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For how long can a worker be trapped on the minimum wage?

An analysis of Portuguese labour market.

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Abstract

To analyse the factors that influence how long a worker would be trapped on minimum wage in Portugal, a survival and a hazard rate analysis were applied. The results indicate that the worker experience a short duration and that a negative duration dependence exists. Minimum wage continues to affect more women, with a lower school level. The estimates indicate that those who belong to the manufacturing sector and to a district with a higher *Kaitz index*, experience a smaller hazard rate. The destinations of exit demonstrated that hazard rate is larger to those who change of firm.

Keywords

Minimum wage;

Duration;

Survival analysis;

Hazard rate.

1) Introduction

Minimum wages (MW) were imposed in Portugal in 1974, for the first time. An argument used to increase the MW is that without the imposition supported by law, the earning MW workers will never get back their purchasing power. However the argument used by the people that are against this increase, is that this is just a temporary wage, because young people can gain some practical experience and then jump to another job or situation with a better wage. Those arguments raise one question: for how long would a MW worker receive it?

More recently, Portugal has been faced an IMF intervention in which some issues about the Portuguese labour market were raised. In the IMF *Memorandum of Understanding* it can be read "Active Labour Market Policies (ALMPs) to improve the employability of the young and disadvantaged categories and ease labour market mismatches." The disadvantage categories are precisely the ones, which are more willing to receive the MW. Understanding which factors make a person receive the MW during more time will help us to understand what they do to get out of this situation faster.

An argument many times used is that an increase in the MW decreases the inequality of income inside one society. This argument is used because one normally associates a MW worker to a certain profile, which generally belongs to the most unfavorable social stratum. In this study it will be defined a MW worker profile and what the characteristics of a MW worker are.

In this study, five questions will be raised: i) would a worker be stuck on MW?; ii) how does the MW duration influence the exit likelihood?; iii) is the probability of exit conditioned by the type of destination?; iv) how do the characteristics of a worker influence

his MW duration?; v) would firm characteristics and the surrounding society influence the worker hazard rate?

This work will be structured in four sections. In the first one it is done a review of the existing literature. The second one is on data and data analysis, where a database is presented and a basic statistical analysis of the used data is done. On the third one the model used will be discussed, and in the last one there will be a discussion of the obtained results, comparing those with the literature review done above.

2) Literature Review

The discussion about the MW and its effects on society started at long time ago but nowadays, with the availability of the statistical data and the econometric methods, more studies on this matter were being conducted. This is particularly evident on the last two decades of the last century. One famous paper on this issue is the one did by Card and Krueger (1993) about the effects of an increase in the MW in one state of the United States (US). They have found that the MW could be increased without provoking an increase in the unemployment at the same time. They also found that the prices increased on the state which applied the MW increase, but not on the sectors of the economy that were more affected by it.

A reflection of the Portuguese labour market rigidity is evidenced in the work of Portugal et al. (2006). In that study the authors found that when the MW increases the job separations between the young earners decrease, so they are now more willing to keep the same job, this constitutes a particular case. It is supported by studies like Eckstein's (2011), which suggested that workers who experience job mobility are more willing to experience wage improvements.

The imposition by law in MW increase is also a factor that could influence the probability of a worker leaving the MW. It is normally argued that this imposition restores the purchasing power lost due to inflation: now all employees in the labour market will experience a wage growth. Smith (1992) alerts for the fact that there are people who will be stuck on the unemployment and on this new MW because their characteristics are not good enough to keep them employed or to improve their wages.

Akyeampong (1989) studied the application of MW in Canada. He argued that the MW was implemented because the politicians and governors of Canada wanted to create a tool for economic stabilization. The MW is needed to minimize the wage gap between unionized workers and non-unionized workers, and as a tool that would work to minimize inequality and poverty. To understand what the effect of applying the MW policy is, Akyeampong typified a Canadian MW worker profile. He found that the profile that fitted the MW worker better is the young female with low education, non-unionized, coming from a metropolitan area or not, but that would probably work on a part-time job in a small firm on the services sector, probably in the accommodation, food or beverage services industry.

These findings go in the same direction as those found by Sussman et al. (2004), who applied a statistical analysis of the characteristics of MW workers and found that they are in general women and poorly educated people, not unionized, that work with a temporary work contract in non-tradable sectors (food and accommodation). They also brought up to the discussion of the place where the MW workers live and found that a large fraction live with their parents, which could be due to their age or be related to their lack of money in order to achieve emancipation.

