
FIXED-TERM CONTRACTS AND OCCUPATIONAL TASKS: AN
EMPIRICAL ANALYSIS FOR PORTUGAL

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Resumo

No estudo do mercado de trabalho existem duas tendências a denotar na literatura. Em primeiro lugar, nos últimos anos, observa-se um aumento do uso dos contratos a termos com o objetivo de diminuir a rigidez presente em alguns mercados de trabalho. Em segundo lugar, verificam-se mudanças ao nível dos empregos e da estrutura das ocupações devido à adoção generalizada de novas tecnologias e o aumento do nível de digitalização das economias. Apesar de, a maioria da literatura estudar os dois fenómenos em separado, estudos mais recentes começam por relacionar as duas e perceber se existe alguma relação entre os dois tópicos.

Usando *linked employer-employee data* para Portugal, para o período de 2010-2019, esta dissertação tem como objetivo o estudo da heterogeneidade ocupacional no uso de contratos a termo. Esta análise foca-se na avaliação de a probabilidade de conversão e a magnitude da diferença salarial entre contratos a termo e contratos sem termo diferirem de acordo com a sua estrutura ocupacional.

Analisando o nível de conversão através de um modelo *logit*, a principal conclusão é que tarefas geralmente associadas com *skills* mais elevados e mais baixos, tendem a ter menores níveis de conversão enquanto, tarefas que requerem *skills* médios têm os maiores níveis de conversão. Isto sugere que trabalho temporário pode ser mais usado, para estes últimos trabalhadores, com uma função de *screening* quando comparado com trabalhadores com tarefas associadas a menores *skills*.

Em termos da análise do gap salarial, e usando um *high dimensional fixed effects model*, pode-se perceber que existe uma penalização salarial para trabalhadores temporários. Adicionalmente, interagindo tarefas com contratos, trabalhadores em tarefas não rotineiras ou rotineiras cognitivas apresentavam um diferencial salarial superior quando comparados com trabalhadores de tarefas manuais, o que está em linha com a literatura existente.

Por último, é ainda importante salientar que as duas análises – conversão e diferencial salarial – é possível observar a existência de heterogeneidade no impacto que as diferentes tarefas têm ao nível da conversão e do diferencial salarial entre contratos.

Códigos JEL: J41, J24, J31

Palavras-chave: Contratos a termo, Tarefas ocupacionais, Diferença salarial, Conversão

Abstract

In the study of the labour markets, there are two trends highlighted in the literature. Firstly, the increase in the use of fixed-term contracts in order to decrease the rigidity present in some labour markets. Secondly, the changes in the jobs and the structure of occupations performed by the workers due to the adoption of new technologies, and the increase in the levels of the economy digitalization. Although the majority of literature studies the two phenomena as separate, recent studies tried to understand the existence of a relation between these topics.

Using Portuguese linked employer-employee data for the period 2010-2019, this dissertation aims to study the occupational heterogeneity in the use of fixed-term contracts. The analysis focus on assessing whether the conversion probability and the magnitude of the wage gap between fixed-term and permanent contracts differ according to the occupational task content.

Looking to a logit model the main conclusion is that tasks related to higher and low skill levels are the ones with lower levels of conversion, while tasks related to median skill levels have the higher rates of conversion. This suggests that temporary employment could be more used for these workers with a function of screening when compared to workers with tasks that involve less skill.

In terms of the wage gap, it is noticed that exists a wage penalty for temporary workers. In addition, interacting the tasks with contracts, non-routine and routine cognitive present a higher wage gap compared to manual tasks, which is in line with the existing literature.

Last, it is also important to refer that in the two analysis – conversion and wage gap - it was possible to observe heterogeneity in the impact that the different tasks have on the conversion and the wage gap.

JEL codes: J41, J24, J31

Keywords: Fixed-term contracts, Occupational change, Wage gap, Conversion

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Abbreviations index

FTC	Fixed-term contracts
OEC	Open-ended contracts
EPL	Employment protection legislation
SBTC	Skill-Biased Technological Change
RBTC	Routine Biased Technological Change
QP	<i>Quadros de Pessoal</i>
NRCA	Non-routine cognitive analytical
NRCI	Non-routine cognitive interpersonal
RC	Routine cognitive
RM	Routine manual
NRMP	Non-routine manual physical task
M	Manual

1. Introduction

The use of temporary forms of work, specially fixed-term contracts (FTC)¹ increased in the last decades in some European countries, and Portugal was not an exception. According to Eurostat, in 2021, temporary employment represented 17%² of the total number of employees in Portugal. This type of contract was first introduced with the objective to increase the flexibility of the rigid labour markets (Bentolila & Saint-Paul, 1992).

Due to their characteristics, there is a debate about the consequences that fixed-term contracts may have on workers careers. Some literature points out that these contracts lead to more insecurity, lower training opportunities and lower wages (Booth et al., 2002; OECD, 2014). However, some authors consider that temporary contracts can facilitate the entrance into the labour market and promote more opportunities to balance work and family life (Gash, 2008). In line with this, the literature studies whether FTC may act as a trap into unemployment or a stepping stone into permanent employment (Kiersztyn, 2016).

Recent literature have shown that the use of FTC and the levels of conversion from FTC to OEC may be influenced by the tasks and the occupations performed by the workers, in the labour market. Reichelt (2015) conclude that in the German labour market, the functions of FTC varies with the different tasks performed by the workers. Berglund et al. (2022), for Netherlands analyze if the different tasks leads to the use of FTC as a trap into unemployment or a stepping-stone into permanent employment. Mattijssen et al. (2020) studies for Sweden whether changes in the occupational structure are related with the distribution of temporary employment.

Indeed, the labour market observes another trend known as polarization which represents changes in the occupational structure. In particular, it traduces in an increase of employment at the bottom and the top of the occupational distribution (Kiersztyn, 2016). This phenomenon has been observed not only in advanced but also in developing economies (Fonseca et al., 2018). The evolution of technology is pointed as a factor that led to this trend.

¹ Even though the concepts of fixed-term contracts and temporary contracts have some differences, in this dissertation they are used as synonyms. In line with this the concept of permanent work and open-ended contracts will be used as synonyms.

² Data available in: https://ec.europa.eu/eurostat/databrowser/view/lfsa_ctpgan/default/table?lang=en accessed on August 15th 2022.

Due to the fact that the literature points out for the existence of heterogeneity of tasks in the use of the different contracts, this dissertation adds to the literature by studying this relation for the Portuguese labour market. Portugal is an interesting case of study in these topics. First, the larger share of the use of fixed-term contracts and the mild levels of Employment protection legislation (EPL) between FTC and OEC compared with other European countries make Portugal an attractive country to study. Second, Portugal is a country with specific attributes to the analysis of occupations and tasks performed by the workers. In fact, the levels of new technologies and robots in the industry and other sectors is lower compared with advanced economies. Furthermore, the Portuguese labour market is characterized by high levels of workers with low qualifications, small levels of human capital, which make it more difficult to implement new technologies in the jobs.

In line with this, this dissertation focuses on the analysis of the heterogeneity of the use of fixed-term contracts among the different occupations and tasks performed by workers. For this, two questions of investigation were considered. First, is there heterogeneity on the conversion from FTC to OEC among the different tasks? Second, are there different levels of wage penalty for FTC workers performing different tasks?

Following the literature (Berglund et al., 2022; Mattijssen et al., 2020; Reichelt, 2015), the focus start in the study of the conversion from FTC to OEC among the different tasks performed by the workers. In addition, in line with Kiersztyn (2016) it is considered not only the conversion, but also the wage gap between temporary and permanent contrcats. The choice of studying also the wage gap is supported by the literature by the fact that is pointed out that wages may be influenced by the occupation and task that the worker performs (Portugal, 2020). In order to reach the objectives proposed were considered data from *Quadros de Pessoal (QP)* for the period 2010-2019.

This dissertation is divided into the following sections. Section 2 defines FTC and OEC and summarizes changes in employment protection legislation. Section 3 includes a literature review about the functions of fixed-term contracts and some evidence about the conversion from FTC to OEC and the wage gap between the two contracts. Section 4 describes the data. Section 5 presents descriptive evidence about contracts, wages and tasks performed by workers in the Portuguese labour market. In addition, section 6 and 7 are related with the analysis of the conversion from FTC and OEC and the wage gap between FTC and OEC, respectively. Lastly, section 8 includes the main conclusions.

2. Employment Legislation

Section 2 is divided in two subsections. Subsection 2.1 presents an introduction that defines fixed-term and open-ended contracts as well as the main differences and effects of them. Subsection 2.2 is dedicated to the study of employment protection legislation and the reforms that were adopted in Portugal during the period of analysis.

2.1. Fixed-term contracts and Open-ended contracts

Fixed-term contracts have a priori a pre-defined date for the end of the contract. They have a maximum duration and can be renewable at a limit of defined times (Bentolila et al., 2019). Fixed-term contracts are one type of contract that is included in the concept of temporary work. In the case of Portugal, temporary work includes fixed-term contracts, contracts from temporary work agencies (*contrato de prestação de serviços*) and contracts in a temporary work agency with uncertain term (*contrato por tempo indeterminado para cedência temporária*³). In addition, for Portugal the maximum duration is two years, including the renewables that are allowed by law⁴. In line with this, open-ended contracts at the beginning do not have a pre-defined duration.

Despite the differences in the duration of contracts, there are more points in what they differ (Bentolila et al., 2019).

Another difference between fixed-term and open-ended contracts is the fact that firing costs are smaller for the former. This happens because in OEC employers have more procedural and financial costs to fire an employee in comparison with FTC (Centeno & Novo, 2012). In terms of the severance payments, the ones of FTC, in the majority of the countries, are below the levels for OEC (Bentolila et al., 2019). In line with this, firms would prefer to use temporary contracts.

Nowadays, some changes have been made and the severance payments of the two contracts are similar. This is true for the specific case of Portugal which adopted between 2011-2014 reforms in employment protection legislation with the objective to approximate

³ Legislation available in <https://dre.pt/dre/legislacao-consolidada/lei/2009-34546475-46738775> (article 172) consulted on august 14th 2022.

⁴ Legislation available in <https://dre.pt/dre/legislacao-consolidada/lei/2009-34546475-46734975> (article 178) consulted on august 14th 2022.

the legislation of temporary and permanent contracts. After this reform the legislation for permanent contracts are closer to the one for temporary contracts.

In terms of the effects that FTC can have on the labour market, there is literature pointing to the benefits that they may have, but there is also literature defending the existence of negative consequences for the labour market.

Indeed, different authors point to different conclusions. On the one hand, some authors claim that temporary forms of work lead to lower wages, less security, worse training opportunities and benefits and to more precarious work (Booth et al., 2002; OECD, 2014). In addition, the segmentation or duality of the labour market is pointed out as negative consequence of the introduction of FTC. According to the segmentation theory, introduction of temporary forms of work lead to the creation of two segments in the labour market. One segment is more likely to have temporary employment rather than the other that have more permanent employment (Polavieja, 2005).

On the other hand, others defend that FTC can be beneficial for workers, especially for the ones that want to obtain more experience in the labour market in order to reach, in the future, permanent contracts or even to have the possibility of combination of work and their personal lives (Gash, 2008). Other perspectives defend that nowadays, several workers prioritize themselves over their job which makes them prefer temporary contracts that are more associated with flexibility, rather than the permanent ones (Guest, 2004).

Kiersztyn (2016) points to the existence of two types of workers under fixed-term contracts. On the one hand, there are workers known as white-collar. These are workers with high skill levels that accept to have temporary contracts in order to get more flexibility, a higher variety in the tasks performed, a better balance between their work and personal life and more autonomy. They have a high valuation in the market and tend to earn higher wages which allow concluding that they do not suffer with the insecurity usually associated with temporary contracts. This leads to the conclusion that they are in temporary work for their own choice. On the other hand, there are, in the majority of cases, workers with low skills. These have temporary contracts, not because they want but, due to external reasons such as economic reasons. They are usually exposed to economic fluctuations and tend to have worse employment opportunities and conditions in comparison with white-collar.

2.2. Employment Protection Legislation in Portugal

A few years ago, some European countries had to deal with high unemployment rates which could be caused by rigid labour market policies.

In order to promote labour market flexibility, many countries adopted two-tier reforms which consisted in the introduction of new contracts such as fixed-term contracts (Portugal & Varejão, 2022). Indeed, the literature defends that labour market flexibility is dependent on the level of hiring and firing restrictions, commonly known as EPL. Instead of changing the legislation for permanent contracts, the decision was to introduce these new forms of contracts following a strategy of flexibility at the margin (Bentolila et al., 2019). As well as other European countries, Portugal has gone through this deregulation process and introduced the FTC in 1976 (Centeno & Novo, 2012).

