DETERMINANTS OF LABOR PRODUCTIVITY IN PORTUGAL

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Master in,
Monetary and Financial Economics

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Acknowledgments

To Professor Ricardo Barradas, for his patience, availability and for all the support provided. He was always there when I needed help. His contribution was essential.

To my family, for the support and motivation throughout my academic path. To my mother, for the dedication, care, determination... she is, without a doubt, an inspiration. To my aunt Sónia, for suggesting me this Master's degree so that I could continue my studies. Their contribution was essential.

To my friends, especially to my great friend Inês Vicente, for our endless friendship and for always being ready to help. Her contribution was essential.

I express my appreciation to all of you for your contributions.

Resumo

De modo a que a economia de um país progrida, é essencial que a produtividade do trabalho cresça de um modo sustentável. Neste sentido, devem conjugar-se uma série de fatores para que se impulsione eficientemente o dinamismo da produtividade do trabalho, de forma a que esta desempenhe um papel fundamental na economia, principalmente em fases de recuperação económica. No entanto, em Portugal, a fraqueza na dinamização deste indicador económico nas últimas décadas, evidenciada pela queda que tem vindo a registar, impossibilita um reforço na sua capacidade natural de se tornar num dos principais impulsionadores da economia. Assim, o objetivo desta dissertação é o de identificar os principais determinantes da produtividade do trabalho em Portugal, cuja análise é fundamental para que se possa traçar um plano de reversão da situação atual. Deste modo, recorre-se a uma análise econométrica de séries cronológicas no período compreendido entre 1977 e 2016. A estimação de uma equação composta por quatro variáveis, PIB, desigualdade do rendimento, salários e financeirização, permitiu assim obter resultados bastante robustos no que diz respeito ao PIB e à desigualdade do rendimento, no entanto, há pouca evidência quanto ao impacto das restantes variáveis na produtividade do trabalho. Os resultados indicam que, no longo prazo, tanto o PIB como a desigualdade do rendimento impactam fortemente a produtividade do trabalho em Portugal, o que permite concluir que esta aumenta (diminui) quando a taxa de crescimento do PIB aumenta (diminui) e quando a desigualdade diminui (aumenta).

Palavras-chave: Produtividade do trabalho, desigualdade do rendimento, PIB, salários, financeirização, Portugal.

Abstract

For a country's economy to progress, it is crucial that labor productivity grows sustainably. For that to happen, plenty of factors must come together to efficiently boost the dynamism of a country's labor productivity, so it would invariably play a fundamental role in the economy, mainly in phases of economic recovery. However, in Portugal, a failure to dynamize this economic indicator over the last decades, evidenced by its steep decline through the years, has prevented the strengthening of its natural capacity to become one of the main drivers of the country's economic performance. For that reason, the purpose of this dissertation is to identify the main determinants of labor productivity in Portugal, as it is critical to draft a plan in order to revert the current situation. Therefore, an econometric analysis of time series was performed for the period comprised between 1977 and 2016. An equation relating four variables, GDP, income inequality, wages, and financialization, was estimated, from which quite robust results were obtained on the impact of GDP and income inequality on labor productivity in Portugal. Nonetheless, inconclusive results were attained for both wages and financialization. Everything considered, it is possible to conclude that, in Portugal, both GDP and income inequality strongly impact labor productivity in the long run, with labor productivity increasing (decreasing) when the GDP growth rate increases (decreases) and when inequality decreases (increases).

Keywords: Labor productivity, income inequality, GDP, wages, financialization, Portugal.

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CHAPTER I

Introduction

Portugal has had low levels of labor productivity for decades and, more recently, the country's labor productivity has even seen a decrease. Additionally, Portugal's labor productivity is one of the lowest when compared with other European Union countries (Table 1). The available data proves, above all, this issue's relevance and significance, highlighting an urge to draft solutions. It is, thus, essential to understand which variables influence labor productivity in Portugal. Globalization (a concept that will be reviewed in detail in section II) is the phenomenon that justifies the importance of this thematic. It is the intense competition between countries to achieve a competitive advantage concerning advanced technology that constitutes a relevant stimulus for the production efficiency process. Therefore, labor productivity - which measures output per worker over a given period of time - is an extremely valuable economic indicator that should never be overlooked, given its usefulness in transmitting fundamental information about a given country's labor market. It also provides relevant information associated with the efficiency and production process quality in a given country, hence the frequently attributed connection between labor productivity and economic growth. As for the variables that influence labor productivity, although it has been largely discussed, most studies focus their analysis on a set of countries and, rarely on a particular one. Regardless, several studies were acknowledged as pertinent, standing out the work of Tridico and Pariboni (2017). This article is the basis supporting this dissertation as the authors try to identify the reason for the increasingly slower growth in labor productivity between 1990 and 2013 in a group of 26 OECD countries, which includes Portugal. However, given that the results reached

Table 1 - *Labor productivity per hour in the EU*

Countries	Labour productivity per hour worked (EU28=100)	
Years	**1995**	**2018**
EU28 - European Union (28 Countries)	100,0	100,0
DE - Germany	134,3	126,8
AT - Austria	119,5	117,7
BE - Belgium	-	134,6
BG - Bulgaria	43,4	Pro 46,3
CY - Cyprus	79,9	Pro 76,6
HR - Croatia	Pro 49,3	-
DK - Denmark	129,4	134,3
SK - Slovakia	48,0	78,2
SI - Slovenia	67,4	84,2
ES - Spain	108,2	Pro 95,7
EE - Estonia	-	69,2
FI - Finland	110,8	108,0
FR - France	132,0	Pro 123,3
GR - Greece	75,0	Pro 64,0
HU - Hungary	47,7	65,6
IE - Ireland	106,1	178,1
IT - Italy	126,0	100,2
LV - Latvia	30,1	60,4
LT - Lithuania	33,9	67,6
LU - Luxemburg	190,3	173,7
MT - Malta	-	80,9
NL - Netherlands	135,9	Pro 126,3
PL - Poland	-	Pro 63,2
PT - Portugal	**68,0**	**s 64,1**
UK - United Kingdom	107,7	97,3
CZ - Czech Republic	60,6	75,4
RO - Romania	23,5	Pro 60,8
SE - Sweden	120,3	113,4