It was also found in the empirical literature that the age is a very important factor when discussing the MW. Carrington et al. (1999) did an analysis with students during ten

years after leaving school. They identified that women with young children, less educated people and people who live outside the metropolitan areas are much more likely to receive the MW, at least on the 10 years after finishing the school. After leaving school the youngsters enter on the labour market, according to Even et al. (2003), new comers to the labour market are much more likely to be MW workers but have also a bigger probability of leaving that state. They also found that the worker mobility matters. They conclude that when a worker changes of industry or job his wage improves, this effect is more relevant when the worker has a low training job.

The job turnover is an important issue when dealing with MW, the problem is that MW could be difficult to find if the MW is too high. According to Hall (1982) MW jobs are easy to find but they do not have a long duration, though an increase in MW improves the job turnover instead of increasing the duration of the MW. In Holzer et al. (2004) it can be seen that low wage jobs have a high turnover and that most of the times it is the job mobility which gives the worker the opportunity of experiencing a higher wage. Eckstein (2011) related job mobility with an increase on wage and found that job turnover explains 40% to 50% of the wage increase of MW earners. On his work, he also found that increasing the MW does not have any expression on the wage distribution and unemployment rates.

Long (1999) applied the theory of human capital - according to which on the first years of his career the employee is in training - to the MW. He argued that with a higher MW some of this initial training would be lost, reducing the potential wage increase. It would be the explanation to a new worker who had entered on the labour market receiving a low wage, he needs to get some experience. Smith et al. (1992) found that 60% of the workers who enter on the labor market on a given year are earning a higher wage a year later, with a raise of 20% on average. To those authors the workers who do not experience a wage increase have a lack

of schooling which prevents them to earn a higher wage. Long (1999) also did a comparison between regions, where the author concluded that regions with a lower level of schooling experience lower wage gains.

As it was suggested by Carrington et al. (2001), the great majority of workers change to a higher wage jobs during his career. On the initial stages of their careers is when the wage growth experienced is larger, it is suggested that if this wage increase is not experienced the worker could be left behind (Carrington et al., 2001). So, if one worker receives an initial wage higher than the MW, he will have much less probability of receiving MW in the future.

Gender inequality is also revealed on the MW earner characteristics. As mentioned by Rubery et al. (2011) women are much more likely than men to be employed in sectors characterized by paying low wages, because they continued being much more affected by family issues than men and also face a lower work mobility. They also alert to the women lower bargaining power and that the women are sometimes affected by employer monopsony.

Education is also correlated with the level of monthly income. Ashenfelter et al. (1999), for example, did a research on the matter and found that the returns of schooling for some subgroups of workers are higher than the average, particularly to those considered as belonging to the disadvantages categories.

Employer characteristics also have an effect on the probability of a worker receives a wage above MW one day. Holzer et al. (2004) did the bridge between the employer and employee characteristics. They found that the employer characteristics affect the earning statues of his workers, and this effect is larger when the firm fixed effect is introduced. Brown et al. (1989) argued that the employer size matters, showing that larger firms pay more to their employees, particularly to those who are considered low wage workers, than small firms, despite the place those people occupy in the company.

3) Data and data analysis

The data used in this work is from a subsample of *Quadros de Pessoal* (annual survey or mandatory answering) database, from *Ministério do Trabalho, Solidariedade e Segurança Social (MTSS)*, which is the most complete database in Portugal when we are dealing with salaries. *Quadros de Pessoal* regime is defined in Decreto-Lei no 123/2002, and it is a compilation of the information which all companies/firms are required to provide, on employees and salary levels.

The period covered by this study is between 1994 and 2013, which is a fraction of the period covered by our database *Quadros de Pessoal*. During that time interval there was one year, 2001, when, for reasons which could not be controlled, the information was not gathered and treated properly.

The database from *Quadros de Pessoal* has one problem, it includes not only the individuals that had started to work on 1994 but also the workers who were already working. Thus looking only to the individuals that were receiving the MW in 1994, workers that started to earn the MW some years before could be included. For this type of workers it could not be estimated correctly how many years they were earning the MW, problems with censored data could be found. The data could be left censored, as showed above or be right censored, in the case of an individual continuing or starting with the MW in 2013. Again, there is not any basis to measure the total duration correctly.

Due to this problem, and trying to avoid unnecessary complications, only the individuals that had begun to earn the MW with less than a year of tenure were chosen, to be tracked. Thus, all the individuals earning the MW, with less than a year of tenure in the company, are those that are included in the sample and permit to measure the beginning of the spell precisely. In relation to the right censoring, the analysis will drop out of the sample those

individuals that started to be followed in 2013. For those who remain on the MW it will only be known that in 2013 the individuals continued receiving the MW, not knowing precisely when they would leave that stage. According to Jenkins (2005), it will be experienced the Type I censoring, where a sample was followed for a certain time (from 1994 to 2013) and the number of exits is random but the duration observed is fixed.