As a result of the introduction of FTC, the market observed many effects. According to the literature, in Portugal like in other European countries, the number of workers under FTC and other forms of temporary employment has increased since their introduction in the market (OECD, 2019). This might happen because there is a significant gap between the Employment Protection Legislation (EPL) of the two types of contracts (fixed-term and open-ended). When this gap is relevant the firms have more incentives to hire workers under fixed-term contracts which leads to more flexibility and consequently the increase of duality (OECD, 2017).

The existence of the legislation gap between the two contracts leads to the combination of workers' protection with the flexibility that firms want to have. The issue is that it is not easy to understand when is going to be the end of a job due to economic changes (Bentolila et al., 2019). In addition, the authors defend that the EPL gap helps firms to choose a hiring policy that looks to the firing costs instead of the duration of contracts, which makes FTC dead ends instead of a stepping-stone to permanent employment.

In the last years, this policy has been reconsidered due to the fact that the countries that adopt the duality strategy did not have an improvement in their labour market situation during periods of high rates of unemployment. In addition, they also faced with an increasement in wage inequality between the forms of contracts (Bentolila et al., 2019).

2.2.1. EPL reforms in Portugal

In the specific case of Portugal, the legislation protection gap is significant, making it a country with strict EPL but at the same time with mild regulation in temporary work (Portugal & Varejão, 2022). However, the protection related to open-ended contracts is higher than the protection related to FTC.

To reduce this, Portugal adopted, between 2011 and 2014, some reforms in Employment Protection Legislation (OECD, 2017). In fact, this period is relevant to the analysis because at that time Portugal was under troika intervention due to the sovereign-debt crisis. All the changes observed in that country were in line with all consolidation policies followed by the European Union countries (Távora & González, 2016). Additionally, this reform had the objective of decreasing the level of protection associated with permanent contracts. Analyzing the severance pay for open-ended contracts at OECD countries, it was possible to conclude that Portugal had one of the highest levels (OECD, 2017). According to Cardoso and Branco (2018), this was the first time that the Portuguese permanent workers faced policies to decline the protection of permanent contracts, which allowed the alignment of the severance pay for temporary and permanent contracts and the decrease of the gap.

This reform had three points of intervention. First, permanent contracts had a decrease in their severance payments. Second, it included a new reason for workers being dismissed. Third, it introduced new dismissing criteria in order to deal with the end of a worker position (OECD, 2017). Similar to the workers under permanent contracts, the ones with fixed-term contracts also had changes in their EPL. On the one hand, they observed a decrease in their severance payment days, but on the other hand, the government decided to extend the duration of FTC. Even though these interventions narrowed the protection between open-ended and fixed-term contracts, it still exists. In conclusion, the main objective, the decrease of labour market dualization, was not achieved during this time (Cardoso & Branco, 2018).

In addition, a tripartite agreement was signed in 2018 with the objective of decreasing the dualism while keeping some flexibility in the labour market. This action reduced the duration of FTC and decrease the situations when people under these contracts could make permanent tasks. In order to foster permanent contracts, the periods of exemption of social security contributions increased for young people in their first job and for long-term unemployed (OECD, 2019).

3. Literature review

This section presents a literature review about the use of fixed-term contracts and the different tasks and occupations in the labour market, and it is divided into two subsections. Subsection 3.1 points the different functions of temporary contracts and includes literature review for the conversion from FTC to OEC and for the wage gap between FTC and OEC. Last, subsection 3.2 summarizes the changes that have been observed in the occupations and the tasks performed by the workers in the labour market.

3.1. Fixed-term contracts functions

Fixed-term contracts can be used for several purposes. On one hand, they can be a bridge into permanent employment but on the other, they can be a trap into unemployment (Reichelt, 2015).

First, FTC can act as a buffer in the labour market. This point of view documents that workers under temporary contracts, act as a buffer for workers under permanent contracts. In a practical way, they act as a shield to give some protection to the permanent workers (Polavieja, 2003). This might happen because workers under contracts have lower dismissal costs. When the firm faces unfavourable conditions, employers fire these workers because of the smaller firing costs in comparison with permanent ones. Moreover, Bentolila and Dolado (1994) defend that, apart from the fact that permanent workers, also called insiders, have more protection in employment, they might have more advantages in wage bargaining.

Second, fixed-term contracts can have a screening function. In fact, at the moment of the hiring, employers cannot observe certain characteristics of the workers and because of this, the quality of the match is not observed. In line with that, employers may use fixed-term contracts to learn about the quality of the match. If the match is successful, the firms offer to them a permanent contract. If the opposite happens, the match can be dissolved and the workers may go unemployed (Boockmann & Hagen, 2008).

Third, FTC are sometimes used as a churning device. Churning is the excess of worker turn-over (workers in and workers out of a job) in comparison to job turn-over (creation and destruction of jobs) (Burgess et al., 2000). Firms use FTC with this function to allocate workers for permanent tasks (Portugal & Varejão, 2022). This process occurs

because firms have small dismissal costs for workers under temporary contracts and consequently, they prefer to hire the workers under temporary contracts rather than offer to them permanent contracts. When it is the time of the end of the contract, they fire the worker and hire another one with the same type of contract (Blanchard & Landier, 2002). Consequently, the labour market is observing the constant destruction of matches (Portugal & Varejão, 2022). Burgess et al. (2000), in their study, conclude that churning is not a result of mismatches, but it is an equilibrium being part of the personal policy of some firms.

The three roles that FTC can take are reflected in two main outcomes – the conversion from FTC and OEC and the wage gap between FTC and OEC – that can influence the type of contract adopted.

3.1.1. Conversion from FTC to OEC

Fixed-term contracts can be used as a bridge or a trap. If FTC are used as a bridge, they can serve as a probation period in which firms try to learn about the quality of the match. Before the conversion of the contract, they offer a FTC to learn about the qualities and skills of the worker. If the workers perform as expected, they will see their contract converted to a permanent one (Wang & Weiss, 1998). The theories of the function of FTC as a trap defend that the objective of the use of FTC is to provide more flexibility on the labour market allowing firms to increase or decrease their workforce. Indeed, they have more flexibility to adjust their levels of employment in periods of fluctuations of the labour demand or product markets (Houseman, 2001). This perspective has had its base in the theory of the dual market (Doeringer, 1970). When this happens, the workers will receive lower levels of training from their employers and because of that, they are more vulnerable to suffer negative impacts for the rest of their career, once the future career depends on what happened in the past (Berton et al., 2011).

In line with these two perspectives are the functions that FTC can have in the labour. In the cases that contracts are stepping-stones is probable that they are used with a function of screening. Although the higher probability of conversion in this situation, it cannot be concluded that every worker will have their contract converted. In addition, when contracts have a function of churning, workers are used to adjustments in fluctuations which decrease their perspectives to have a conversion of their contract (Portugal & Varejão, 2004).

However, it is important to have attention in the interpretation of the results of screening because these theories do not make a distinction between the skills of the worker in the probation period. In fact, the costs of screening a worker are different depending on their skill. If the workers have lower skills, the firms have more costs to screen them. In this case is expected that workers with higher skills have more temporary contracts and consequently, more levels of conversion to permanent contracts (Gash, 2008).

In the analysis of the conversion of contracts is also important to understand the replaceability of the worker once they are related to the type of contract that the worker has. When workers are easy to replace, the employers will prefer to offer them a temporary contract which helps firms to use them as adjustments in economic fluctuations. In this case, employers use FTC with the function of screening to find suitable candidates for a specific position. This replaceability is highly related to the occupations and tasks that the workers perform in the labour market (Mattijssen et al., 2020). The authors add that in the cases of jobs, that require high skills and have high-monitoring costs, the probability of the worker to transit to a permanent contract is higher than for jobs that involve less skill. This happens due to the necessity that these jobs create in terms of the need for a permanent position for that specific worker.

When FTC are used with the screening function, it is possible that, even in the cases that the conversion of the contract with the same employer does not happen, this helps the workers of high-level occupations to transit for a permanent contract with another employer (Kiersztyn, 2016). In the cases that firms use FTC to lower costs, they will not invest in the worker, especially in their training, which makes it more difficult to have the contract converted. This could lead to the conclusion that tasks that involve more skilled workers will have higher rates of conversion. However, Kiersztyn (2016) does not support this evidence. Indeed, the author concludes that tasks that involve middle-skills present the higher rates of conversion compared to tasks that involve high and low-skills. In addition, it is easy to believe that tasks that require less-skills, such as manual tasks, have lower levels of conversion and that FTC are a trap into unemployment in this specific tasks. However, Booth et al. (2002) and Gash (2008) does not find evidence for this.

Another point that is believed to interfere in the levels of conversion between FTC and OEC is the Employment Protection Legislation. Bentolila et al. (2019) in their study find that in the cases of high levels of the EPL gap, the use of FTC is more significant and

the rate of conversion to permanent contracts is lower. In that case, it is more probable to use FTC as a churning device.

In their analysis, McGinnity and Mertens (2002) conclude for the existence of a two-tier labour market in Germany, which allows to conclude that temporary workers with higher qualifications have more conversion of their contacts into permanent contracts and that workers with lower qualifications are used to adjust fluctuations in the labour market. This proves that temporary employment in Germany is used as a bridge for permanent employment. Portugal and Varejão (2022) had similar conclusions but with different levels of conversion for Portugal. In fact, they found that the level of conversion was 18.6%. Booth et al. (2002) using British data also conclude that temporary jobs, specially FTC, are stepping stones to permanent contracts. Güell and Petrongolo (2000) found for Spain that there were two periods of conversion of the contracts. One of them occurs in the first year of a contract which allows to conclude that FTC are used as screening device giving the opportunity to have permanent contracts to the workers with good performances and better qualifications. The other one occurs at the end of the limit of the contract. This might happen because firms want to keep this worker but the only way to do it is to offer a permanent contract.

It is also important to refer that most of the studies consider only point-in-time transitions between the two types of contracts (Gash, 2008). This is suitable for situations when linear careers – transition from temporary to permanent work – are the majority cases in the labour market (Booth et al., 2002). However, nowadays this is losing the position as the dominant path of career in the labour market. Indeed, lifelong jobs are becoming less standard, and individuals prefer to choose the type of security that they want to have. Some of them prefer to be in a high-paid occupation with a more flexible contract – FTC – rather than be in a low-paid occupation with a permanent contract (Mattijssen et al., 2020).

3.1.2. Wage gap between FTC and OEC

If temporary contracts have the same level of desire as permanent ones, the wages in both types must be similar. If a worker has a temporary contract, for example, a FTC, (s)he should receive a higher wage than a worker with a permanent one to neutralize the risk of having less employment protection (Güell, 2000). However, Booth et al. (2002) find evidence, for Great Britain, that workers under temporary contracts earn lower wages than the ones under permanent contracts which leads to less satisfaction with their jobs and lower

levels of training. In addition, Mertens et al. (2007) find evidence for Spain and Germany of the wage penalty for workers under temporary contracts compared to workers under permanent contracts.

There are some reasons explaining why temporary workers do not earn compensation in comparison to permanent workers (Hagen, 2002).

First, the productivity of the worker may be an explanation for the wage gap between the two types of contracts. The literature points out that workers under fixed-term contracts tend to have lower levels of productivity when compared to the ones under permanent contracts (Bentolila et al., 2019). According to the basic literature, in a labour market under perfect competition, the wage of a worker should be equal to his/her marginal productivity. In line with this, differences in wages, under these circumstances, are related to differences in the productivity of the workers (Portugal, 2020). If the workers under FTC are less productive than the ones under OEC, it will be expected that the wages for permanent workers are higher than the ones for temporary workers. In addition, the EPL gap can also have an impact on this. Has shown by Dolado et al. (2021) the higher the EPL gap between contracts, the more effort workers under permanent contracts put into their job leading to higher levels of productivity and consequently, the possibility of earning higher wages.

Second, another important point for the analysis of the gap is the dual market theory. According to this theory, the labour market is divided into two segments: primary and secondary. The first one is characterized by workers with higher skills and the second one have workers with lower levels of the skill (Doeringer, 1970). The authors also defend that the workers under FTC are allocated into the secondary segment and the workers under OEC are in the primary segment. This theory predicts that the probability for the transitions from one segment to another very low which allows to conclude that temporary workers will face lower levels of wages in comparison to permanent ones (Doeringer, 1970).