s Estimated Value
Pro Provisional Value

Source: Eurostat | Institutos Nacionais de Estatística - Contas Nacionais Anuais

by the authors reflect only the average of the total number of countries considered, an independent study is needed to identify the specific characteristics of each individual country. The authors also developed an extended version of Labini's original productivity equation (1999) through the inclusion of four variables, GDP, wages, inequality, and financialization, considered determinants of labor productivity. Regarding the connection of each of these variables with labor productivity, the authors argue for a positive relation between the GDP growth rate and the labor productivity growth rate, namely via the contribution of published studies, like Smith (1776), Verdoorn (1949), and Kaldor (1957; 1966; 1967). In Tridico and Pariboni (2017), it is also argued that financialization is associated with the intensification of inequality in income distribution, so that both tend to promote the deceleration of labor productivity. Finally, the authors defend a positive relation between wages and labor productivity through the "Webb-Sylos Labini" effect. After presenting the theoretical arguments that support their positions regarding the relation of each independent variable with labor productivity, the authors resort to an econometric study of panel data to produce the respective estimates, which, consequently, confirm their theoretical arguments. The authors end by concluding that labor productivity increases (decreases) when wages increase (decrease), the GDP growth rate increases (decreases), inequality decreases (increases) and financialization decreases (increases).

The aim of this dissertation is to apply the work productivity equation developed in Tridico and Pariboni (2017), specifically to the Portuguese case, to find the determinants of the country's labor productivity. Therefore, to identify those determinants, an econometric analysis of time series in the period between 1977 and 2016 is done. An equation with four independent variables, particularly, GDP, wages, inequality and financialization, was estimated. The results were obtained through the application of the Autoregressive Distributed Lag (ARDL) estimator, after having concluded that there was a set of integrated variables of both order zero and one, that is, stationary variables, respectively, in levels and first differences. Several proxies were considered to evaluate financialization in order to analyze the financial system through different perspectives. This work shows that inequality and GDP are the variables that present the most robust results in the long run, with the former having a negative impact, and the latter contributing positively to labor productivity.

This dissertation is structured as follows: section II corresponds to the literature review that seeks to provide a wide range of studies about labor productivity and its potential determinant variables; section III describes the data and methodology used; section IV presents the obtained results, as well as their interpretation; section V, seeks to expose the conclusions to be drawn

and also makes a brief assessment of the results in order to evaluate whether or not they were expected according to the theoretical arguments exposed throughout this dissertation and, particularly, in the cited literature. Finally, a suggestion for a more in-depth approach to be further developed is also presented.

CHAPTER II

Literature Review

The determinants of labor productivity have been regularly discussed in the literature. And as a diversity of studies emerged with distinct results over the years, the range of possible variables influencing labor productivity has only winded. The article that better supports this study is the Tridico and Pariboni (2017), namely because it seeks to explain the slowdown in labor productivity in relation to inequality and financialization. The authors sought to identify the reason for the increasingly slower growth in labor productivity in some developed countries in recent years. So, they developed an econometric study using panel data applied to 26 OECD countries between 1990 and 2013. Naturally, the authors took into account several assumptions inherent to numerous theories, and, in order to develop the econometric study, they resorted to the Labini's traditional productivity equation (1999). Those assumptions concern labor productivity determinants which have been widely discussed in two theories, the post-Keynesian and the Classical-Kaldorian theories. The authors specifically resort to post-Keynesian theory to establish a relation between labor productivity and inequality, as well as labor productivity and the financialization degree. They also resort, in particular, to the Classical-Kaldorian theory to establish a relation between labor productivity and poor GDP performance and also between the decline in wages.

It is broadly recognized, though, that until the mid-1970s, the economic growth in most developed countries was evident, and the wages were steadily and sustainably rising. Nonetheless, the return rate in these countries had not grown since 1945, which led to a paradigm shift in the world's economy (Tridico and Pariboni, 2017).

The so-called "financial capitalism" emerged in the late 1970s from the stagnation of the return rate. And with this new exclusively aimed profit perspective, the emergence of phenomena, such as financialization and globalization, which would become the new paradigm's pillars, was inevitable. Expectedly, accompanying these phenomena, a series of concepts emerged, and changes happened in each of these countries' economic activity. Among those changes, it is worth highlighting the rise of labor flexibility (or labor market deregulation), free trade, capital mobility, and the financial sector's deregulation (Tridico and Pariboni, 2017).

As supported by several authors, labor flexibility triggers a reduction in labor costs (Vergeer and Kleinknecht, 2014), mainly in a profit-driven economy, which will negatively

affect labor productivity. On the flipside, according to Vergeer and Kleinknecht (2014), a strong regulation of the labor market constitutes a barrier to unfair dismissal, which contributes to the workers' confidence about their job stability, a situation that favors the growth of labor productivity.

Once the managers start to get paid for the profit their company can generate (that is, they are remunerated according to short-term performance), they end up focusing their attention on the dividends distribution (since they act under the shareholders' interests) and on the profitability of the company's activity, and progressively less on eventual productivity gains. That certainly leads managers to further resort to speculative investments and increasingly less to productive investments (Tridico and Pariboni, 2017), a behavior that, through the speculation and indebtedness, alludes to the financialization phenomenon. In these situations, the main goal of managers is to become gradually more competitive, an ideology that in Tridico and Pariboni (2017) is named "corporate downsizing" and "downsize and distribute" at the level of non-financial companies.

Globalization, or rather, the rapid integration of different societies and economies of the world, as defined in World Bank (2008), has, to a certain extent, harmed labor productivity in developed countries. The emergence of laws favorable to the flexibility of companies' activities to promote profitability, gave rise to aggressive outsourcing practices as a way of increasing competitiveness, which allowed these companies to focus solely on their core business. On the one hand, this situation benefits companies in terms of profitability. On the other hand, globalization also creates, as mentioned, labor flexibility, stagnation, and can even lead to wage reduction, hence, contributing negatively to labor productivity (Tridico and Pariboni, 2017).

