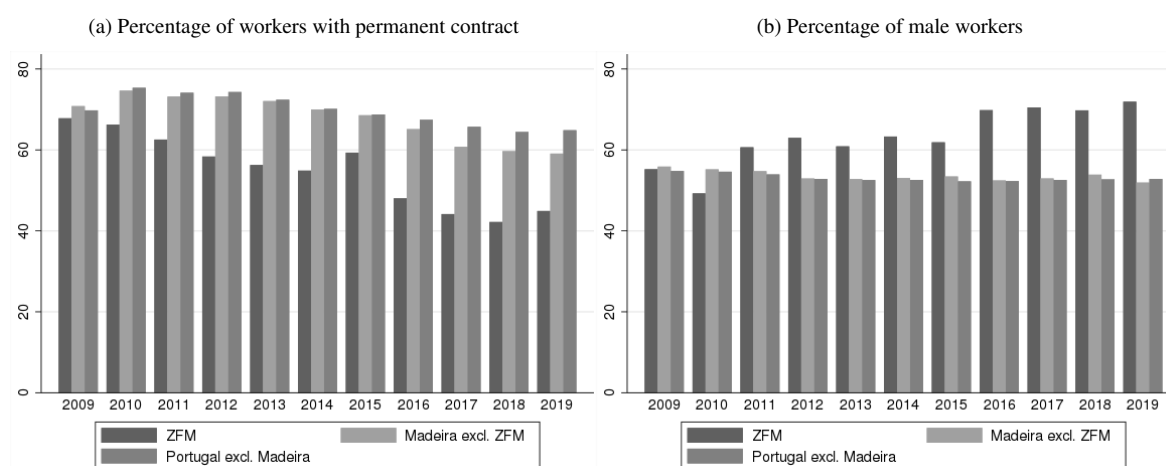
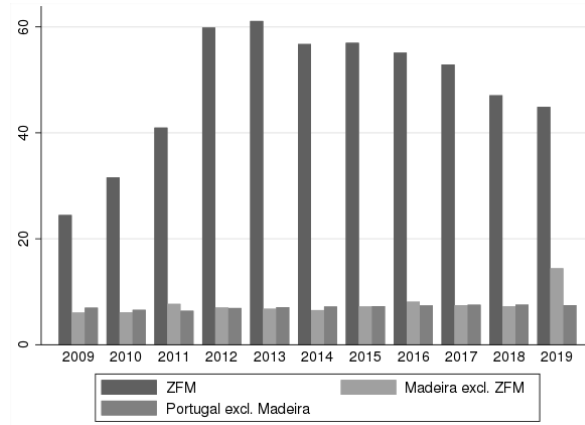


Figure A.2: Percentage of part-time workers with multiple jobs



B Post-reform movers: heterogeneity across time

Table B.1: Change in log wage

	(1)	(2)	(3)	(4)	(5)	(6)
Mover to ZFM	0.00884 (0.035)	0.00452 (0.034)	0.0102 (0.035)	0.00544 (0.034)	-0.0171 (0.034)	-0.000265 (0.035)
Mover to ZFM * Post 2016	-0.00637 (0.039)	0.00295 (0.039)	0.0174 (0.040)	0.0227 (0.039)	0.0429 (0.039)	0.0266 (0.040)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	No	No	Yes	Yes	Yes	Yes
Worker Controls	No	Yes	No	Yes	Yes	Yes
Firm Controls	No	No	No	No	Yes E	Yes T
Observations	1,902,110	1,902,110	1,902,110	1,902,110	1,902,110	1,836,336
Adjusted R-squared	0.003	0.045	0.007	0.047	0.048	0.050

Notes: The dependent variable is the change in logarithm of monthly wage. Worker-level controls comprise the change in education and the change in dummy variables for white-collar jobs, part-time jobs, and permanent contract. Firm-level controls comprise the change in the dummy variable measuring if the firm has at least 50% of foreign capital and the change in either the logarithm of employment (E) or turnover (T). Region fixed effects are defined at the NUTS2 level, comprising 7 regions, including the Madeira archipelago. Sector fixed effects are defined at the CAE 2-digits level comprising 86 sectors. Standard errors in parenthesis are clustered at the worker level. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***)

Table B.2: Change in log hourly wage

	(1)	(2)	(3)	(4)	(5)	(6)
Mover to ZFM	-0.00390 (0.022)	-0.00696 (0.022)	-0.0157 (0.022)	-0.0189 (0.022)	-0.0329 (0.022)	-0.0422* (0.022)
Mover to ZFM * Post 2016	0.112*** (0.024)	0.116*** (0.025)	0.127*** (0.024)	0.130*** (0.024)	0.146*** (0.025)	0.152*** (0.025)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	No	No	Yes	Yes	Yes	Yes
Worker Controls	No	Yes	No	Yes	Yes	Yes
Firm Controls	No	No	No	No	Yes E	Yes T
Observations	1,902,110	1,902,110	1,902,110	1,902,110	1,902,110	1,836,336
Adjusted R-squared	0.008	0.014	0.019	0.024	0.032	0.040

Notes: The dependent variable is the change in logarithm of the hourly wage. Worker-level controls comprise the change in education and the change in dummy variables for foreign nationality, white-collar jobs, part-time jobs, and permanent contract. Firm-level controls comprise the change in the dummy variable measuring if the firm has at least 50% of foreign capital and the change in either the logarithm of employment (E) or turnover (T). Region fixed effects are defined at the NUTS2 level, comprising 7 regions, including the Madeira archipelago. Sector fixed effects are defined at the CAE 2-digits level comprising 86 sectors. Standard errors in parenthesis are clustered at the worker level. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***).

Table B.3: Change in log hours

	(1)	(2)	(3)	(4)	(5)	(6)
Mover to ZFM	0.0127 (0.028)	0.0115 (0.026)	0.0259 (0.028)	0.0243 (0.026)	0.0158 (0.026)	0.0419 (0.027)
Mover to ZFM * Post 2016	-0.118*** (0.032)	-0.113*** (0.030)	-0.110*** (0.032)	-0.107*** (0.030)	-0.103*** (0.030)	-0.126*** (0.031)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	No	No	Yes	Yes	Yes	Yes
Worker Controls	No	Yes	No	Yes	Yes	Yes
Firm Controls	No	No	No	No	Yes E	Yes T
Observations	1,902,110	1,902,110	1,902,110	1,902,110	1,902,110	1,836,336
Adjusted R-squared	0.001	0.046	0.002	0.047	0.047	0.046

Notes: The dependent variable is the change in logarithm of number of hours of work. Worker-level controls comprise the change in education and the change in dummy variables for foreign nationality, white-collar jobs, part-time jobs, and permanent contract. Firm-level controls comprise the change in the dummy variable measuring if the firm has at least 50% of foreign capital and the change in either the logarithm of employment (E) or turnover (T). Region fixed effects are defined at the NUTS2 level, comprising 7 regions, including the Madeira archipelago. Sector fixed effects are defined at the CAE 2-digits level comprising 86 sectors. Standard errors in parenthesis are clustered at the worker level. Stars indicate significance levels of 10% (*), 5% (**), and 1%(***).