Third, as pointed out by Booth et al. (2002) the wage gap observed between the two types of contracts can happen because temporary workers have small investments in specific human capital or because of their lower abilities. Indeed, firms tend to invest less in the training of workers under temporary contracts rather than in the ones under permanent contracts (OECD, 2014). Booth et al. (2002) conclude that when firms know the ability of the worker, they will offer a specific type of contract. For example, if the firms can observe that the worker have high abilities, they will give him or her a permanent contract which let

to invest in specific training. But, if this is not observable, the firm may offer a temporary one to test the level of the ability of the worker. This study concludes that the workers, who started working under temporary contracts, have in general lower abilities and will have a wage penalty for all their careers. However, this is only true if FTC are not used with the screening function.

Another reason is that workers under temporary contracts are outsiders and because of that, they have lower wages than the insiders (Hagen, 2002). Effectively, the insider-outsider theory defends that the type of contracts can influence on their wages and work conditions (Lindbeck & Snower, 2002). Indeed, as mentioned above, workers with permanent contracts have more wage bargaining power which allows them to negotiate higher wages than the workers with temporary contracts (Bentolila & Dolado, 1994). Consequently, the first ones can achieve better levels of wages which allow the tendency of the existence of the wage gap.

Silvério (2015) using a high dimensional fixed-effects model, considering fixed-effects for the worker, firm and job title, conclude for the existence of a wage penalty for FTC workers compared to OEC workers. In that same study, the author also concludes that temporary workers, in Portugal, tend to have characteristics related to lower wages which are in line with the literature of screening for temporary contracts. This means that the unobserved characteristics of the worker have a significant impact in the level of the wage penalty between contracts.

Apart from the wage penalty for FTC, it is possible to conclude that workers under FTC are concentrated in smaller firms and low-paying occupations. In these firms, especially in these occupations, the wage gap between workers under the two types of contracts is lower in comparison with the ones under permanent contracts (De la Rica, 2004). The author concluded that the observed skills of the workers explain most of the wage gap and a small part is explained by job characteristics. In addition, Mertens et al. (2007) concluded that workers under FTC are low-skill workers and are concentrated in the low-wage segment (secondary segment according to the segmentation theory).

Additionally, Loh (1994) argues that low-paid jobs under FTC are used as a sorting mechanism in which only the workers that have greater skills will want this kind of work because they know that they have a higher probability to obtain a permanent contract. In that case, FTC are an extension of the probation period. In line with this, Hagen (2002)

concluded that for some workers, FTC are a sorting mechanism and high-skill workers accept initially these contracts expecting to earn higher wages in the future.

Considering the impact on the wage gap of the different tasks performed by the worker, Kiersztyn (2016) show that the wages for temporary workers tend to be lower than the ones for permanent workers. In addition, interacting the type of contracts with the different tasks performed by the workers, the same author presents that all tasks under temporary contracts have a negative impact on wages. Despite the inclusion of additional variables to control for unobserved heterogeneity, the results remain unchanged which leads to the conclusion that FTC have, generally, a negative impact in the income of the workers compared to those under OEC (Kiersztyn, 2016). The author adds that there is one type of task, unskilled manual, that needs to have a cautious interpretation. Their results find a small wage penalty for them which may be related to the existence of a minimum wage, which represents a floor in the earnings not allowing firms to offer a wage under this limit. Manual workers tend to be stuck in that earning independently of what type of contract and for that reason they tend to have a lower wage gap.

3.2. Occupational structure

Apart from the increase in the use of temporary forms of work, the labour market faced other changes in the last years. Indeed, it is generally agreed that technology nowadays plays an important role in the economy and society. The introduction and adoption of new technologies caused structural changes in the labour market. Some evidence of these changes was observed in countries like the United States of America in which, technology leads a decrease in the demand for the low skilled workers and an increase for the high skilled ones. This theory was known as the Skill-Biased Technological Change theory (SBTC) (Autor & Katz, 1999; Katz & Murphy, 1992). Furthermore, this theory defends that technology is biased in favour of high-skill and more educated workers (Autor & Katz, 1999).

However, subsequent studies show that the SBTC theory does not explain the tendencies that are observed in the labour market. Autor, Levy and Murnane (2003) develop the ALM theory (also known as RBTC - Routine Biased Technological Change (Goos et al., 2009)), argue that computer capital and labour is seen as substitutes or complements depending on the type of the task. Prior to ALM theory studies have focused in the skill of the worker and after that the focus changed to the tasks performed by the workers besides their skill. If the worker performs non-routine tasks which involve a certain level of complexity, computers may be a complement. In contrast, if the worker has cognitive and manual tasks in which it is possible to find guides to do the tasks, the computers are substitutes for them. In the same study, the authors find that technology, in specific computerization, increases the labour demand for non-routine cognitive tasks and decreases for routine cognitive and manual tasks. Additionally, Goos and Manning (2007) defend that the tasks that have the complementary function of technology, are tasks usually associated with workers with higher-skills. However, there are some works performed by low-skilled workers that are not affected by technology and an example of that is cleaning, as pointed out by the authors. If the non-routine cognitive tasks include tasks with high and low-skilled workers, it is possible to conclude that an increase in the employment in this type of work will lead to the increase of employment of the low and high-skill workers. In addition, the workers who perform middle-skills tasks will face a decrease in their of employment levels (Goos & Manning, 2007). This process is called polarization.

Goos and Manning (2007) argue that polarization is the process in which technology leads to the increase of the demand for low and well-paid occupations. Using the model of

the ALM theory, they showed that routine tasks are performed by workers in the middle of the wage/occupational distribution and that workers who perform non-routine tasks are at the bottom and the top of the wage/occupational distribution.

According to the literature, there are many studies concluding for the existence of polarization such as Goos and Manning (2007) for the UK; Autor et al. (2006) for the US; Goos et al. (2014) for 16 European countries in which Portugal is included. In contrast to these results, Fernández-Macías (2012) find evidence for the process of polarization and upgrading in Europe. The author concludes that for example France, Germany and UK are facing polarization which is in line with the ideas of the routinization hypothesis (RBTC), but countries like Luxemburg, Denmark and Sweden are observing a process of upgrading which supports the idea of SBTC. Additionally, the author defends that Portugal and Spain are facing a mid-upgrading situation. In the specific case of Portugal, Fonseca et al. (2018) find evidence of polarization. They also conclude that this change was in the majority driven by technology changes, especially due to the transition of workers from manufacturing to the services sector. In addition, the authors show an increase in the employment level of workers that perform abstract tasks and a decrease in that workers that perform routine manual and routine cognitive tasks.

As mentioned above, the literature tends to study the changes in the occupation structure and the use of temporary contracts as separate subjects. However, recently, authors are trying to relate these two literatures once it is possible that the changes in the occupational structure may be related to the changes in the use of contracts. Berglund et al. (2022) find, for Sweden, that the combination of dualization and occupational change has severe consequences for the Swedish labour market. They also conclude that the increase of the high-paid occupations consists in permanent contracts, while in low-paid the predominant type is temporary contracts. Their study does not conclude the existence of wage inequality but concludes the existence of income⁵ inequality.

In addition, Kiersztyn (2016) conclude the existence of a relation between occupations and the use of temporary contracts. From another perspective and looking at wages and conversion of contracts, the author concludes that workers in high-status occupations tend to be used as screening devices to improve the quality of the matches

⁵ The income includes the wage, the number of hours worked and the stability of the work (Berglund et al., 2022).

between workers and firms. Despite the higher wage penalty between contracts that these occupations present, they tend to have a higher probability of conversion of the contracts. In the case of low-status occupations, they are used to adjust the work force when it is needed. In the same line, Reichelt (2015) concludes that, in the case of Germany, workers in occupations that requires low skills are used as a buffer stock which means that firms use them to react to adverse conditions in the economy. However, workers with high skills are used for screening.

4. Data Description

Section number 4 presents the description of the data considered in the analysis. First, subsection 4.1 describes the dataset and its advantages Subsection 4.2 summarizes the changes made in the data and describes the final sample of analysis.

4.1. *Quadros de Pessoal (QP)*

Quadros de Pessoal (QP) is a Portuguese matched employer-employee dataset which is conducted by the Portuguese Ministry of Labour, Solidarity and Social Security since the 1980s. The data is collected every year in October and covers all establishments with at least one wage earner. It covers almost every worker of the private sector in the economy, not only in manufacturing but also in the services sector. However, agriculture is a sector with low coverage in the dataset. In addition, self-employed, civil servants and household employees are not represented in the data.

The dataset encompasses information about the workers, firms and establishments. Variables such as gender, age, nationality, education, tenure, occupation, type of contract, wages and number of hours worked are characteristics of the worker. In addition, the number of workers, localization and type of economic activity are examples of firms and establishments characteristics.

Furthermore, the data related to wages, one of the topics of interest, is very complete and detailed. It is possible to find information about base wages, regular and irregular benefits and overtime payments. It also includes the number of normal and extra hours worked.

All workers, firms and establishments at QP have a unique number of identification which makes it possible to follow them across the years of the analysis. Additionally, every worker also has the code of the firm and establishment in order to match them with their employer.

Due to the fact that the fulfillment of the dataset is compulsory and that the information needs to be available in a public space, the dataset suffers less with problems of non-responses usually associated with household and firm surveys (Portugal, 2020).

Quadros de Pessoal was the data set chosen for the analysis due to the fact that it presents complete information about firms, workers and all of their relevant characteristics

for the objectives in the analysis. In addition, the compulsory of responses of this administrative dataset increases the reliability of the data.

4.2. Definition of the sample

This study uses firms and workers data for the period of 2010 until 2019.

The restrictions applied to the dataset are summarized below.

Firstly, duplicate records were removed⁶ in order to have no more than one observation for each worker in a specific year. In this case, the decision was to keep the first observation of the duplicates and drop all the other ones. In line with this, were also dropped observations in which all information about the worker was not totally repeated, but the worker appears more than one time per year in one firm. In these cases, the decision was to kept in the analysis the main job represented by the job in which they have more hours of work⁷.

In addition, the sample includes full-time employees⁸ with a valid identifier – with at least 6 digits – age between 18 and 67 years old, with a complete period of work and a full base wage.

Considering the data related to firms, at first, were dropped all the observations of firms with public capital due to the lack of representation of the public sector, which means that only firms with private capital were considered. In terms of localization were only analyzed firms located in mainland Portugal⁹. Lastly, firms from sectors such as Agriculture, Fishery and Activities of international organizations and other extraterritorial institutions, were also excluded.

Lastly, it is also important to refer that when the two datasets – worker and firm - were merged one last change was made in it. This one is related to the decision to keep the largest connected set¹⁰. The objective of this adjustment is to guarantee that is possible to compare between the estimation of fixed effects (Silvério, 2015). Torres et al. (2013) defend that in a practical way what is done is to consider a restriction for every “mobility group”. A

⁶ In this process the loss of observations was 2.4% of the observations.

⁷ In the cases where the number of hours worked is equal or zero, the criteria to choose which observation to keep is random.

⁸ Observations related to employers and other classifications were not considered.

⁹ This decision is based due to the lack of representation of Azores.

¹⁰ In this process were dropped 3.3% of the observations.

“mobility group is included by all workers and firms that have a connection in a moment of the time (Abowd et al., 2002). In a mobility group, it is expected that, for example, at least one worker in firm A that as already worked in firm B. If this is true, the two firms are related due to the fact that they have a worker that has worked in the two of them. In this case, is possible to conclude that the group of people and firms is connected. In the opposite way, when the group is not connected to another group, this means that the workers of the first one has never been employed by a firm that belongs to the second group or that never a firm of the first group have employed a person of the second group (Abowd et al., 2002). If the sample of analysis has more than one “mobility group”, this entails that the coefficients obtained do not be comparable across the different groups. A solution to this is to keep the largest “mobility group” (Torres et al., 2013). Since the objective of the analysis is to use estimations of fixed effects, this change was made to guarantee the comparison of the estimations¹¹.

In terms of the wages, only real wages were considered which means that nominal wages needed to be deflated. To change from nominal to real wages was necessary to use the Consumer Price Index (IPC) and the base taken into account was the year 2012. A variable related to wages was created. It is the real hourly wage which includes the base wage, the regular benefits and the overtime payments. In this case, the number of hours that were used are normal and extra hours.