On this database the CAE – Rev. 3 form the INE, with 2 digits was applied.

3.1) Definition of minimum wage earner

Nowadays with the part time workers boom, some workers have now more than one job. Thus one possibility was to study not the monthly wage but the hourly wage. In fact in this research sample the part time workers were residual and relatively recent. Because of that it was decided to work only with the monthly wage, as the purpose of this work is to study the monthly MW duration. Including part time workers could also bias the results, particularly for those with short duration, because they normally have part time jobs to complement other income, in particular, the monthly allowance given by their parents.

In Portugal the MW appeared in 1974. After 1974 the governments gained the responsibility of proposing discretionary MW increases, usually with the consultation of employers and workers representatives. The MW in Portugal covers all workers aged 16 or more, excluding agricultural and house-hold services (Cardoso et al., 2006). In the period covered by this study, according to our database, 19 wage increases, summarized on table 1, occurred.

Looking to this resume table, one can see that year after year the incidence of the MW on the sample increased. That situation could be explained by the fact that year after year it was more difficult to leave the MW stage, thus the new workers who entered on the labour

market receiving the MW would be added to the people who were already on the MW. As it could be seen the incidence of the MW is larger on the more recent level of the MW and is responsible for more than 20% of the sample.

On the original database there was not a variable that could identify the MW earner, so a new variable was created to identify if the worker is receiving the MW in that year or not. In order to know that, other two variables included on the sample were used, the *base remuneration* and the *minimum wage*. The first variable represents the base salary of the worker and the other identified what the MW in a determined year was. So one could be able to know exactly who the workers receiving the MW were, it was decided to mark those receiving a base salary equal to the MW. [1]

As said above, this study focused on the earnings mobility of a MW worker. To understand and measure this, it would be needed to define a break point where it could be said that the worker was no more on the MW. That point of transition would not influence the qualitative results that would be achieved. A test with a 10 € difference[2], and with a relative difference through time of 2.5% was done. The 2.5% as its break point was chosen because it was sensitive to the evolution of the MW along the years and keeping the same weight through times.

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[1] Given that the workers do not receive a salary precisely equal to the MW all months, we to mark them gave a margin of more or less 1 euro, in order to avoid having workers leaving from the MW because of rounding errors.

[2] We also did the tests for an increase of 10 euro the results are very similar but are not consistent through time because a 10 euro increase has much more weight on the MW of the beginning years of our sample. In spite of not having any support for that on the literature review we decide to use the 2.5% increase.

MW evolution through time

Year of reference	Minimum Wage - General Regime	Total
1994	245,9	20 824
1995	259,4	25 206
1996	272,3	25 046
1997	282,8	31 295
1998	293,8	32 880
1999	305,8	36 719
2000	318,2	40 523
2002	348	39 594
2003	356,6	41 504
2004	365,6	43 751
2005	374,7	52 310
2006	385,9	53 814
2007	403	62 266
2008	426	68 416
2009	450	67 146
2010	475	70 467
2011	485	74 616
2012	485	71 165
2013	485	85 653

Table 1 – Minimum wage – General Regime. Computed by the author.

During his working life, one could receive different wages, sometimes those wages could be higher than the others before but sometimes they could be lower. This implies that some workers could leave the stage of MW and return to it after a few years. In this study, only the first spell is retained.

What was observed in the sample was that the largest part of workers had left the MW on the first spell and never got back on it.[3] Looking at the period it occurred (duration - *dur),* (see figure 1)*,* it could be seen that the largest part of MW earners had left that state on the first years receiving the MW. It could also be seen that after one year receiving the MW more

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[3] On this work the results found are only based on the first spell.

than 50% of the workers had left that stage remaining only those who because of their characteristics would not be able to experience a higher wage (Smith et al., 1992). [4]

Different spells

Spell	Freq.
1	466,021
2	76,005
3	21,714
4	6,499
5	1,842
6	358
7	64
8	9
9	1

Table 2 – Different spells observed in our sample. Computed by the author.

The data had also been treated in order to understand the destinations of the exit, if remaining on the same firm earning a higher wage or if one had to change to a new one to get a wage increase. Thus, the MW earners were divided in two categories[5]: i) the ones that leave the MW because they change of firm, and ii) the ones that move away from MW because they get a wage increase, remaining on the same company.