To synthesize the paradigm shift process and the respective consequences for the economy and labor productivity, in Tridico and Pariboni (2017) is presented a relevant explanatory scheme (Figure 1).

Figure 1 - *From financial capitalism to declining labor productivity*
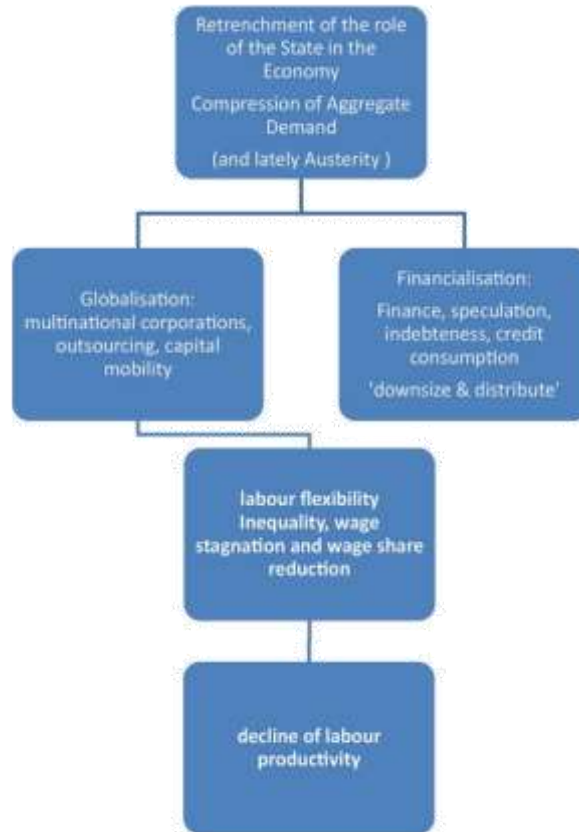
Fonte: Tridico and Pariboni (2017)

Throughout this dissertation, Tridico and Pariboni (2017) has been specially referenced since their work made an important contribution to the overall understanding of the labor productivity determinants, having been, thus, the source of the selected variables to be tested through a single econometric study. The authors did not limit themselves to just simply test the validity of Labini's traditional productivity equation (1999) in different contexts (Carnevali *et al*., 2019), but they have also expressed their own evidence based view and adapted the equation so that it was in line with the post-Keynesian and Classical-Kaldorian theories, developing an extended version of the referred equation. In addition, they applied it to a broader sample, a total of 26 OECD countries. Nevertheless, Labini's original productivity equation (1999), summarized in Tridico and Pariboni (2017), is presented below as follows:

$$g^Y = g^{Y/L} = f(g^Y, W/P_{ma}, 1 - \Pi), with\ f'g_Y, f'_{W/P_{ma}}, f'_{1-\Pi} > 0 \qquad (1)$$

citing Tridico and Pariboni (2017), the first argument (g^Y) corresponds to the so-called "Smith effect", and the second argument (W/P_{ma}) to the named "Ricardo effect". Given the complexity and variety bibliographic production regarding these effects, it is now essential to

proceed with its interpretation under a scope that includes both parameters in Labini's original equation (1999), considering also their views on each of the effects' relation to labor productivity.

Starting with the "Smith effect", it is usually associated with the market's size (Carnevali *et al.*, 2019). The logic behind this effect dates back to 1776, when Smith published "The Wealth of Nations" (1776). It was through his research that the first reference to the positive relation between labor productivity and a given country's economy total production emerged. The relation between these two variables results from the division of labor (which allows workers to focus on specific tasks) which, in turn, is a consequence of the market's expansion (Smith, 1776), as it is later confirmed by Verdoorn (1949), "One could have expected a priori to find a correlation between labor productivity and output, given that the division of labor only comes about through increases in the volume of production". This reference to Verdoorn's study is not by chance, since he later came to contribute to this thematic. In Verdoorn (1949) it is concluded that the manufacturing industry is a fundamental part of a country's economy as it is the sector that presents the highest levels of productivity. Therefore, through Smith's original concept of division of labor (1776), in Verdoorn (1949) it is established a direct relation between production and labor productivity in the manufacturing industry.

After 1957, Kaldor added his contribution to this thematic, thus leading to the origin of the termed "Kaldor-Verdoorn law". According to the Classical-Kaldorian theory, labor productivity is endogenous, being the increase in demand and, consequently, the rise of the economy's growth rate, that mostly promote labor productivity (Kaldor, 1966; 1967). The rise of the economy's production in response to an increase in demand happens through increasing returns to scale (Kaldor, 1957), a phenomenon associated particularly with labor division processes and the manufacturing industry, which Kaldor defends to be the economy's engine, depending on it all the other sectors. As referenced in Carnevali *et al.* (2019), Kaldor argues that, comparatively to the other sectors, the growth rate of labor productivity in the manufacturing industry is higher. And so, the workforce ends up being transferred from less productive sectors to more productive ones, promoting a greater growth of the labor productivity and the general production of the economy.

Assuming that the manufacturing industry is, in fact, the engine of the economy and since it is operating through increasing returns to scale, it is possible to state that it facilitates technological progress, which is beneficial for the economic development. In these terms, this sector contributes more than the remaining in terms of production and labor productivity.

Throughout his study on this thematic, Kaldor formulates three laws summarizing his results, later known as "The Three Laws of Economic Growth".

In his first law, Kaldor establishes a relation between the manufacturing industry production and the total production of the economy, by asserting that the higher the sector's growth rate, the higher the economy's growth rate. Its second law, known as "Kaldor-Verdoorn law" states more precisely that the manufacturing industry's labor productivity growth rate depends positively on the sector's production growth rate, a relation established through the increasing returns to scale related with the sector. Lastly, the third law established that the growth rate of the productivity of all economic sectors depends positively on the growth rate of the manufacturing industry sector's production.

Considering the contributions of Adam Smith and Verdoorn, and the Kaldor's three laws, a positive relation can be recognized between production and labor productivity. Moreover, in Carnevali *et al*. (2019)[1], cited frequently throughout this literature review, a similar conclusion was drawn. By elaborating a study to analyze the labor productivity determinants in both core and peripheral countries of the Eurozone between 1996 and 2016, the authors concluded, regarding the "Smith effect", that the economic growth positively influences labor productivity in both core and peripheral country groups.