In order to study the occupations and tasks performed by the workers it is necessary to use a division for the different types of tasks of the Portuguese labour market. In line with that, the division followed was proposed by Acemoglu and Autor (2011) in which tasks were divided into more to less complex and demanded. There are (i) non-routine cognitive analytical task (NRCA), (ii) non-routine cognitive interpersonal task (NRCI), (iii) routine cognitive task (RC), (iv) routine manual task (RM) and (v) non-routine manual physical task (NRMP)¹². To allocate every occupation to their task is necessary to use the O*NET descriptors. With these is possible to recode the occupations into the International Standard Classification of Occupations from the International Labour Organization (ISCO-08). Araújo (2019) calculated a weighted average of the Portuguese occupations (2-digit) to allocate them into the five categories mentioned above. In line with Maia (2019) the division

¹¹ To analyze how is the mathematical process behind this change see Abowd, J. M., Creecy, R. H., & Kramarz, F. (2002). Computing person and firm effects using linked longitudinal employer-employee data. .

¹² For simplification, in this analysis the fifth category, non-routine manual physical task (NRMP) will be referred as manual (M).

of the occupations adopted is the one of Araújo (2019) . The allocation of the different tasks to the main category is presented in annex A Table 5.

To conclude, the final dataset of the analysis has 16 859 257 observations. All variables used in the models are described in annex A Table 4.

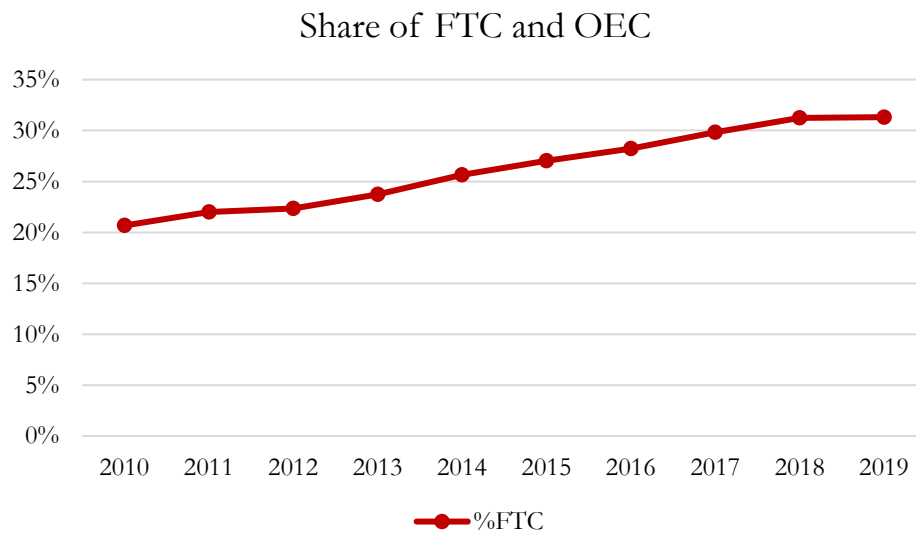
5. Fixed-term contracts and occupational tasks in Portugal

Section 5 presents some descriptive evidence about the use of fixed-term contracts in the Portuguese labour market and in the distribution by occupational tasks. First, subsection 5.1 summarizes the use of temporary and permanent contracts in the Portuguese labour market in the period between 2010-2019. It is followed by subsection 5.2 which presents a characterization of the wages. Subsection 5.3 has a description of the different tasks performed by the workers and their distribution among the two types of contracts relevant for the analysis. Last, subsection 5.4 resumes some evidence for the conversion from FTC to OEC.

5.1. The use of FTC and OEC

Due to the fact that the main objective of this dissertation is to analyze the wage gap and conversion between FTC and OEC, it is important to look at descriptive evidence of temporary contracts and the characteristics of workers under these contracts.

Firstly, in the Portuguese labour market is possible to observe that from 2010 until 2019 the weight of FTC in the number of employees increased as suggested by Figure 1.



source: author's calculations using Quadros de Pessoal data

Figure 1 – Share of FTC and OEC in Portugal between 2010-2019

However, the share of people under permanent contracts continues to be dominant in the Portuguese labour market. Indeed, in 2019, 31.3%¹³ of workers were under temporary contracts and 68.7% were workers under permanent contracts¹⁴. In 2010, 20.7% of the workers were under FTC while 79.3% have OEC.

Considering the workers under FTC, young workers - up to 35 years old - are the ones that have more of these types of contracts – 49.7%. Further, in the case of OEC, the distribution of these contracts between the different age groups is more similar. 26.5% of them have less than 35 years old, 33.3% have between 35 and 45 and 26.6% have between 45 and 55 years old.

In terms of gender, there are more men with FTC and OEC compared to women. These results are not a surprise once there are more employed men in the sample of analysis. Considering nationality, the results also show the dominance of native workers in the Portuguese labour market compared to immigrants¹⁵.

Analyzing the educational level, the conclusion is similar in all types of contracts. For workers under temporary contracts, the majority of them have as their highest level conclude the basic level - 50.9% of workers under FTC concluded the basic level. In this category of contracts, the more qualified workers present the lowest share of fixed-term contracts - 17.9% for workers with college and 31.2 with secondary. In terms of the workers under permanent contracts, the conclusions are similar. More qualified workers have a lower share of permanent contracts while workers with a basic level of education present the highest share - 19.8% for more qualified workers and 54.4% for less qualified workers (annex B Table 10). This happens due to the highest presence of workers with lower levels of qualification in the Portuguese labour market.

¹³ This analysis includes only fixed-term contracts and open-ended contracts which can mean that the shares presented may be higher than the official statistics that includes other categories of contracts.

¹⁴ In annex B Table 6 are presented the absolute values and the share of workers for all years in analysis.

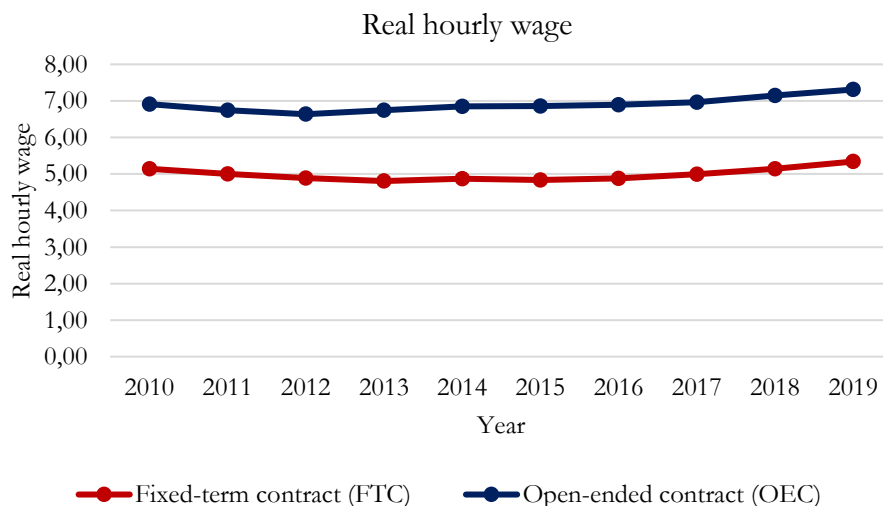
¹⁵ To complement the analysis, see annex B Tables 7, 8, 9.

5.2. Wages

In addition, for the study of the wage gap is necessary to understand and characterize the Portuguese labour market in terms of wages. It is possible to conclude that, during the period of analysis, considering the age group, the average of the real hourly wage follows the typical tendency to increase with the years of experience in the labour market¹⁶.

Considering the two measures of wages and gender, in both cases, the average and median wages for men are higher than for women. The same happens when it comes to the analysis of nationality. In every case, immigrants have lower real hourly wages in comparison to the ones that have Portuguese nationality.¹⁷

Comparing wages between workers under FTC and OEC, the real hourly wages (Figure 2), has increased slightly through the years. However, at some point, it was possible to find a decrease related to the periods of the Portuguese sovereign debt crisis. In the last year considered, the level of the wage in every case of study was higher than it was at the beginning of the period – 2010, which traduces into an increase of 3.8% of the average real hourly wages for workers under temporary contracts and an increase of 5.8% of the average real hourly wages for workers under permanent contracts. This analysis, which does not control for any other variables, suggests the existence of a wage gap in absolute terms between FTC and OEC¹⁸.



source: author's calculations using Quadros de Pessoal data

Figure 2 - Real hourly wage in Portugal between 2010-2019

¹⁶ See annex B Table 11.

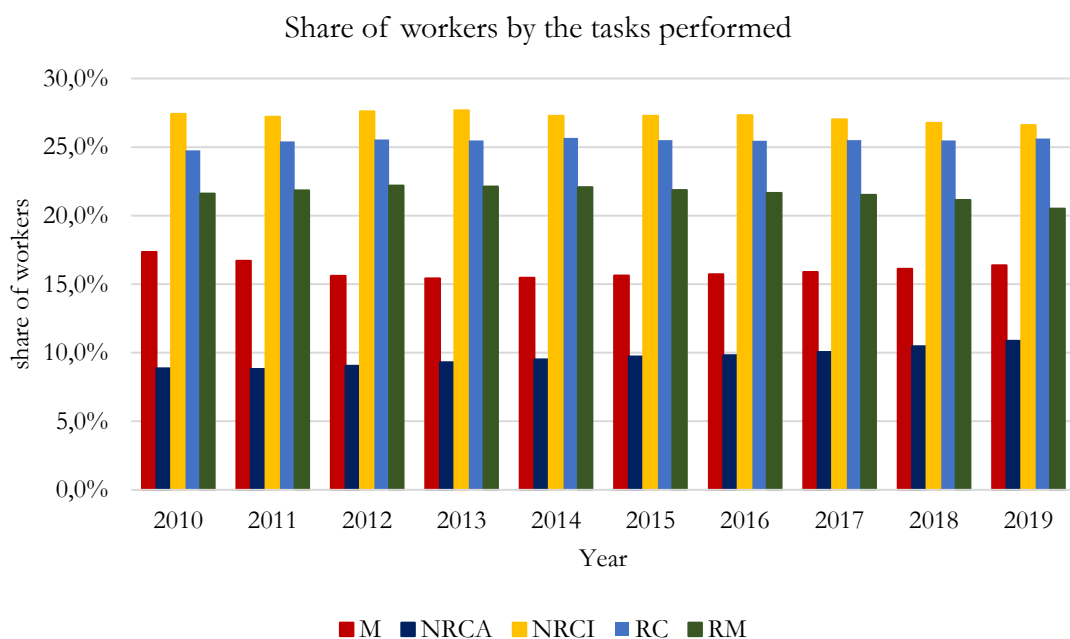
¹⁷ Consult in statistics in annex B Tables 12, 13.

¹⁸ The detailed descriptive statistics are in annex B Table 14.

5.3. Tasks

Analyzing the evolution of the tasks in the Portuguese labour market in the period considered, it is possible to observe through Figure 3 that the category that presents the highest representation of workers is NRCI tasks – 26.6% of the employees perform this task. This category is followed by RC and RM that includes, respectively, 25.6% and 20.5% of number of employees in the analysis sample. NRCA arises as a category less represented with only 10.9% of the total of workers.

In terms of the analysis of the share of workers by tasks during the years, it is noticeable the increase of the share of workers performing non-routine cognitive abstract tasks. Routine cognitive also present an increase in their share in the Portuguese labour market. The remaining tasks – manual, non-routine cognitive interpersonal and routine manual – show a decrease in the share of the number of total employees¹⁹.



source: author's calculations using Quadros de Pessoal data

Figure 3 – Share of workers by the type of tasks performed in the Portuguese labour market between 2010-2019

¹⁹ Annex B Tables 15, 16.

Analyzing the distribution of the tasks for the different types of contracts, the results seem to differ.