3.2) The variables

In this section the individual specific variables intended to control for individual characteristics are discussed. Typical variables should be taken into account when studying individuals, as *age*[6] and *education*[7], so they were present on the model. The variable *age* was here defined between 16 and 64 years old, with the majority part of the individuals being on

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[4] See figure 1

[5] On the data are also those that just move out of the sample but it isn't known what destination they took, because of that the results presented here will not include this type of MW workers, which are treated as censored.

[6] On the model age will be reflected as set of a dummy variables, with the individuals grouped by age.

[7] On the model education will be presented as set of a dummy variables, see table 1 in annex.

the interval until 30, which was according Carrington et al (2001) and Akyeampong (1989), who related the youngest people to the MW.

Other characteristic highlighted on the literature was also controlled tenure, here reflected on the duration (*log dur)* of the MW stage, given the definition of duration pointed above. Controlling for tenure allowed us to understand if remaining or not more time on the company receiving the MW increased the probability of a higher wage in the future (in duration dependence). It reflected the results found on the literature review, in Hall (1982) and Holzer et al. (2004), where the authors related the increase on wage with the job turnover which is characterized by a short tenure. Other variable that was highlighted on the literature was the nationality of the individual. Here the data did not allow to study that. [8]

The firm specific chosen variables were also related to what was highlighted on our literature review. [9] A factor that could contribute to a worker not to receive the MW was the type of capital owner, if it was public or private. Finally the sector in which the company operates would be controlled

For policy purposes, a new variable was computed, *Kaits Index*, computed at the district level*,* which was generated having as base the MW in the individual district divided by the median wage on that district. With this variable, district and economy wide specific effects could be controlled, enabling to know the influence of that factor on the transition of the individual to a higher wage.

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[8] Using our sample is not possible to know the worker nationality to all years.
[9] We also tried to control for the size of the company, using the variable *people* (number of workers working on the company) but it was not defined for the all sample.

4) The model

Suppose that time is divided into j intervals $[T_0, T_1), [T_1, T_2), ..., [T_{j-1}, \propto)$. The data is observed on a discrete time basis, $T \in (1, ..., j)$, where $T = t$ represents an exit on the interval $[T_{t-1}, T_t)$.

The *survival function* returns the probability of an individual survive in T_{t+1}, given that he has survived until T_j, is defined as (Addison and Portugal, 2008),

$$S(t) = P(T > t) = \prod_{z=1}^{t}[1 - h(z)], t = 1,2, ..., j\text{-}1.$$

Where *h(j)*, represents the *hazard function*, which gives the probability of exit in time T_j conditional to the individual survive until time T_{j-1}, defined as,

$$h(t) = P(T = t | T \geq t)$$

An extension of the proportional hazard model to discrete time is,

$$S(t|x_i) = S_0(t)^{\exp(x'_i \beta)},$$

Where $S(t|x_i)$ returns the probability if individual i with covariates x_i survive until time t and $S_0(t)$ represents the *baseline survival function*, where the covariates equal to zero.

The *complementary log log* hazard function is a discrete time proportional hazard model. Using the relationship between the *hazard* and the *survival functions*, we can write,

$$h(t|x_i) = 1 - [1 - h_0(t)]^{\exp(x'_i \beta)}$$

Duration dependence will be accounted for via the inclusion of *log duratias* as an additional covariate. It will also be presented the Kaplan-Meier Survival Function.

A possible problem that creates a bias on the hazard function estimates is the unobserved individual heterogeneity (UIH). This problem is reflected on the quickness that an individual leave from one state to another. If some individuals leave from one state more quickly than others, in the end only the less prepared workers will remain and the estimates will be biased. It shows that the individuals have a different hazard rate.

To deal with that, two types of models will be estimated.[10] The first type is the parametric approach, where a multiplicative term v, to capture the UIH is included (Jenkins, 2005). If v is above average the individual leave faster, if v is below average the individual leave slower, defined as,

$$h(t, X|v) = 1 - [1 - h_0(t)]^{\exp(x'_i \beta)v}, where\ v > 0$$

The second mode, to be estimated is the mass point approach, where the sample is divided in two, according to the capabilities of the individual to leave the state (Jenkins, 2005). The first group, the "hares", have a larger intercept and will leave the MW with a faster rate and the second group, the "tortoises", will leave at a slower rate. The *hazard function* could be defined as,

Assuming a fraction of *w* individuals,

$$h_1(t|x_i) = 1 - [1 - h_0(t)]^{\exp(\beta_0 + \beta_1 x_{1i} + \cdots + \beta_j x_{ji})}$$

While, for the remaining fraction *1-w*,

$$h_2(t|x_i) = 1 - [1 - h_0(t)]^{\exp(\beta_0 + \delta + \beta_1 x_{1i} + \cdots + \beta_j x_{ji})}$$

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[10] We also used the spilt population survival model (spsruv) where the hazard rate is equal to zero for a fraction of the population.