The second argument of Labini's equation (1999), named "Ricardo effect" (introduced by Hayek, 1942), concerns the relative labor costs or, more specifically, the costs of labor relatively to the price of investment goods, that is, machines. According to Labini's theory (1999), the sign of this effect is positive, which supports that when there is an increase in relative labor costs, there is also an increase in labor productivity. This positive relation between these two variables, productivity and relative labor costs, is also tested and confirmed in the econometric study presented in Carnevali *et al*. (2019) for both core and peripheral Eurozone country groups. In the employer's perspective, a persistent growth in labor costs represents a stimulus to reorganize the production process more efficiently, explicitly via investment goods without having to hire more workers (Labini, 1999). In addition, an increase in the relative labor costs in relation to the price of machines may have implied a drop in its price, which is why employers, facing this situation, prefer to replace workers with machines. However, it is important to note that this is a strategic decision whose results will only take effect in the long-term (Carnevali et al., 2019; Labini, 1999).

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[1] Unlike in Tridico and Pariboni (2017), Carnevali *et al.* (2019) study was based on the Sylos-Labini productivity equations, in order to test its validity and empirically analyze the determinants of labor productivity.

As already mentioned, in Tridico and Pariboni (2017), the authors did not only just test the validity of Labini's traditional productivity equation (1999) in a given context but also analyzed it critically based on the literature associated with labor productivity and according to the post-Keynesian and Classical-Kaldorian theories. In result, they concluded that the labor productivity determinants that had to be included in the estimation were GDP growth rate, wages, inequality, and financialization. In other words, they decided against including the "Ricardo effect" in the estimation, establishing, instead, a comparison between the relative and absolute labor costs. The "Ricardo effect" implies an analysis of cost in relation to other productive factors, whereas an analysis of absolute cost does not imply a comparison between the costs of labor and the other productive factors. Nevertheless, the influence of each cost analysis on labor productivity is quite similar, as mentioned in Guarini (2016, quoted in Tridico and Pariboni, 2017). In order to explain the absence of the "Ricardo effect" parameter from the estimation, the authors also resort to Gehrke (2003) study. Gehrke's aim was to exclusively analyze the meaning and validity of the "Ricardo effect", and one of his conclusions is that this effect "(…) presupposes very special assumptions about the available set of production methods, and thus (Ricardo effect) is not of general validity" – Gehrke (2003: p. 146).

On this account, Labini's (1999) extended equation developed by Tridico and Pariboni (2017) relates four variables as labor productivity determinants, as follows:

$$g^{\lambda} = g^{Y/Lh} = f(g^{Y}, 1 - \Pi, Ineq, Fin) \tag{2}$$

Where g^{Y} represents GDP, $1 - \Pi$ signifies wages, $Ineq$ denotes inequality and Fin represents financialization. It should be noted that these four variables were identified as labor productivity determinants in Tridico and Pariboni (2017) study, which took into account the previously mentioned theories and a previous analysis of the Labini's original productivity equation (1999).

In Tridico and Pariboni (2017), financialization is included in the estimation in order to determine to what extent financialization has affected the most recent trends in labor productivity. This matter has been analytically investigated accordingly to the labor structure of the post-Keynesian model of endogenous growth in labor productivity. It is, thus, necessary to highlight the general ideas found in the relevant literature regarding this thematic.

As previously mentioned, the profitability rates' stagnation in most developed countries until the end of the 1970s, led to the emergence of the financialization process, a phenomenon that has been growing since the end of the 1980s (Tridico and Pariboni, 2017). That is, it was during the economic paradigm shift (of which this phenomenon is an integral part) that the

financialization process developed, until reaching maximum levels during the 2008 financial crisis (Giacché, 2011; Tridico and Pariboni, 2017).

According to Giacché (2011), financialization has three purposes: providing credit to families, providing credit to companies and speculating about capital appreciation. The growing labor market deregulation, which is registered since the late 1970s, promoted wage stagnation as a result of a greater degree of freedom for the employers. However, unlike in the previous profitability rates' stagnation, this time there was no subsequent paradigm shift in the economy. On the contrary, the so-called "financial capitalism" was even potentiated, as there were no changes in consumption patterns, "(…) a wage earner whose wage decreases but who consumes as before or even more than before." – Giacché (2011: p. 26). Financialization also benefited companies, since they were provided with easier access to credit and the companies themselves encouraged the granting of credit to consumers (e.g., the automotive industry). These firms, as previously mentioned, sought to achieve profit through financial operations (Giacché, 2011; Tridico and Pariboni, 2017). For such purpose, that of obtaining higher profit levels in the shortest period of time, is speculation one of the main pillars of financialization, as "since the 1980s, the boom of finance and credit made it possible to speculate with the hope of obtaining otherwise impossible levels of profit." – Giacché (2011: p. 27). Therefore, one of the many reasons for expecting a negative relation between financialization and labor productivity is the fact that company managers are remunerated for short-term performance, representing this an incentive to reinvest profits in speculative investments, which is to say, the "downsize and distribute" ideology. This method hinders technological progress, which, in turn, directly influences labor productivity. This situation persisted until the financial crash in 2008 when financialization reached its maximum levels, as mentioned in Lazonick (2000, quoted in Tridico and Pariboni, 2017).

Financialization is also associated with greater labor flexibility that contributes to an increase in inequality. In Tridico (2017), it is argued, based on Hein (2015), that financialization worsens the income distribution (increases inequality). Since company managers are remunerated according to short-term performance and, so, choose to resort to speculative investment (in order to enhance the shareholders-oriented value by maximizing dividends), a consequent reduction in production costs is inevitable, namely through wages reduction, which Soskice (1990, quoted in Dasgupta, 2013: p. 13) associates with wage flexibility "It refers to the firm's ability to adjust wages in a manner which suits the changing conditions of cost competitiveness and product demand in the market. Among others, labor regulation (…) is viewed as the principal hindrance for this type of flexibility at the firm level".