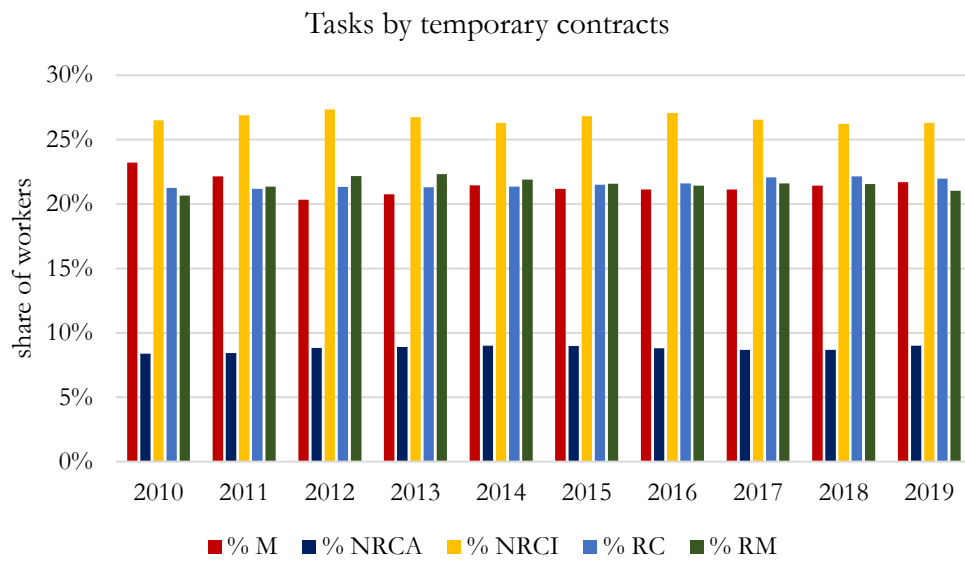
First, workers under FTC (Figure 4) tend to perform more non-routine cognitive interpersonal tasks, representing in 2019 26.3% of the workers. This category is followed by manual, routine cognitive and routine manual which have a similar weight in temporary employment, representing 21.7%, 22.0% and 21.0% of number of workers under FTC, respectively in 2019. Clearly, non-routine cognitive abstract shows the less significant representation in FTC - 9.0% of number of workers under temporary contracts. It is also important to refer that, manual tasks and non-routine cognitive tasks lost some weight in the total of workers under temporary contracts²⁰.

Second, for workers under permanent contracts (Figure 5), the distribution of tasks differs. Non-routine cognitive interpersonal and routine cognitive have a higher representation in the labour market – representing 26.7% and 27.3% of the workers under OEC. In addition, manual tasks present lower representation in the labour market when the workers are under permanent contracts compared to workers under temporary contracts - 14.0% in 2019. In line with the results for workers under FTC and OEC, non-routine cognitive abstract is the task with the small weight in the labour market²¹.

Comparing the two tables, it is visible the difference that M tasks present in the total of the two types of contracts. Indeed, workers under FTC show a higher share in this task compared to workers in the same task but with OEC. In addition, workers performing RC tasks also seem to have a different weight in the total of workers under the two types of contracts. In this case, this task in workers under permanent contracts are the more represented task in the weight of tasks by contract, compared to workers under temporary contracts in which routine cognitive tasks appears as the second most representative task.

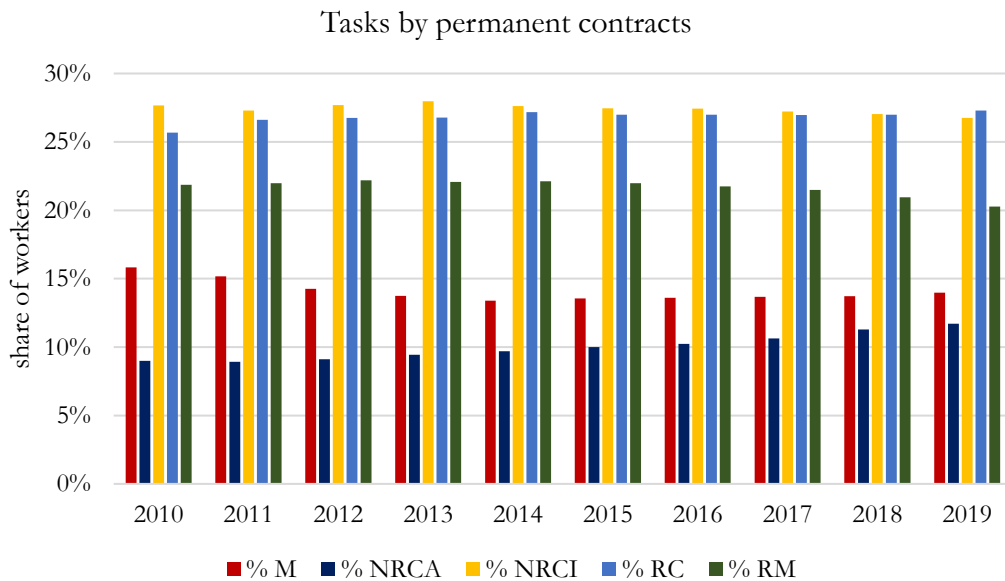
²⁰ Complementary information in annex B Table 17.

²¹ Complementary information in annex B Table 18.



Source: author's calculations using Quadros de Pessoal data

Figure 4 -Distribution of the tasks for temporary contracts (FTC)

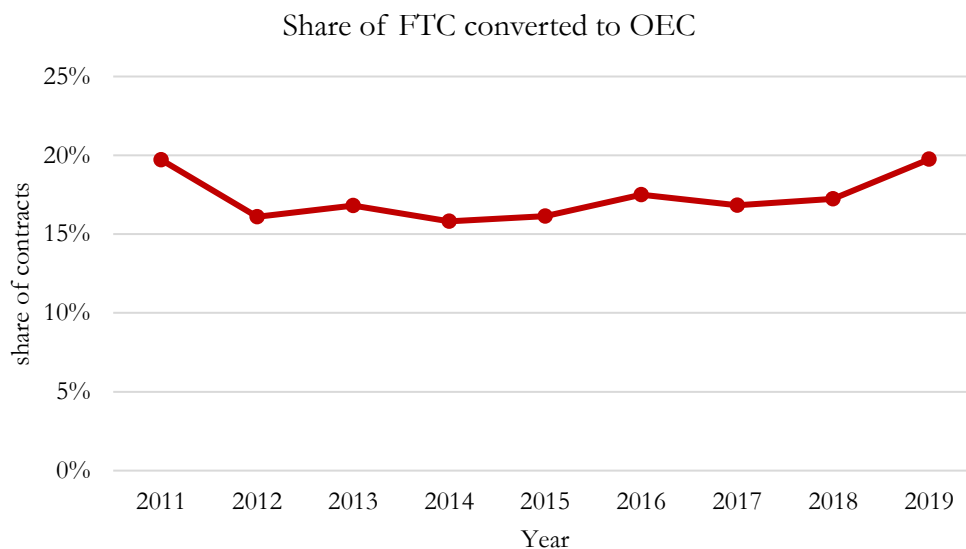


Source: author's calculations using Quadros de Pessoal data

Figure 5 - Distribution of the tasks for permanent contracts (OEC)

5.4. Conversion

The other relevant point for the analysis is the conversion of the contracts. Analyzing the results obtained when created the variable, it is possible to conclude that the levels of conversion from FTC to OEC increased during the period 2011-2019²². However, looking at Figure 6, which considers the share of contracts converted from FTC to OEC compared to the contracts that were not converted, the analysis changes. Indeed, the weight that converted FTC have on the labour market remains similar considering only the first and last year of analysis, 2011 and 2019 – 19.7% in these two years. Even though, the behavior of the share in 2011 and 2019, during the intermediate years, the share has slightly changed – on average, between the period of analysis the share represented 17.3% for contracts converted from FTC to OEC.



Source: author's calculations using Quadros de Pessoal data

Figure 6 - Share of Contracts converted from FTC to OEC in Portugal between 2011-2019

²² Consult annex B Tables 19, 20.

6. Estimation of the probability of conversion from FTC to OEC

This dissertation aims to study the heterogeneity of FTC among occupational tasks. For this, in section 6 is studied the conversion of contracts from FTC to OEC. It is divided into four subsections. Subsection 6.1 presents a literature review about the models that are usually adopted to estimate the conversion of contracts. In line with this, subsection 6.2 shows some explanations about the model considered to be the better option to reach the objectives of this dissertation. Subsection 6.3 specificizes the equation considered to estimate as well as the variable that are included in it. Last, subsection 6.4 resumes the results obtained and the discussion of these results.

6.1. Different approaches to estimate the conversion of contracts

The literature presents a variety of methods use to estimate the conversion from FTC to OEC due to the fact that the analysis of the transition between these two types of contracts depends on the perspective that is adopted by the authors, the final objectives of the studies and the type and characteristics of the data available.

Gash (2008) used competing risk models to analyze the transitions of workers under temporary contracts to permanent contracts or to unemployment. The particularity of these models is that they can study more than ways of exiting from temporary employment. In addition, the author considered a piecewise constant exponential model that allows understanding if the risk of exit for other forms of work or for inactivity or unemployment decreases or increases in the period considered.

Güell and Petrongolo (2000) chose time hazard functions due to the structure of the panel data available for the study. This model allowed to know the risk of the ending of the fixed-term contract. To study the cases where the ending of the FTC was due to transition to a permanent one, the authors used a competing risk model that helps to understand the different types of exits from temporary contracts.

Portugal and Varejão (2022) studied the transitions between FTC and OEC from two different perspectives. Their objective was to understand what types of employers convert contracts and what are the employees that have their contracts converted. For their first question, they decided to use a beta-binomial model because these models analyze the probability that an event (the conversion of the contract) occurs in the different trials

depending on the unobserved characteristics of the workers. For their second question – the part of the employee – the model considered was a cause-specific hazard model to distinguish between the different possibilities of exiting from a fixed-term contract. As the dependent variable was the duration of the contracts, a complementary log-log model was adopted to treat the discrete variable related to the time.

Beyond these perspectives, there are others that focus on different approaches to the logistic models (McGinnity & Mertens, 2002) in order to understand if FTC are a bridge to permanent work or a trap of unemployment considered a multinomial logistic regression (an extension of the binary logistic models) to analyze the transitions to unemployment and to permanent contracts. Kiersztyn (2016) to explain the transitions to OEC, used a random-intercept logistic model. Polavieja (2003) adopted logit models to study the probability that new entrants of the labour market have an open-ended contract. It is also important to refer that the author considered “new entrants” all workers that have transited from temporary to permanent employment and workers that have transited from other situations.

6.2. Binary choice models

To estimate the conversion from FTC to OEC was created a binary variable named conversion which takes the value 1 in case the contract is converted to an OEC and 0 otherwise. One contract is considered converted if in the year t the worker has a permanent contract and in the year $t-1$, the same worker has a temporary contract. In addition, it was considered for the creation of the variable that the employer remained unchanged during this transition. Since the objective is to analyze if the contract was converted or not, the variable conversion was the best choice for the dependent variable of the model. In that case, only models with binary variables as dependent variables were accepted.

The first model that the literature presents is the Linear Probability Model (LPM). The LPM consists of a particular case of the binary regression model in which the dependent variable takes the value 1 or 0 and depends on the independent variables. However, in this model the coefficients can assume values out of the interval $[0,1]$ and it is known that the probability has to be always between this interval (Aldrich & Nelson, 1984; Verbeek, 2017).

The logit models arose as a solution for the problems associated with the last models. Logit models measure the log-odds of an event occur comparing to this event not occur. It includes a binary dependent variable and independent variables that can take the form of

binary or continuous variables. In this model, the probability obtained by the estimation of located between the interval of $[0,1]$ which means that the problems associated with the LPM are exceeded. As in the LPM, the coefficients of logit models are estimated by the method of the maximum likelihood (Verbeek, 2017).

6.3. The model adopted

In this study, for the analysis of conversion between contracts, the model adopted consists of a logit model. The specification and the variables are summarized below

$$Conversion_{i,f,t} = \beta X_{i,f,t} + \gamma Task_{i,f,t} + \lambda_t + \varepsilon_{i,f,t} \quad (6.1)$$

$Conversion_{i,f,t}$ represents a dummy variable that assumes the value 1 in the case that the worker i ($i=1, \dots, N$) working at firm f ($f=1, \dots, F$) at year t ($t=1, \dots, T$) with a FTC in the year $t-1$ has his/her contract converted to a OEC in year t . The variable $Task_{i,f,t}$ consists in an inclusion of dummy variables for every type of task considered. $X_{i,f,t}$ represents a set of variables that controls for workers. Some of them are, squared term of age, educational level, gender, nationality, tenure, squared term of tenure, Economic Activity of the firm (CAE), localization and the log of dimension of the firm. Last, the regression also includes time dummies (λ_t), to control for the macroeconomic effects.