5) Results

In order to present here the different hazard rates through time, the Kaplan – Meier estimate was computed (see figure 1). Here it could be seen that the largest majority of the workers had left the MW stage until the fifth year receiving it, and that more than 50% had left the MW after the first year receiving it.
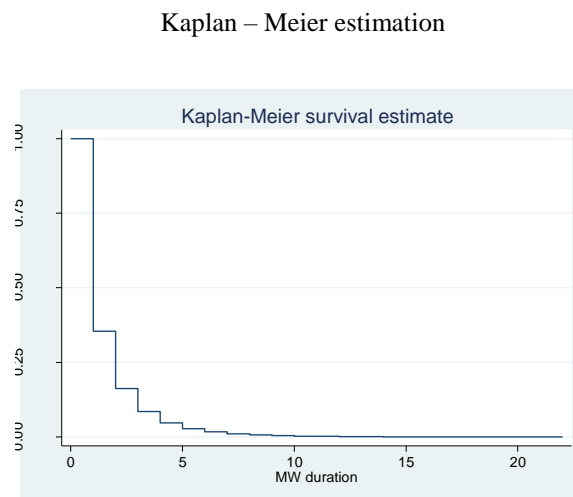
Kaplan – Meier estimation

Figure 1 – Kaplan – Meier survival and failure estimates, not having in attention the different types of destinations. Computed by the author.

To understand what the drivers of minimum wage persistence are, it was first presented a base model (Model 1, see table 3), to which the variables described above were added, in order to understand their power and the effects of the base variables. The results showed that an individual with a higher tenure had less probability of leaving the MW. If the duration increased in one percent the *hazard rate* of leaving the MW became smaller by 0,563 percent, ceteris paribus. Thus, a negative duration dependence is observed. Gender discrimination was also verified. A male worker had a much higher probability, close to 17%, ceteris paribus, of leaving the MW than a female. These results had met what was referred by Rubery et al (2011), which referred that women has been characterized as low paying sectors workers.

It could also be seen that the age group matters, for those who were less than 20 years age, it was not considered to be a factor that could prevent a wage increase. For all other age groups, the age would decrease their probability of exiting, comparing to those who had more than 55 years. The size of this effect change between age groups, the effect of the groups that were at the end was smaller than the groups that were middle aged. For those who belong to an age group between 21 (inclusive) and 50 (inclusive) the effect was very similar, showing that after a certain age the effect has remained constant.

Confronting those findings with literature review, it could be seen that, Even et al (2003) found that the young people after finishing school and entering in the labour market had much higher probability to receive the MW but had also much higher probability of leaving that state. In our results, when the worker got older the probability of getting a higher wage decreased, until he achieved a determined (older than 45 years) age group. Akyeampong (1989) and Sussman et al. (2004), related the persistence of the MW with the fact of being young and women, precisely the results found in this study.

Carrington et al. (1999) identified that less educated people, particularly women with young children, were more willing to earn the MW, and Smith et al. (1992), who, as said above, related this MW duration with the lack of schooling, following the results found in Portugal, there was less probability of being apart from the MW if people were less educated. The results showed that less educated individuals with basic, for example, have a smaller probability of leaving the MW by 28.9 log points, ceteris paribus, than a worker with a college degree.

The variable that captured how binding the MW is, the *Kaitz index*, showed that its effect mattered. Looking at the results, this effect is large and statistical significant, an

increase of 0.1 on the *Kaitz index* returned a smaller, in less 7.17%, probability of exit, ceteris paribus.

Model 2 (see table 3) started to include some of the firm specific variables chosen. It could be seen that the results found on the Model 1 remained almost the same, keeping the size of the effect practically constant. Thus, focusing only on those two variables, it could be seen that when a worker works on a public owned firm his probability of exit is reduced by 5%, ceteris paribus, instead if the worker belongs to a foreign owned firm, he could see his probability of exiting increased by 7%, ceteris paribus. The results agreed to those found by Holzer et al. (2004), it was argued that the owner is a strong determiner of the earning level of the workers.

Sussman et al. (2004), and Akyeampong (1989) identified the food and accommodation sectors as being sectors characterized by having MW workers. The model presented also account for that factor (see model 3). The size effects of the other variables, already analyzed, remained approximately the same.