As a matter of fact, work flexibility (in particular, wage flexibility) only simplifies this whole process as it allows managers to reduce both wages and the number of workers, that is, easily creating precarious work, which increases inequality in income distribution (measured by the Gini coefficient).

The negative relation established between labor flexibility/inequality and labor productivity can also be explained, according to Tridico and Pariboni (2017), by the fact that a decrease in wages, and an increase in both precarious work and inequality leads to a gradual decrease in production as workers receive insufficient incentives to produce. In conclusion, a wage reduction translates into a decline in labor productivity.

Therefore, and according to Tridico and Pariboni (2017), the theory that explains how wages influence labor productivity is the "Webb-Sylos Labini effect". In Webb (1912), the author defended the establishment of a legal minimum wage as a way to prevent excessive wage compression by company managers, representing, thus, a strong obstacle to labor flexibility "(…) entrepreneurs have to find other ways to lower the production costs with respect to their competitors. Indeed, they are induced to hunt for productivity gains to be generated by means of improvements in the productive process." (Tridico and Pariboni, 2017: p. 243). Along these lines, Sylos Labini argues that this exerted pressure on the rise of labor costs "(…) provides a stimulus to reorganize the production process in a more efficient way (…) by making the necessary investment relatively convenient, the adoption of technologically advanced equipment and machinery, which allow to raise production without having to increase the number of employees" (Tridico and Pariboni, 2017: p. 243). From another point of view, the named "Marshall effect", mentioned by Carnevali *et al.* (2019), confirms that wages are positively related to labor productivity, since higher wages attract highly productive workers and encourage them to be more efficient (Marshall, 1890, cited in Carnevali *et al.*, 2019).

Concerning wages and labor flexibility, in Vergeer and Kleinknecht (2014), the authors also developed an econometric model based on data from 20 OECD countries. The aim of the study was to confirm their ideas mainly in respect of the influence of both wages and labor flexibility on labor productivity. So, basically, the authors argue that the labor market deregulation causes a widespread tendency to reduce costs (for example, through wages), leading to a weakening of the market through a rise of precarious and unproductive work. Like in Tridico and Pariboni (2017), they further state that labor flexibility and, in particular, wage flexibility, generates a greater tendency towards a reduction in wages, which, in turn, harms labor productivity. The results presented in Carnevali *et al.* (2019) do not confirm the referred trend, but neither do they support that a reduction in labor market rigidity promotes labor

productivity. Thus, against their predictions, the results didn't show evidence of a possible relation between labor flexibility and labor productivity.

Contrariwise, in both Vergeer and Kleinknecht (2014) and Tridico and Pariboni (201) is expected a negative relation between labor flexibility (which contributes to inequality) and labor productivity, and a positive one between wages and labor productivity.

Lastly, the results presented in Tridico and Pariboni (2017) confirm the theoretical arguments exposed throughout this review. So, labor productivity growth increases (decreases) when wages increase (decrease), the GDP growth rate increases (decreases), inequality decreases (increases) and financialization decreases (increase).

As one of the European countries with the lowest labor productivity, Portugal is an interesting case study. Through this dissertation, the intended contribute to this area of research is to apply an econometric model specifically to the Portuguese case and later determine if the obtained results correlate or not with the ideas and conclusions defended by the cited authors.

CHAPTER III

Data and Methodology

Given the available data for Portugal, each variable considered was analyzed annually over the period between 1977 and 2016. Since data regarding inequality (in this case, measured by the Income Inequality Top 1% Share) and market capitalization (one of the proxies for financialization) are only available, respectively, since 1976 and 1977, it was not possible to extend the period under analysis. It is worth noting that these two proxies have less data set when compared to the other three (money supply, total credit from the non-financial sector, and the financial value added) that will also be considered to measure this variable. However, with data available since 1977, it is also possible to analyze the financialization process' evolution from its beginning until it reached its peak just before the 2008 financial crisis (Barradas *et al*., 2018). The use of different proxies to measure financialization is a very common strategy in the related literature since it allows an analysis of the financial system through different perspectives, namely by using proxies associated with the banking system (more appropriated according to the Portuguese financial reality, such as the money supply proxies, financial value added and total credit to the non-financial sector) and with the financial markets, such as the stock market capitalization proxy, which Tridico and Pariboni (2017) also used in their model.

Both the proxies and the sources of the respective variables are shown in Table 2. The descriptive statistics for each of the variables are presented in Table 3, while the correlations between them are shown in Table 4. Figures A1 to A8 graphs the dependent variable's evolution, labor productivity, and all independent variables. It should be noted that, in Table 4, the correlation between inequality and labor productivity is negative, which means that between 1977 and 2016 in Portugal, a negative correlation between these variables is confirmed, given that they occurred simultaneously. As illustrated in Figures A1 and A3, there was an increase in inequality in Portugal and a slowdown in labor productivity. Financialization also correlates negatively with labor productivity, regardless of the considered proxy. Regarding wages and GDP, as these variables have also decreased over the analyzed period, both, but especially the former, positively correlate with labor productivity (Figure A4). Nevertheless, this does not confirm these variables' contribution to the decline in labor productivity. A causal relation between these variables and labor productivity can only be determined through the results of the econometric study.

Table 2 – The proxies and sources of each variable

Variable	Proxy	Source
Labor Productivity	Gross domestic product at current prices per hour worked (annual %)	AMECO
GDP	Gross domestic product at 2015 reference levels (annual %)	AMECO
Wage Share	Adjusted wage share (% of GDP)	AMECO
Inequality	Income Inequality Top 1% Share (%)	World Inequality Database
Credit	Total credit to private non-financial sector (% of GDP)	Fred St. Louis
Money Supply	Liquid liabilities (% of GDP)	Fred St. Louis
Stock Market Capitalization	Stock market capitalization (% of GDP)	Fred St. Louis
Financial Value Added	Gross value added of financial, insurance and real estate activities (% of total)	PORDATA