6.4. Discussion of the results

Considering equation (6.1), the results in Table 1 column (1) show that, in comparison with the base category (manual tasks), all tasks have a positive impact on the conversion of contracts. This means that manual workers are less likely to have their contract converted from FTC to OEC, *ceteris paribus*. However, the results do not show conclusions about the dimension of this impact. To measure the impact is necessary to consider the marginal effects of the variables. These results are presented in Table 1 column (2). From the analysis of the average marginal effect of a worker having their contract converted when he/she performs a specific task, the results show that non-routine cognitive interpersonal workers, compared with manual workers are the ones with a higher probability on the

conversion of the contract. Indeed, these workers are more likely to have their contract converted (their probability of conversion compared to manual workers increases, on average, by 2.8 percentage points, *ceteris paribus*). The following workers with the most significant impact on the conversion are the workers performing routine cognitive tasks with an increase of 1.9 percentage points in the probability of conversion when compared to the workers of manual tasks, *ceteris paribus*. Last, routine manual and non-routine cognitive abstract tasks workers have similar increases in the probabilities of having their contract converted compared to workers performing manual tasks. On average, they are more likely of having their contract converted on 1.4 and 1.3 percentage points, *ceteris paribus*.

These results are in line with the literature (Kiersztyn, 2016). First, non-routine tasks are more associated with higher levels of conversion. As mentioned above, tasks such as NRCI, which is constituted by high and medium-skill workers, present a higher average marginal effect, compared to manual tasks. However, the marginal average marginal effect of NRCA workers is slightly lower which may be associated with the heterogeneity of activities included in this occupational task given that it included not only experts, but also technicians. Nonetheless, to conclude for this further studies are necessary. The results for the routine tasks are expected to be lower than the non-routine ones given that routine tasks tend to involve less skill and they are easier to replace (Autor, Levy, Murnane, et al., 2003). From the analysis, it seems that NRCI workers compared to manual tasks, are the ones in which FTC are more likely to be used as a screening mechanism in which fixed-term contracts are an extension of the probationary period to understand if it is or is not a good match for the firm. However, since workers performing manual tasks are less likely to have their contract converted from FTC to OEC, it is expected that they tend to have a higher probability of having FTC being used as buffer stock. In that case, firms use temporary contracts in order to adjust their labour force in macroeconomic fluctuations. Similar to the other results this is in line with the literature of Kiersztyn (2016).

For the analysis of Table 1, it is possible to conclude that in line with the evidence presented in the literature age and tenure at the firm present a relation that traduces in have, initially a higher probability of conversion but, at certain point this probability that continue to exists is small, compared to the beginning. In addition, it is possible to conclude that workers that have studied at a secondary or a college level, when compared to workers who only have in maximum the basic year, are more likely to have, on average, their contract

Table 1 - Conversion of contracts in Portugal between 2011-2019

Conversion	Coefficients (1)	Marginal effects (2)
NRCA	0,09083*** (0.00739)	0.01309
NRCI	0,19792*** (0.00568)	0.02751
RC	0,13910*** (0.00562)	0.01914
RM	0,10149*** (0.00553)	0.01377
tenure	0,11538*** (0.00172)	-
tenure ²	-0.00510 (0.00012)	-
age	0,00862*** (0.00108)	-
age2	-0,00011*** (0.00001)	-
secondary	0,10933*** (0.00405)	-
college	0,26061*** (0.00525)	-
female	-0,06985*** (0.00347)	-
industry	0,39220*** (0.00721)	-
services	0,26054*** (0.00678)	-
dim	0,11221*** (0.00085)	-
<i>Norte</i>	0.10492*** (0.00807)	-
<i>Algarve</i>	-0.21583*** (0.01078)	-
<i>Centro</i>	0.06298*** (0.00840)	-
<i>Lisboa</i>	0.03765*** (0.00816)	-
constant	-2.26502*** (0.02310)	-
year	Yes	
N = 2 916 203		
Pseudo R ² = 0.0194		
Log pseudolikelihood = -1328887.7		

Notes: The standard errors presented are clustered at the worker level. *** 1% significant, **5% significant
*10% significant. source: author's calculations using *Quadros de Pessoal* data

converted, *ceteris paribus*. As expected, woman and immigrants are, on average, less likely to have their contract converted from FTC to OEC, compared to man and native workers, *ceteris paribus*.

7. Estimation of the wage gap between FTC and OEC

Section 7 presents the adopted econometric model to estimate the wage gap between temporary and permanent contracts and its heterogeneity among occupational tasks. It is divided into 4 subsections. Subsection 7.1 summarizes the principal models adopted by the literature to estimate the wage gap. Subsection 7.2 presents a description of the model that is more adequate to use in the study of the wage gap in this dissertation. In subsection 7.3 is introduced the equation considered in the analysis as well as the description of the variables included. Finally, subsection 7.4 reports the results of the estimations of the study and the discussion of the results obtained.

7.1. Different approaches to estimate the wage gap

As mentioned in the section of the wage gap, it is possible to state that the literature concludes for the existence of a wage penalty for FTC in comparison to OEC. Despite the common conclusions, there is not a consensus about what method is the most appropriate to estimate the wage gap. The decision of what method to use may be influenced by the data available in the different countries and by the type of analysis the authors want to do.

First, there are models based on the traditional Mincerian wage equation in which is possible to add a control for the type of contract of the worker. Nonetheless, estimating a model of the wage gap may have some problems related to the level of sensitivity of the observable controls that are included in the model which could mean that exists a bias in omitted variables (Pfeifer, 2012). In addition, these models could also have another problem related to heterogeneity. This happens when unobserved characteristics of the workers are correlated with the regressors included in the model which leads to biased estimates. That is why researchers tend to adopt models of fixed effects once they have a property of control over the unobserved time-invariant characteristics.

Second, the other perspective defends that the type of contract may have a correlation with unobservable characteristics that influence the wage, when it is a choice variable. If is not introduced in the model a correction for the selection problem, the estimates will be biased. The issue can be solved by introducing in the model the Heckman correction to the standard OLS regression (Hagen, 2002). However, due to their strong assumptions, these models have received some criticism because of their strong assumptions (Silvério, 2015).

Apart from these two perspectives, it is possible to find in the literature other methods of estimations. Mertens et al. (2007) used a quantile regression in order to understand if the wage gap changes along the wage distribution. De la Rica (2004) estimate two different regressions one for workers under FTC and another one for workers under OEC.

7.2. The high dimensional fixed-effect model

The interest in the use of models with fixed effects arose to control for the unobserved heterogeneity existent among certain groups of observations. In addition, the increased availability of micro datasets was also an important point for the interest in this topic (Guimarães & Portugal, 2010).

In a practical way, fixed-effects models consist of an addition of a set of variables – dummy variables – that absorb group-specific heterogeneity controlling the variability that exists between these groups (Guimarães & Portugal, 2010). More specifically, it consists of a within transformation which is added to the model dummy variables for every category of the fixed-effects (Wooldridge, 2010). However, this within transformation is not possible to implement in two specific situations: when the datasets are large and when the objective is to add more than one fixed effect (Correia, 2016). It is also important to refer that the addition of the dummy variables does not have an easy implementation especially in the cases of high dimensional fixed-effects models. Indeed, in the study of labour economics is important to account for more than one fixed effect – usually one fixed effect for the worker and another for the firm – which make not feasible an introduction of dummy variables because of the large number of group for workers and firms (Guimarães & Portugal, 2010). Gormley and Matsa (2014) showed that these limitations really exist.

With the objective to overcome these limitations, there were efforts to develop feasible and computationally efficient models that estimate for more than one fixed effects (Correia, 2016).

Abowd et al. (1999) were the first authors to propose a model to estimate high dimensional fixed effects in order to account for two fixed effects – worker and firm. In their work, they found a solution that provides approximate estimations to the least squares linear regression. Some years later, Abowd et al. (2002) created an algorithm that gave the exact least square solution of the linear regression model with two fixed effects. In line with this

Guimarães and Portugal (2010) developed a model based on a Gauss-Seidel iterative algorithm in which is possible to have the exact least square solution for linear regression models with tow or even more high dimensional fixed-effects.

It is also important to refer that high dimensional fixed-effects models are very computationally intensive which could be a problem some years ago and could influence the results obtained in estimations of the models mentioned above. However, due to the improvements in the quality and availability of the panel datasets and due to the evolution of econometric tools and technology in recent years, it is possible to have new information about the models and a higher liability in the results obtained (Torres et al., 2013).

Nevertheless, Guimarães and Portugal (2010) argue that all of the methods mentioned above could not lead to consistent estimations because this one is only achieved when the dimension of the groups does not have any relation with the size of the sample in analysis. This only can happen if the number of parameters keeps the same even when the sample size tends to infinity.

7.3. The model adopted

In this study, for the analysis of the wage gap the model adopted consists of a high dimensional fixed-effects model²³. The specification and the variables are summarized below.

$$w_{i,f,t} = \alpha_i + \theta_f + \gamma_t + \delta FTC_{i,f,t} + \lambda Task_{i,f,t} + \beta X_{i,t} + \varepsilon_{i,f,t} \quad (7.1)$$

$w_{i,f,t}$ is the natural logarithm of the real hourly wage of the worker i ($i=1, \dots, N$) working at firm f ($f=1, \dots, F$) at year t ($t=1, \dots, T$). γ_t is composed by a group of annual dummies that control for time trends and capture macroeconomic effects. $FTC_{i,f,t}$ is a dummy variable that takes the value 1 if the worker has a FTC and 0 when the worker has an OEC. $Task_{i,f,t}$ represents one binary variable for each different types of tasks performed by the worker (NRCA, NRCI, RC, RM, M). $X_{i,f,t}$ represents a set of individual controls for the worker such as the age of the worker, quadratic term of the age, tenure at that firm, quadratic term of the

²³ The algorithm followed is the one proposed by Guimarães, P., & Portugal, P. (2010). A simple feasible procedure to fit models with high-dimensional fixed effects. *The Stata Journal*, 10(4), 628-649.

To estimate the regression in Stata the command used is the “*reghdfe*” developed by Correia, S. (2016). A feasible estimator for linear models with multi-way fixed effects. *Preprint at <http://scoreia.com/research/hdfe.pdf>*.

tenure at the firm, highest level of education completed and the dimension of the firm. In addition, a_i is the fixed effect of the worker which controls for observed and unobserved time-invariant characteristics and θ_j represents the fixed effect for the firm which controls for observed and unobserved firm time-invariant characteristics. In this model the parameter of interest is the one associated with the variable $FTC_{i,j,t}$.

7.4. Discussion of the results

For the analysis of the wage gap between FTC and OEC the first step followed was to use a regression with fixed effects. Indeed, as mentioned above, a simple OLS regression²⁴ is not the best option to choose because it is possible that the worker has unobserved characteristics that may be related to the independent variables of the model. When an explanatory variable is correlated with the error term, one of the Gauss-Markov assumptions is violated. Since this happens, the estimations of the regression may be inconsistent. To solve this issue are applied in the model fixed effects for the worker and the firm.

The regression presented includes fixed effects for the worker and firm. In addition, it includes variables of control for the worker and the firm such as age, level of schooling and tenure. The results are summarized in Table 2. According to this estimation, it is possible to conclude that, for Portugal, workers under FTC seems to have, on average, a wage penalty compared to workers with OEC. For the analysis is possible to understand that workers under temporary contracts tend to earn less 2.9 %²⁵ than the permanent workers, *ceteris paribus*. Considering a OLS regression, without worker and firm unobserved heterogeneity, which has the limitations mentioned above, the wage gap between FTC and OEC is approximately 6.2%. This could mean that the specific fixed effect for the worker, which controls for the observed and unobserved time-invariant characteristics of the worker, is responsible for a significant part of the wage gap. This is in line with the results of Silvério (2015) that shows that the effect of the worker is responsible for a relevant part of the wage gap. Although the facts mentioned, to reach this conclusion additional studies need to be done. These first results are in line with the literature that points to the existence of this wage gap between contracts.

²⁴ The results of OLS are presented in annex C Table 21.

²⁵ For the interpretation of dummy variables the results presented follows this formula: $(e^{\text{coefficient}} - 1) * 100$.

In terms of the types of tasks performed by the workers, only routine manual workers receive lower wages, on average, when compared to manual tasks, which means that workers performing this task have a wage penalty of 0.5%, on average, *ceteris paribus*. All of the other tasks present a positive impact on wages compared to the manual ones. Although performing the remaining tasks lead to a wage premium, the dimension of this impact is heterogeneous the tasks.

Furthermore, workers performing non-routine cognitive abstract, non-routine cognitive interpersonal and routine cognitive earn higher wages, on average, compared to workers performing manual tasks, *ceteris paribus*. As expected, non-routine cognitive abstract tasks are the ones that present the higher wage premium. When compared to the workers in manual tasks, non-routine cognitive abstract workers tend to earn, on average, more 5.5%, *ceteris paribus*. This category is followed by workers performing non-routine cognitive interpersonal that receive, on average, more 4.9%, compared to manual workers, *ceteris paribus*. Routine manual tasks present the opposite conclusion of the other variables. The results point to the fact that workers performing routine manual tasks have, on average, a wage penalty of 0.5%, *ceteris paribus*. In comparison to the OLS regression, the dimension of the impact of the tasks on wages decreases significantly which may show that individual unobserved characteristics have an important impact on the definition of wages. This results are in line with the literature of Kiersztyn (2016).