Those sector specific variables indicated that working on determined sectors was relevant to exit or not the MW faster. When looking to the Portuguese case, the manufacturing sector could be identified as being the one from which it was more difficult to leave, with a probability of exit smaller by 11.3 log points, ceteris paribus, comparing to those who work in other services. The sector of food and accommodation revealed also a statistical significance but had a very small effect. To a person who works on the food and accommodation sector the probability of exit is only smaller by 2.82%, comparing to a worker who belonged to the other services, ceteris paribus. The construction sector does not have any statistical significance to explain the exit from MW.

Complementary Log-log estimation results

VARIABLES	Cloglog Model 1	Cloglog Model 2	Cloglog Model 3
log duration	-0.563***	-0.563***	-0.556***
	(0.00568)	(0.00569)	(0.00569)
basic	-0.289***	-0.288***	-0.270***
	(0.0131)	(0.0131)	(0.0131)
secondary	-0.184***	-0.184***	-0.178***
	(0.0134)	(0.0134)	(0.0134)
age ≤ 20	-0.00762	-0.00926	0.00603
	(0.0117)	(0.0117)	(0.0118)
21 ≤ age ≤ 25	-0.115***	-0.116***	-0.108***
	(0.0113)	(0.0113)	(0.0113)
26 ≤ age ≤ 30	-0.168***	-0.169***	-0.162***
	(0.0116)	(0.0116)	(0.0116)
31 ≤ age ≤ 35	-0.148***	-0.149***	-0.142***
	(0.0119)	(0.0119)	(0.0119)
36 ≤ age ≤ 40	-0.139***	-0.140***	-0.134***
	(0.0124)	(0.0124)	(0.0124)
41 ≤ age ≤ 45	-0.125***	-0.125***	-0.120***
	(0.0129)	(0.0129)	(0.0129)
46 ≤ age ≤ 50	-0.110***	-0.110***	-0.106***
	(0.0136)	(0.0136)	(0.0136)
51 ≤ age ≤ 55	-0.0557***	-0.0561***	-0.0539***
	(0.0146)	(0.0146)	(0.0146)
male	0.172***	0.173***	0.168***
	(0.00409)	(0.00410)	(0.00418)
foreign firm		0.0715***	0.0786***
		(0.0107)	(0.0107)
public firm		-0.0522***	-0.0714***
		(0.0132)	(0.0133)
kaitz index	-0.717***	-0.704***	-0.604***
	(0.0213)	(0.0214)	(0.0221)
food and accommodation			-0.0282***
			(0.00639)
manufacturing			-0.113***
			(0.00624)
construction			-0.00820
			(0.00535)
year dummies	Yes	Yes	Yes
Constant	1.508***	1.498***	1.427***
	(0.0262)	(0.0262)	(0.0265)
Observations	466,021	466,021	466,021

Table 3 – *Cloglog* estimation results. [11] Computed by the author.

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[11] See table 1 in annex for variables description.

Models controlling for UIH were also estimated. The *Stata functions* used, *pgmhaz8[12]* and *hshaz[13]*, were not able to differentiate those who exit faster, the "hares", from those who leave slower, the "tortoises". Different models and also variables tests were done to try to detect some variable specific problem. In the end, the model continued to converge to the *cloglog model* presented above. However, this time with the difference between the two hazard rates: on the *hshaz* case, and the variance of the *Gamma Distribution*, on the *pgmhaz8* case, tending to zero. Those results indicate that the chosen variables capture the heterogeneity between individuals adequately.

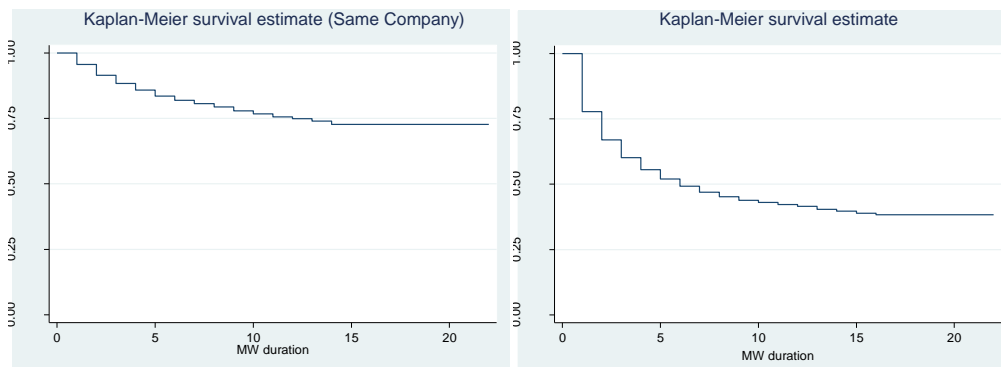Kaplan – Meier estimation for different destinations

Figure 2 – Kaplan – Meier survival estimates. Those who have as exit destination same firm are at left, and those who have as exit destination other firm are at right.