Table 3 – The descriptive statistics of each variable

Variable	Mean	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
Labor Productivity	0.107	0.055	0.277	-0.003	0.091	0.618	1.837
GDP	0.024	0.021	0.079	-0.041	0.028	-0.027	2.747
Wage Share	0.597	0.586	0.810	0.510	0.061	1.625	5.943
Inequality	0.095	0.099	0.110	0.072	0.011	-0.827	2.603
Credit	1.425	1.310	2.301	0.788	0.486	0.370	1.731
Money Supply	0.855	0.842	1.015	0.583	0.105	-0.455	2.752
Stock Market Capitalization	0.226	0.265	0.512	0.003	0.162	0.009	1.819
Financial Value Added	0.138	0.135	0.181	0.097	0.027	0.159	1.856

Table 4 – The correlations between variables

	LP	GDP	WS	INEQ	C	MS	SMC	FVA
Labor Productivity	1.000							
GDP	0.517***	1.000						
Wage Share	0.648***	0.364**	1.000					
Inequality	-0.847***	-0.257	-0.498***	1.000				
Credit	-0.650***	-0.697***	-0.377**	0.382**	1.000			
Money Supply	-0.800***	-0.714***	-0.647***	0.513***	0.847***	1.000		
S.M.Capitalization	-0.846***	-0.286*	-0.509***	0.792***	0.567***	0.683***	1.000	
Financial Value Added	-0.861***	-0.539***	-0.557***	0.712***	0.814***	0.783***	0.678***	1.000

Note: *** indicates statistical significance at 1% level, ** indicates statistical significance at 5% level and * indicates statistical significance at 10% level

To pick the most appropriate econometric methodology in order to estimate the referred equation, it is necessary to assess the existence (or not) of unit roots in each variable through the augmented Dickey–Fuller test (1979) (ADF) and the Phillips–Perron test (1998) (PP), the results of which are revealed in Tables 5 and 6, respectively. The specific purpose of both tests is to reveal whether the variables are stationary at level, I (0), or in first differences, I (1).

Table 5 – *P-values* of the ADF unit root test

Variable	Level			First Difference		
	Intercept	*Trend and Intercept*	*None*	*Intercept*	*Trend and Intercept*	*None*
Labor Productivity	0.289	0.932	0.015*	0.000*	0.000	0.000
GDP	0.067	0.008*	0.023	0.000	0.001	0.000*
Wage Share	0.001	0.192*	0.005	0.001	0.663	0.045*
Inequality	0.733	0.659	0.848*	0.000	0.000	0.000*
Credit	0.509	0.523	0.630*	0.174	0.627	0.022*
Money Supply	0.305	0.035*	0.979	0.001	0.008	0.000*
Stock Market Capitalization	0.512*	0.950	0.745	0.001	0.003	0.000*
Financial Value Added	0.925	0.011*	0.967	0.003*	0.016	0.109

Note: The lag lengths were selected automatically based on the AIC criteria and * indicates the exogenous variables included in the test according to the AIC criteria

Table 6 – *P-values* of the PP unit root test

Variable	Level			First Difference		
	Intercept	*Trend and Intercept*	*None*	*Intercept*	*Trend and Intercept*	*None*
Labor Productivity	0.450	0.276*	0.000	0.000*	0.000	0.000
GDP	0.068	0.088*	0.027	0.000	0.000	0.000*
Wage Share	0.002*	0.019	0.013	0.001	0.009	0.000*
Inequality	0.695	0.296*	0.792	0.000	0.000	0.000*
Credit	0.792	0.757	0.816*	0.165	0.457	0.021*
Money Supply	0.168	0.094*	0.955	0.004	0.024	0.000*
Stock Market Capitalization	0.491*	0.839	0.637	0.002	0.013	0.000*
Financial Value Added	0.924	0.190*	0.970	0.000	0.000	0.000*

Note: * indicates the exogenous variables included in the test according to the AIC criteria

According to both tests, GDP and money supply are stationary at level, that is, I (0), which is shown in Tables 5 and 6. Labor productivity and the financial value added, on the contrary, are stationary at level only according to the ADF test, while wages are stationary at level according to the PP test. Inequality, credit, and market capitalization, according to both tests, only become stationary in first differences, that is, I(1). Hence, it is important to emphasize that we are in the presence of a combination of variables which are integrated of order zero and one.

Based on the results, the most appropriate econometric methodology for this case is the Autoregressive Distributed Lag (ARDL), proposed in Pesaran (1997), Pesaran and Shin (1999), and Pesaran *et al*. (2001). Since the ARDL estimator is standardly used in situations dealing with a combination of variables integrated in a different order, I(0) and I(1), as it is one of its advantages, it is the most suitable methodology for this study. Moreover, this estimator is more reliable for small and finite samples, and produces, even in the long run, consistent estimates, which is appropriate to proceed with the estimates required in this study.

Implementing the ARDL procedure comprises a series of investigation steps, starting with the analysis of the number of lags to be included in the estimates according to the information criteria. Then, the study of the cointegration relation between variables continues, using the band testing methodology developed in Pesaran *et al*. (2001). The next step is the econometric analysis of any issues that may threaten the estimates' reliability, through a set of diagnostic tests to assess the residues' autocorrelation (using the Breusch-Godfrey Serial Correlation LM test), their normality (using the Jarque-Bera test), if they are homoscedastic (using the Breusch-Pagan-Godfrey test), and identifying possible specification errors due to omitted variables or incorrect functional form (Ramsey's RESET test). Finally, short and long-term estimates for labor productivity in Portugal are presented.

CHAPTER IV

Results

As mentioned, the ARDL methodology implementation begins with the analysis of the number of lags to be included in the estimates, according to the information criteria. Thus, for the credit, the money supply, and the market capitalization proxy models, lags between zero and five were considered. For the financial value-added proxy model were considered lags between zero and four so that the stability condition[2] is guaranteed, which would not happen if a greater number of lags had been considered.