The remaining variables present the expected results. Age and tenure do not have a linear growth in their coefficients. Indeed, they present higher growth rates in the first years of the workers at the labour market, but at a certain point, this growth gets smaller. In addition, education has a positive impact on wages. Workers with university degree receive, on average more 5.3% compared to the ones with only the basic education, *ceteris paribus*. The dimension of the firm has also a positive impact on wages.

Table 2 - Estimation of the wage gap between FTC and OEC in Portugal

Log real hourly wage	Worker and firm FE (2)
FTC	-0.02956*** (0.00023)
NRCA	0.04760*** (0.00082)
NRCI	0.04160*** (0.00059)
RC	0.02127*** (0.00055)
RM	-0.00490*** (0.00050)
age ²	-0.00022*** (0.00000)
tenure	0.00656*** (0.00005)
tenure ²	-0.00017*** (0.00000)
secondary	0.00484*** (0.00086)
college	0.05133*** (0.00028)
dim	0.03991*** (0.00028)
constant	1.85548*** (0.00306)
N = 16 813 763	
R-squared = 0.9516	
Adj R-squared = 0.9405	
Within R-squared = 0.0345	
Root MSE = 0.1269	
Notes: The standard errors presented are clustered at the worker level. *** 1% significant, **5% significant *10% significant. The parameter pf the linear variables “age” and “gender” cannot be identified due to the inclusion of worker and year fixed effects. <i>source: author's calculations and Quadros de Pessoa</i>	

Since the main objective of this dissertation is to study the occupational heterogeneity of workers under fixed-term contracts, it is added to the model of equation (7.1) interactions for the variables related to the tasks and the type of contract. These results are presented in Table 3. The results obtained are quite interesting. The variable FTC continues to show the existence of wage penalty for workers under temporary contracts when compared to the ones under permanent contracts - on average, FTC workers performing manual tasks receive less 1.7% than OEC workers performing the same tasks, *ceteris paribus*.

For the analysis of the table, it seems that workers under permanent contracts have, on average, wage premiums for the different types of tasks performed in comparison to manual workers, being everything else equal. In addition, non-routine cognitive abstract workers presents the higher premium on the wages, *ceteris paribus*. Similar to the model presented in Table 2, only routine manual workers receive, on average, lower wages, compared to manual workers, *ceteris paribus*.

In terms of the tasks and the type of contract associated, it seems for the analysis that all of them, compared to manual tasks, are associated with a wage penalty between temporary and permanent contracts, *ceteris paribus*. It is also important to refer that comparing to the results for Table 2, without the interaction between the variables, only routine manual workers presented a wage penalty comparing to manual tasks, *ceteris paribus*. For the analysis, it seems that non-routine cognitive abstract workers and routine cognitive workers presents a higher wage penalty between FTC and OEC, compared to workers performing manual tasks, *ceteris paribus*.

The results presented above are not a surprise since the literature has already found evidence for the existence of a wage gap between workers under temporary and permanent contracts (Mertens et al., 2007). Considering the different tasks that the worker performs, the literature points to a higher wage penalty for non-routine occupations and a lower wage penalty for manual occupations (Kiersztyn, 2016). The results seem to be in line with this idea, once tasks such as NRCA, compared to manual workers, seem to have a higher wage penalty for fixed-term contracts.

In line with the results of the regressions, it is possible to observe that seems to exist heterogeneity of the wage gap between the different types of tasks performed by the workers in the Portuguese labour market.

Table 3 - Estimation of the wage gap between FTC and OEC in Portugal in the period of 2010-2019 - Interaction of task variables with contract variable.

Log real hourly wage	Worker and firm FE
FTC	-0.01693*** (0.00047)
NRCA	0.05893*** (0.00086)
NRCI	0.04791*** (0.00064)
RC	0.03044*** (0.00059)
RM	-0.00422*** (0.00053)
FTC*NRCA	-0.03138*** (0.00090)
FTC*NRCI	-0.01377*** (0.00061)
FTC*RC	-0.02340*** (0.00062)
FTC*RM	-0.00033 (0.00056)
age ²	-0.00021*** (0.00000)
tenure	0.00659*** (0.00005)
tenure2	-0.00016*** (0.00000)
secondary	0.00495*** (0.00038)
college	0.05163*** (0.00086)
dim	0.03981*** (0.00028)
constant	1.84778 (0.00305)
N = 16 813 763	
R –squared = 0.9516	
Adj R-squared = 0.9406	
Within R-squared = 0.0351	
Root MSE = 0.1269	

Notes: The standard errors presented are clustered at the worker level. *** 1% significant, **5% significant *10% significant The parameter pf the linear variables “age” and “gender” cannot be identified due to the inclusion of worker and year fixed-effects.

source: author's calculations using *Quadros de Pessoal* data

8. Conclusion

The Portuguese labour market, in line with other labour markets, faced, in the last years, an increase in the use of temporary forms of work in order to increase the flexibility of the rigid labour markets (Bentolila & Saint-Paul, 1992). In line with the changes observed in the use of contracts, it is observed that the types of tasks performed by workers and their occupations have been changing (Kiersztyn, 2016). These can happen due to generalized adoption of the use of new technologies.

The literature, during the years, has studied the two trends of the labour market in separate but recent studies tried to understand if the two of them can have a relation (Berglund et al., 2022; Kiersztyn, 2016; Mattijssen et al., 2020; Reichelt, 2015). In general, looking into the levels of conversion from FTC and OEC or considering that FTC can act as a stepping-stone or a trap to unemployment, the conclusions pointed out that different occupations lead to the use of temporary contracts with different functions. Since this type of study is recent, there are further studies to be done in order to understand the relation between the use of fixed-term contracts and the evolution of the occupation structure in the labour markets.

In this context, this dissertation has the objective to study the relation between the two kinds of literature once it was not done for Portugal – it is only known, according to Silvério (2015) that exists a wage penalty for workers under FTC compared to OEC and that the structure of occupations is changing, as conclude Fonseca et al. (2018). Similar to the literature that already exists, this study analyzed the levels of conversion between FTC and OEC in the Portuguese labour market between 2010 and 2019. In addition, it analyzed the wage gap between temporary and permanent contracts since the literature points out that wages may be influenced by the type of tasks performed by the workers (Portugal, 2020). For this was used data from *Quadros de Pessoal* and two different econometric models.

For the analysis, it was possible to conclude that between 2010 and 2019 the use of FTC and OEC as did the employment. However, considering the share of contracts in the labour market, FTC presents an increase in the weight of the contracts existent, while OEC presents a decrease in their importance in the labour market.

In terms of tasks, the Portuguese labour market is characterized by a large number of RC and RM workers. However, the category that presents the higher number of workers

employed is NRCI. Although all tasks present more workers under open-ended contracts, it seems that from 2010 until 2019, the number of workers under fixed-term contracts increased significantly mostly in NRCI, RC and RM. Looking at the share of workers under fixed-term contracts, it seems that NRCA, RC and RM gained importance in these types of contracts while M and NRCI lost some weight in the case of workers under temporary contracts.

Considering the empirical analysis of this dissertation - the analysis of the conversion from FTC to OEC and the wage gap between FTC and OEC some results are relevant to refer.

First, in the study of the conversion between FTC and OEC the model adopted was a logit model which considered the type of tasks, some controls for firm and worker and time dummies to control for macroeconomic fluctuations. For the analysis of these results, all tasks present a positive impact on the level of conversion of contracts. Looking at the average marginal effects of the variables, the workers task that are more likely to have their contract converted from FTC to OEC are the workers performing non-routine cognitive interpersonal tasks, compared to workers who perform manual tasks, *ceteris paribus*. This category is followed by workers on routine cognitive, routine manual and last routine cognitive abstract tasks, compared to workers performing manual tasks, *ceteris paribus*. These results show that exists a heterogeneity in the levels of conversion of contracts depending on the tasks that the workers perform. The results are in line with the literature in which non-routine workers are more likely to have their contract converted from a FTC to a OEC.

These results seem to show that M workers tend to be more used as a buffer stock while NRCI workers tend to be used as screening devices.

Second, the analysis of the wage gap was considered a high dimensional fixed effects model in order to count for observed and unobserved heterogeneity of the firm and worker. Considering the fixed effects of the worker and firm, it is possible to conclude the existence of a wage penalty for FTC workers compared to OEC workers, *ceteris paribus*. Looking at the different tasks performing every task, with an exception for routine manual tasks, represents a wage premium when compared to manual tasks, *ceteris paribus*.

Even though the positive impact that performing every task compared to manual task have on wages, when it is considered a model with an interaction for tasks and the type of contract the results change. In this case, workers under temporary contracts performing

NRCA, NRCI, RC or RM tasks, compared to manual tasks, seem to have a wage penalty when compared to workers under permanent contracts in the same situation. The results are in line with the existing literature once it points out that tasks such as NRCI are associated with a higher wage penalty. One more time, the differences observed in the results of the wage gap may show the heterogeneity of FTC and OEC among the different tasks.

The analysis of the conversion probability and the wage gap between both types of contract indicate that the role of fixed-term contracts in the Portuguese labour market may differ according to the occupational task content.

Despite the contributions that this dissertation has once there is no similar study for Portugal, it is possible to point out a limitation that the study present. First, the results obtained in the high dimensional fixed-effects models did not allow to conclude that the specific fixed effect for the worker and firm, which controls for the observed and unobserved time-invariant characteristics of the worker or firm, is responsible for a significant part of the wage gap. To draw this conclusion further studies, need to be done. An example of it is the Gelbach decomposition which divides and measures the effect that the fixed effects have in the specification in study²⁶. In line with this, to expand this analysis is suggested to use this decomposition. In addition, further studies can focus on the impact that contracts could have in all changes that has been observed in the occupational structure during the last years.

²⁶This study will not use the Gelbach decomposition but for further information about it see Silvério, F. J. B. (2015). *What hides behind the fixed-term contracts wage gap?* Nova - School of Business and Economics].

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10. Annex

Annex A – Definition of the variables considered

Table 4 - Description of the variables considered in the models

Variable	Description
Age	Age (years)
age	Age of the worker
age ²	Age squared
Gender	Gender of the worker
female	1 if female, 0 otherwise
Nationality	Nationality of the worker
imig	1 if the worker is not Portuguese, 0 otherwise
Tenure	Tenure of the worker in the current firm (years)
tenure	Tenure
tenure ²	Tenure squared
Education	Level of education complete
basic*	1 if basic education; 0 otherwise
secondary	1 if high-school education; 0 otherwise
college	1 if university education; 0 otherwise
Type of contract	Type of contract
FTC	1 if contract = Fixed-term contract, 0 otherwise (Open-ended contract)
Type of task	Type of task performed by the worker
M*	1 if task = manual; 0 otherwise
NRCA	1 if task = non routine cognitive abstract; 0 otherwise
NRCI	1 if task = non routine cognitive interpersonal; 0 otherwise
RC	1 if task = routine cognitive; 0 otherwise
RM	1 if task = routine manual; 0 otherwise
Wage	Wage
lrwageh	Logarithm of the real hourly wage composed by the base wage, overtime payments and regular benefits
Dimension	Dimension of the firm (number of workers)
dim	Logarithm of the number of the workers in the firm
Economic Activity	Economic Activity Code (CAE)

agriculture	1 if CAE = A; 0 otherwise
industry	1 if CAE= B, C, D, E; 0 otherwise
construction*	1 if CAE= F; 0 otherwise
services	1 if CAE = G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U; 0 otherwise
Location (NUT II)	Location of the firm
Norte	1 if NUT 2 = Norte; 0 otherwise
Algarve	1 if NUT 2 = Algarve; 0 otherwise
Centro	1 if NUT 2 = Centro; 0 otherwise
Lisboa	1 if NUT 2 = Lisboa; 0 otherwise
Alentejo*	1 if NUT 2 = Alentejo; 0 otherwise
Year	Year of reference
year_2010*	1 if year = 2010; 0 otherwise
year_2011	1 if year = 2011; 0 otherwise
year_2012	1 if year = 2012; 0 otherwise
year_2013	1 if year = 2013; 0 otherwise
year_2014	1 if year = 2014; 0 otherwise
year_2015	1 if year = 2015; 0 otherwise
year_2016	1 if year = 2016; 0 otherwise
year_2017	1 if year = 2017; 0 otherwise
year_2018	1 if year = 2018; 0 otherwise
year_2019	1 if year = 2019; 0 otherwise
Notes: The variables with a * were considered the base category (the omitted variable). The codes 20, 21, 22, 30, 31, 32 were considered FTC and the codes 10, 11, 12, 13 were considered OEC. In the economic activity is defined using the Classification of Economic Activity (Revision 3) at the section level.	