On figure 2, it is computed the Kaplan – Meier estimate, it shows that the workers who exit of MW remaining on the same firm have a smaller hazard rate than the workers who exit of MW changing of firm. The result shows that it was easier to an individual to leave the MW changing of the firm than remaining in the same. The graph also permits to verify that the negative duration dependence was observed, again, but now it was less accentuated than before.

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[12] Parametrical approach estimator, with gamma frailty.
[13] Mass point approach estimator.

Regarding the different destinations of exit a mass point approach[14] was applied (see table 4). The model only was capable to split the population for those who remained on the company, where 70% of the sample have a zero hazard rate. The results demonstrate that, for those who exit the MW and remain on the same company, tenure is valued. Tenure is observed on the duration variable, given the definition above. It could be seen that, when the worker increases his MW duration in one percent, his hazard rate increases by 0.117%, ceteris paribus. Thus, a positive duration dependence is verified for this destination.

The results achieved for male and education variables remain similar to those found above. However, the size of the education effect is larger, for example, the effect of having basic education almost doubles. Age is a variable that could help the MW earner, as the model indicates, when the worker changes to other age group, he increases his likelihood of exit, until the 40 years old. The Kaitz index was a powerful variable with an increase of 0.1 provoking a raise of 10% on the exit likelihood.

When controlling for the type of capital, it could be seen that, again, working on a public owned firm, decreases the likelihood of experience a wage increase by 16.9 log points, ceteris paribus. As mentioned above, it is easier to a foreign firm worker, to get a wage increase. Sector remains also an important variable to explain the MW duration. If a worker belongs to the food and accommodation sector, his hazard rate decrease in 22.3 log points, ceteris paribus. Although, if he works on the manufacturing sector his hazard rate increases by 28.7 log points, ceteris paribus. On what concerns to construction, it remained statistical insignificant.

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[14] Split population survival function.

Mass point approach with different destinations

VARIABLES	Split population model	Split population model
	Model 1	Model 2
log duration	0.117***	-1.295***
	(0.0422)	(0.0128)
basic	-0.501***	-0.0589***
	(0.0523)	(0.0222)
secundary	-0.234***	0.0657***
	(0.0532)	(0.0227)
age ≤ 20	0.249***	-0.161***
	(0.0518)	(0.0240)
21 ≤ age ≤25	0.279***	0.0546**
	(0.0503)	(0.0227)
26 ≤ age ≤ 30	0.150***	0.362***
	(0.0516)	(0.0228)
31 ≤ age ≤ 35	0.178***	0.512***
	(0.0529)	(0.0231)
36 ≤ age ≤ 40	0.165***	0.552***
	(0.0546)	(0.0236)
41 ≤ age ≤ 45	0.125**	0.498***
	(0.0569)	(0.0244)
46 ≤ age ≤ 50	0.158***	0.437***
	(0.0594)	(0.0255)
51 ≤ age ≤ 55	0.176***	0.347***
	(0.0631)	(0.0276)
male	0.147***	0.220***
	(0.0173)	(0.00725)
foreign firm	0.199***	0.129***
	(0.0409)	(0.0179)
public firm	-0.169***	-0.201***
	(0.0551)	(0.0220)
kaitz index	1.004***	-0.458***
	(0.0936)	(0.0384)
food and accommodation	-0.223***	-0.0132
	(0.0282)	(0.0111)
manufactoring	0.287***	-0.0689***
	(0.0246)	(0.0110)
construction	0.0172	0.0160*
	(0.0222)	(0.00918)
year dummies	Yes	Yes
Constant	-2.367***	-0.367***
	(0.112)	(0.0476)
Intercept of susceptible individuals	0.858***	-
	(0.0587)	
Probability that a transition is never made	0,7023	0
	(0,0122)	
Observations	466,021	466,021

Table 4- Exit destinations, computed by the author[15].

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[15] See table 1 in annex for variables description.

For those who exit moving to other firm the mass point approach does not revealed capable to divide the population in two (see table 4, model 2). The results reveal that those who see their MW duration increase by 1%, see their probability of exit changing of firm reduced by 1.295%, ceteris paribus. Thus, it is observed a negative duration dependence.