Table 7 – Values of the information criteria by lag

Proxy (Financial System)	Lag	LR	FPE	AIC	SC	HQ
Credit	0	n.a.	5.53e-15	-18.640	-18.418	-18.563
	1	265.383	2.49e-18	-26.362	-25.029*	-25.902
	2	31.031	3.13e-18	-26.227	-23.783	-25.383
	3	44.270*	1.64e-18	-27.128	-23.573	-25.901
	4	34.139	1.05e-18	-28.138	-23.472	-26.527
	5	31.125	4.63e-19*	-30.168*	-24.390	-28.174*
Money Supply	0	n.a.	1.73e-16	-22.103	-21.881	-22.027
	1	201.080	7.16e-19	-27.609	-26.275*	-27.148
	2	32.282	8.54e-19	-27.525	-25.081	-26.681
	3	42.415*	4.94e-19	-28.329	-24.774	-27.102
	4	34.489	3.09e-19	-29.364	-24.698	-27.753
	5	34.153	9.70e-20*	-31.730*	-25.953	-29.736*
Stock Market Capitalization	0	n.a.	5.72e-16	-20.908	-20.686	-20.831
	1	180.66	4.78e-18	-25.709	-24.376	-25.249
	2	45.805	3.25e-18	-26.189	-23.745	-25.345
	3	45.079*	1.63e-18	-27.133	-23.578	-25.906
	4	33.650	1.08e-18	-28.108	-23.442	-26.497
	5	31.622	4.51e-19*	-30.193*	-24.416*	-28.199*
Financial Value Added	0	n.a.	1.04e-17	-24.918	-24.698	-24.841
	1	221.109*	2.66e-20*	-30.899	-29.580*	-30.439*
	2	23.978	4.45e-20	-30.470	-28.050	-29.625
	3	34.965	3.92e-20	-30.829	-27.310	-29.601
	4	27.428	4.20e-20	-31.269*	-26.650	-29.657

Note: * indicates the optimal lag order selected by the respective information criteria

After determining the number of lags to be considered for each model, it is necessary to analyze the cointegration relation between the variables under study using the band test methodology (Table 8). As shown, all models present a value associated with F-Statistic higher than the upper bound by at least 10%, meaning that the variables are cointegrated in all of them.

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[2] A maximum of five lags was considered to be included in most of the VAR models in question, since, with a higher number of lags, they would not fulfill the stability condition, otherwise at least one characteristic polynomial root would be outside the unit circle (Lütkepohl, 1991).

Table 8 – Bounds test for cointegration analysis

Growth Model Proxy (Financial System)	F-Statistic	Critical Value	Lower Bound Value	Upper Bound Value
Credit	4.484 (5 lag)	1%	5.15	6.62
		5%	3.58	4.67
		10%	3.04	4.00
Money Supply	17.895 (5 lag)	1%	5.15	6.62
		5%	3.58	4.67
		10%	3.04	4.00
Stock Market Capitalization	8.647 (5 lag)	1%	5.15	6.62
		5%	3.58	4.67
		10%	3.04	4.00
Financial Value Added	4.291 (1 lag)	1%	5.15	6.62
		5%	3.58	4.67
		10%	3.04	4.00

The following step, as previously mentioned, concerns the diagnostic tests (Table 9), specifically, the Breusch-Godfrey test that assesses autocorrelation, the Jarque-Bera test which assesses normality, the Breusch-Pagan-Godfrey test that measures heteroscedasticity, and finally, the Ramsey's RESET test which evaluates whether the model is well specified in its functional form. According to the resulting data, displayed on Table 9, and given that the *p-values* of all the tests are higher than the traditional significance levels, it can be stated that, in all the tests, the errors are not autocorrelated, but are normal and homoscedastic and the models are correctly specified in their functional form. Therefore, it confirms that the models do not indicate any econometric issues. Subsequently, it is now possible to proceed to the last step, which corresponds to the presentation and analysis of the long and short-term results.

Table *9* – Diagnostic tests for ARDL estimates

Growth Model Proxy (Financial System)	Diagnostic Test	F-Statistic	*P-value*
Credit	Breusch-Godfrey	0.904	0.378
	Jarque-Bera	2.185	0.335
	Breusch-Pagan-Godfrey	0.400	0.960
	Ramsey's RESET	0.130	0.731
Money Supply	Breusch-Godfrey	3.325	0.142
	Jarque-Bera	0.768	0.681
	Breusch-Pagan-Godfrey	1.902	0.245
	Ramsey's RESET	0.009	0.928
Stock Market Capitalization	Breusch-Godfrey	0.001	0.975
	Jarque-Bera	0.543	0.762
	Breusch-Pagan-Godfrey	0.453	0.943
	Ramsey's RESET	1.626	0.238
Financial Value Added	Breusch-Godfrey	1.645	0.222
	Jarque-Bera	0.819	0.664
	Breusch-Pagan-Godfrey	1.256	0.336
	Ramsey's RESET	2.697	0.125

Note: Breusch-Godfrey tests were conducted with 1 lag and Ramsey's RESET tests were performed with 1 fitted term, albeit results do not change if we had used more lags and more fitted terms, respectively

In the long run (Table 10), only the GDP and inequality coefficients are presented as statistically significant in all the considered models. The relation direction obtained between both variables and labor productivity is consistent with the previously discussed literature in section II of this study. The GDP (Smith effect) positively influences labor productivity in

Portugal, while inequality has a negative influence. It is important to note that, in the money supply proxy model, inequality has a strong impact on labor productivity, as, for each 1 p.p. increase in income inequality, labor productivity decreases by approximately 7,9 p.p.

Regarding wages, except for the financial value added model, which establishes a negative relation between wages and labor productivity, there is no evidence of it having an impact on labor productivity, meaning that, in general, in Portugal, the evolution of wages does not influence labor productivity. It is, thus, possible to claim that, due to the wages' reduction trend (in % of GDP) that has characterized the Portuguese economy over the last years (Figure A4), insignificant wage increases do not contribute to improve labor productivity. On the contrary, in the reviewed literature, it is argued that an increase in wages can stimulate an increase in productivity, since an increase in labor costs leads employers to organize the production process more efficiently by advancing the technology used to boost production without needing to hire more workers (Labini, 1999). Yet, this argument is quite limited to the financial capacity of each company. Due to financial constraints, certain employers may prefer to increase wages instead of investing in technology, thus, delaying the production process and, subsequently, labor productivity. This reasoning may explain the long-term results for the financial value added model. As far as financialization is concerned, there is only some evidence of its influence through the money supply proxy. A negative relation between this variable and labor productivity was obtained, confirming the arguments presented throughout section II. Due to the insignificant results regarding the trend of each model, no exogenous factors that could explain the evolution of labor productivity were identified.