Table 5 - Detailed description of the codes included in the different tasks

Manual (M)	
Prof_2d code	Description
61	Farmers and market- oriented skilled agricultural and livestock workers
62	Market-oriented forestry, fishing and hunting workers
71	Skilled construction workers and similar, except electrician
74	Skilled workers and similar, except electrician
83	Vehicle drivers and mobile equipment operators
93	Unskilled workers in mining, construction, manufacturing and transport
96	Workers of waste and other basic services
Non routine cognitive abstract (NRCA)	
Prof_2d code	Description
21	Experts in the physical sciences, mathematics, engineering and related techniques
24	Finance, accounting, administrative organization, public relations and business specialists
25	Information and communication technology experts
26	Legal, social, artistic and cultural specialists
34	Intermediate technicians of legal, social, sports, cultural and similar services
35	Information and communication technology technicians
Non routine cognitive interpersonal (NRCI)	
Prof_2d code	Description
11	Representatives of the legislature and of executive bodies, senior managers of public administration, specialized organizations, directors and managers of companies
12	Directors of administrative and commercial services
13	Production and specialized service directors
14	Hotel, restaurant, trade and other service managers
22	Health professionals
23	Teachers
51	Personal service workers

52	Sellers
53	Personal care and similar workers
95	Street vendors (except food) and street service providers
Routine cognitive (RC)	
Prof_2d code	Description
31	Intermediate science and engineering technicians and professions
32	Intermediate health technicians and professionals
33	Intermediate, finance, administrative and business technicians
41	Clerks, secretaries general and data processing operators
42	Customer support staff
43	Data, accounting, statistics, financial services and registry operators
44	Other administrative support staff
54	Protection and security personnel
Routine manual (RM)	
Prof_2d code	Description
72	Skilled workers in metallurgy, metalworking and similar
73	Skilled workers in printing, precision instrument manufacturing, jewelers, craftsmen and similar
75	Food processing, woodworking, clothing and other industries and crafts workers
81	Fixed plant operators and machines
82	Assembly workers
91	Cleaning workers
92	Unskilled workers in agriculture, livestock, fisheries and forest
94	Assistants preparing meals

source: Araújo (2019); Maia (2019)

Annex B – Additional descriptive statistics

Table 6 - The number of FTC and OEC in the Portuguese labour market

Year	FTC	OEC	%FTC	%OEC
2010	386 492	1 483 285	20,7%	79,3%
2011	404 584	1 434 333	22,0%	78,0%
2012	383 454	1 331 684	22,4%	77,6%
2013	404 148	1 299 611	23,7%	76,3%
2014	449 749	1 304 276	25,6%	74,4%
2015	488 723	1 319 022	27,0%	73,0%
2016	528 193	1 342 310	28,2%	71,8%
2017	576 892	1 357 626	29,8%	70,2%
2018	626 786	1 378 691	31,3%	68,7%
2019	632 965	1 388 270	31,3%	68,7%

source: author's calculations using Quadros de Pessoal data

Table 7 - Type of contract by age group

Age group	FTC	OEC	%FTC	%OEC
[18,35[	2 428 079	3 612 020	49,7%	26,5%
[35, 45[	1 312 004	4 547 561	26,9%	33,3%
[45,55[	817 595	3 630 429	16,7%	26,6%
[55, 67[	324 308	1 849 098	6,6%	13,6%

source: author's calculations using Quadros de Pessoal data

Table 8 - Type of contract by gender

Gender	FTC	OEC	%FTC	%OEC
Male	2 681 572	7 365 336	54,9%	54,0%
Female	2 200 414	6 273 772	45,1%	46,0%

source: author's calculations using Quadros de Pessoal data

Table 9 - Type of contract by nationality

Nationality	FTC	OEC	%FTC	%OEC
Portuguese	4 457 257	13 256 574	91,3%	97,2%
Immigrant	424 729	382 534	8,7%	2,8%

source: author's calculations using Quadros de Pessoal data

Table 10 - Type of contract by level of schooling

Habilitations	FTC	OEC	%FTC	%OEC
Basic	2 487 021	7 426 416	50,9%	54,4%
Secondary	1 522 791	3 513 971	31,2%	25,8%
College	872 174	2 698 721	17,9%	19,8%

source: author's calculations using Quadros de Pessoal data

Table 11 - Real hourly wage by age group

Age group	Average (€)		Median (€)	
	FTC	OEC	FTC	OEC
[18,35[	4,96	5,64	4,14	4,54
[35, 45[	5,19	7,26	4,21	5,22
[45,55[	4,84	7,43	3,99	4,90
[55, 67[	4,92	7,51	3,98	4,81

source: author's calculations using Quadros de Pessoal data

Table 12 - Real hourly wage by gender

Gender	Average (€)		Median (€)	
	FTC	OEC	FTC	OEC
Male	3,33	7,62	4,35	5,33
Female	3,12	6,08	3,88	4,40

source: author's calculations using Quadros de Pessoal data

Table 13 - Real hourly wage by nationality

Nationality	Average (€)		Median (€)	
	FTC	OEC	FTC	OEC
Portuguese	3,23	6,92	4,16	4,89
Immigrant	3,02	6,55	3,84	4,20

source: author's calculations using Quadros de Pessoal data

Table 14 - Real hourly wage in the Portuguese labour market 2010-2019

Year	Average (€)		Median (€)	
	FTC	OEC	FTC	OEC
2010	5,15	6,91	4,15	4,83
2011	5,00	6,75	4,04	4,73
2012	4,89	6,64	3,94	4,64
2013	4,81	6,74	3,90	4,70
2014	4,87	6,85	3,96	4,78
2015	4,83	6,86	3,96	4,82
2016	4,87	6,89	4,01	4,85
2017	5,00	6,96	4,12	4,93
2018	5,14	7,14	4,26	5,07
2019	5,34	7,31	4,45	5,27
Growth rate	3,8%	5,8%	7,4%	9,1%

source: author's calculations using Quadros de Pessoal data

Table 15 - Type of task performed by year

Year	M	NRCA	NRCI	RC	RM
2010	324 404	165 823	512 632	462 882	404 017
2011	307 268	162 124	500 249	467 436	401 716
2012	267 823	155 092	473 496	438 136	380 365
2013	262 356	158 534	471 119	433 789	376 792
2014	271 176	166 796	478 083	450 051	386 901
2015	282 208	175 754	492 846	460 769	395 025
2016	293 790	183 717	510 782	475 931	404 798
2017	307 275	194 307	522 231	493 058	416 047
2018	323 238	210 079	536 670	510 531	423 723
2019	331 027	219 325	537 363	517 657	414 439
Growth rate 2010-2019	2,0%	32,3%	4,8%	11,8%	2,6%

source: author's calculations using Quadros de Pessoal data

Table 16 - Tasks performed by the workers by year (%)

Year	M	NRCA	NRCI	RC	RM
2010	17,4%	8,9%	27,4%	24,8%	21,6%
2011	16,7%	8,8%	27,2%	25,4%	21,8%
2012	15,6%	9,0%	27,6%	25,5%	22,2%
2013	15,4%	9,3%	27,7%	25,5%	22,1%
2014	15,5%	9,5%	27,3%	25,7%	22,1%
2015	15,6%	9,7%	27,3%	25,5%	21,9%
2016	15,7%	9,8%	27,3%	25,5%	21,7%
2017	15,9%	10,1%	27,0%	25,5%	21,5%
2018	16,1%	10,5%	26,8%	25,5%	21,1%
2019	16,4%	10,9%	26,6%	25,6%	20,5%

source: author's calculations using Quadros de Pessoal data

Table 17 - Distribution of the tasks by temporary contracts

Year	M	NRCA	NRCI	RC	FTC					
					RM	% M	% NRCA	% NRCI	% RC	% RM
2010	89 766	32 347	102 387	82 140	79 851	23,2%	8,4%	26,5%	21,3%	20,7%
2011	89 554	34 124	108 818	85 693	86 347	22,1%	8,4%	26,9%	21,2%	21,3%
2012	77 989	33 849	104 780	81 781	84 977	20,3%	8,8%	27,3%	21,3%	22,2%
2013	83 803	35 904	108 009	86 005	90 123	20,8%	8,9%	26,7%	21,3%	22,3%
2014	96 454	40 487	118 128	95 927	98 447	21,5%	9,0%	26,3%	21,3%	21,9%
2015	103 355	43 786	130 918	104 975	105 321	21,2%	9,0%	26,8%	21,5%	21,6%
2016	111 414	46 392	142 795	113 969	113 054	21,1%	8,8%	27,1%	21,6%	21,4%
2017	121 794	49 948	152 911	127 185	124 436	21,1%	8,7%	26,5%	22,1%	21,6%
2018	134 131	54 389	164 191	138 625	134 911	21,4%	8,7%	26,2%	22,1%	21,5%
2019	137 236	56 902	166 288	138 887	133 012	21,7%	9,0%	26,3%	22,0%	21,0%

source: author's calculations using Quadros de Pessoal data

Table 18 - Distribution of the tasks by permanent contracts

OEC										
Year	M	NRCA	NRCI	RC	RM	% M	% NRCA	% NRCI	% RC	% RM
2010	234 638	133 476	410 245	380 742	324 166	15,8%	9,0%	27,7%	25,7%	21,9%
2011	217 714	128 000	391 431	381 743	315 369	15,2%	8,9%	27,3%	26,6%	22,0%
2012	189 834	121 243	368 716	356 355	295 388	14,3%	9,1%	27,7%	26,8%	22,2%
2013	178 553	122 630	363 110	347 784	286 669	13,7%	9,4%	28,0%	26,8%	22,1%
2014	174 722	126 309	359 955	354 124	288 454	13,4%	9,7%	27,6%	27,2%	22,1%
2015	178 853	131 968	361 928	355 794	289 704	13,6%	10,0%	27,5%	27,0%	22,0%
2016	182 376	137 325	367 987	361 962	291 744	13,6%	10,2%	27,4%	27,0%	21,7%
2017	185 481	144 359	369 320	365 873	291 611	13,7%	10,6%	27,2%	27,0%	21,5%
2018	189 107	155 690	372 479	371 906	288 812	13,7%	11,3%	27,0%	27,0%	21,0%
2019	193 791	162 423	371 075	378 770	281 427	14,0%	11,7%	26,7%	27,3%	20,3%

source: author's calculations using Quadros de Pessoal data

Table 19 - Number of contracts converted in the Portuguese labour market

Year	Contracts converted
2011	54 920
2012	47 785
2013	51 331
2014	51 299
2015	56 936
2016	67 465
2017	69 848
2018	77 964
2019	94 010

source: author's calculations using Quadros de Pessoal data

Table 20 - Share of contracts converted and not converted in the Portuguese labour market

Year	% converted	% not converted
2011	19,7%	80,3%
2012	16,1%	83,9%
2013	16,8%	83,2%
2014	15,8%	84,2%
2015	16,1%	83,9%
2016	17,5%	82,5%
2017	16,8%	83,2%
2018	17,2%	82,8%
2019	19,7%	80,3%

source: author's calculations using Quadros de Pessoal data

Annex C – Estimation results

Table 21 - Results of OLS for the estimation of the wage gap between FTC and OEC

Log real hourly wage	OLS
FTC	-0.06400*** (0.00044)
NRCA	0.23164*** (0.00117)
NRCI	0.00674*** (0.00063)
RC	0.06730*** (0.00067)
RM	-0.08319*** (0.00056)
age	0.02611*** (0.00014)
age ²	-0.00024*** (0.00000)
tenure	0.01710*** (0.00008)
tenure ²	-0.00012*** (0.00000)
secondary	0.22152*** (0.00060)
college	0.65173*** (0.00100)
constant	0.79780*** (0.00255)
year	Yes

N = 16 859 257

R – squared = 0.4166

Root MSE = 0.39559

Notes: The standard errors presented are clustered at the worker level. *** 1% significant, **5% significant *10% significant.

source: author's calculations using *Quadros de Pessoal* data