Regarding the individual characteristics one could observe that the control education variables have now a small coefficient, where those on secondary education experience a higher probability of exit comparing to those with a superior degree, ceteris paribus. Age, as verified on the model 1, table 4, revealed to be a facilitator of exit, now with a larger effect, until a certain age. Gender reveals when comparing to the other models to be a factor that influence the exit of MW but not the type of exit. It could be observed that its coefficient changes but the size effect remains almost the same.

In what concerns to the individual external factors, the results continue to evidence the paper of the owner of capital, with the foreign firm acting as an exit facilitator and the public firm acting as barrier. Getting a wage increase while changing of company also revealed to be a barrier for those who were on a district with a higher Kaitz index. According to our results an increase of 0.1 reduces the exit likelihood to other firm by 4.58%, ceteris paribus. The sector variables demonstrated to be loyalty dependent on the case of those changing to another firm the manufacturing sector act as barrier with a negative coefficient and larger than food and accommodation sector coefficient. On the case of remaining with the same company one could verify that the opposite happen.

The final result to be highlighted is the one verified on all models. The use of year dummies allowed us to understand how the hazard rate changes through time and, it could be seen that the coefficient of these year dummies increase through time, in particular on the

more recent years of our sample. Thus, it is demonstrated that is more and more difficult to exit from MW.

6) Conclusion

The results of this work indicate that the MW duration in Portugal is, in general, short with more than 50% of the workers exiting from the MW within a year. A negative duration dependence is observed, it can be concluded that those who remain on the MW for several years have less and less probabilities of exit. This exit likelihood has also been decreasing through time, in particular in more recent years.

Looking at the different destinations, it can also be concluded that it is easier to exit from MW changing of firm. The results show that the hazard rate for those who remain on the same company is smaller than those who experience a new one.

Regarding to what explanatory variables indicate, one can conclude that a person between the 20 and the 50 years old do not experience a great variation on the hazard rate. Having a basic or even a secondary education contributes to remain on the MW, comparing to those with a college degree, ceteris paribus. Gender discrimination is also observed, being male increases the probability of leaving the MW salary level, in comparison with female.

Finally another innovation of this paper is that it can be concluded that those who live on a district with a higher Kaitz index, have a higher probability to continue on that salary level. The sector variables indicate that belonging to the sector of manufacturing is relevant to explain the permanence on MW, showing a negative relation between belonging to this sector and experiencing an exit.

7) Appendix

Variables description

Variables	Description
duration	Variable that returns how many years starting on the first time has an individual stayed on minimum wage.
age	Gives in each period the age of each individual on the sample. Here dummies were used.
male	Standard dummy variable of gender. It assumes the value of 1 if the individual is male and 0 otherwise.
education	Categorical variable of education,divided in 3 categories: i) basic; ii) secondary and iii) college degree.
foreign firm	Dummy variable that gives information about the type of ownership. If the majority (more thatn 50%) of capital is owned by a foreign investor/company then the variable assumes the value of 1, and 0 otherwise.
public firm	Dummy variable that gives information about the type of ownership. If the majority (more thatn 50%) of capital is owned by a public entity then the variable assumes the value of 1, and 0 otherwise.
manufactoring	Dummy variable that assumes the value of 1 if the individual works on the industry sector, and 0 otherwise.
construction	Dummy variable that assumes the value of 1 if the individual works on the construction sector, and 0 otherwise.
food and accommodation	Dummy variable that assumes the value of 1 if the individual works on the catering sector, and 0 otherwise.
other services	Dummy variable that assumes the value of 1 if the individual works on the consulting, administrative and non-profit sectors, and 0 otherwise.
year	Returns the year on which the sample was gathered. On the model dummies were used.
kaitz index	Variable based on the minimum wage divided by the median wage on the district where the individual live.
spell	Gives to us the number of times that an individual is receiving the minimum salary. The models were computed with the first spell as base.
exit	Binary variable that assumes the value 1 if the individual does exit the spell, this is, if the individual, for in the considered period, stays with a minimum-wage salary. The alternative (exit=0) is verified when an individual is identified, in that period, as being with minimum-wage salaries. Note that the individual may exit the spell with many different destinations: for higher paying jobs or, for any reason out of the labour market.
exit min wage same firm	Binary variable that assumes the value 1 if the individual leaves the minimum wage to earn a higher wage remaining on the same company.
exit min wage other firm	Binary variable that assumes the value 1 if the individual leaves the minimum salary to earn a higher wage changing of company.

Table 1 – Variables summary.

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