Table 10 – The long-term estimates of the models

Variable	Credit	Money Supply	Stock Market Capitalization	Financial Value Added
GDP	1.420** (0.584) [2.429]	1.991*** (0.379) [5.246]	3.227*** (0.760) [4.247]	0.983** (0.405) [2.430]
Wage Share	-0.122 (0.219) [-0.556]	0.215 (0.212) [1.018]	-0.261 (0.256) [-1.019]	-0.703*** (0.226) [-3.115]
Inequality	-2.348*** (1.215) [-1.932]	-7.913*** (1.417) [-5.586]	-4.598** (1.649) [-2.789]	-2.285** (1.037) [-2.203]
Financialization	0.036 (0.029) [-1.243]	-0.590*** (0.099) [-5.984]	0.003 (0.062) [0.050]	0.120 (0.642) [0.186]
@TREND	-0.004 (0.002) [-1.870]	0.005* (0.002) [2.335]	0.002 (0.002) [0.732]	-0.005** (0.002) [-2.251]

Note: Standard errors in (), t-statistics in [], *** indicates statistical significance at 1% level, ** indicates statistical significance at 5% level and * indicates statistical significance at 10% level

Concerning the short-term results (Table 11), there are three main conclusions to be drawn. First, the coefficient of the error correction mechanism is statistically significant in all models

at a 1% significance level, being always negative and varying between 0 and -2. As this coefficient measures the speed of adjustment towards long-term equilibrium, it means that the considered models are stable and converge for the long-term whenever an imbalance occurs. Second, it confirms that labor productivity is a persistent variable, that is, the productivity of previous years is positive and statistically significant and, so, contributes to explain contemporary labor productivity. Finally, the models have a high R-square and an adjusted R-square, indicating that the models describe reasonably well the evolution of labor productivity in Portugal.

Table 11 – The short-term estimates of the models

Proxy (Financial System)	Variable	Coefficient	Standard Error	T-Statistic
Credit $R^2 = 0.962$ Adjusted $R^2 = 0.892$	Δ**Labor Productivity**$_{t-1}$	0.797***	0.167	4.779
	Δ**Labor Productivity**$_{t-2}$	0.602***	0.129	4.658
	Δ**Labor Productivity**$_{t-3}$	0.330**	0.117	2.828
	Δ**GDP**$_{t-1}$	-1.405***	0.272	-5.166
	Δ**GDP**$_{t-2}$	-1.028***	0.257	-3.998
	Δ**GDP**$_{t-3}$	-0.832***	0.237	-3.505
	Δ**GDP**$_{t-4}$	-0.758***	0.137	-5.539
	Δ**Wage Share**$_{t-1}$	0.100	0.195	0.513
	Δ**Wage Share**$_{t-2}$	-0.804**	0.248	-3.245
	Δ**Inequality**$_{t-1}$	1.102***	0.593	1.858
	Δ**Inequality**$_{t-2}$	0.338***	0.632	0.535
	Δ**Inequality**$_{t-3}$	-0.641***	0.586	-1.093
	Δ**Inequality**$_{t-4}$	1.684***	0.695	2.422
	Δ**Financialization**$_{t-1}$	-0.050***	0.057	-0.886
	Δ**Financialization**$_{t-2}$	0.053***	0.063	0.840
	Δ**Financialization**$_{t-3}$	-0.167***	0.064	-2.621
	Δ**Financialization**$_{t-4}$	-0.143***	0.055	-2.614
	ECT$_{t-1}$	-1.296***	0.191	-6.791
Money Supply $R^2 = 0.993$ Adjusted $R^2 = 0.979$	Δ**Labor Productivity**$_{t-1}$	0.753***	0.075	10.037
	Δ**Labor Productivity**$_{t-2}$	1.133***	0.093	12.194
	Δ**Labor Productivity**$_{t-3}$	1.187***	0.094	12.601
	Δ**Labor Productivity**$_{t-4}$	0.713***	0.078	9.111
	Δ**GDP**$_{t-1}$	-1.526***	0.098	-15.520
	Δ**GDP**$_{t-2}$	-1.060***	0.111	-9.585
	Δ**GDP**$_{t-3}$	-0.918***	0.096	-9.574
	Δ**GDP**$_{t-4}$	-0.936***	0.088	-10.657
	Δ**Wage Share**$_{t-1}$	-0.691***	0.114	-6.0577
	Δ**Wage Share**$_{t-2}$	-0.897***	0.073	-12.293
	Δ**Wage Share**$_{t-3}$	0.612***	0.082	7.477
	Δ**Wage Share**$_{t-4}$	1.388***	0.122	11.332
	Δ**Inequality**$_{t-1}$	3.401***	0.363	9.362
	Δ**Inequality**$_{t-2}$	1.048**	0.285	3.673
	Δ**Inequality**$_{t-3}$	1.278**	0.343	3.728
	Δ**Inequality**$_{t-4}$	1.535***	0.298	5.154
	Δ**Financialization**$_{t-1}$	0.264***	0.065	4.060
	Δ**Financialization**$_{t-2}$	-0.090	0.056	-1.614
	Δ**Financialization**$_{t-3}$	0.543***	0.051	10.600
	ECT$_{t-1}$	-1.633***	0.111	-14.654
Stock Market Capitalization $R^2 = 0.954$ Adjusted $R^2 = 0.889$	Δ**Labor Productivity**$_{t-1}$	0.298**	0.103	2.894
	Δ**GDP**$_{t-1}$	-2.862***	0.319	-8.979
	Δ**GDP**$_{t-2}$	-1.778***	0.261	-6.803
	Δ**GDP**$_{t-3}$	-1.167***	0.220	-5.317
	Δ**GDP**$_{t-4}$	-0.860***	0.149	-5.763
	Δ**Wage Share**$_{t-1}$	-0.505**	0.223	-2.263
	Δ**Wage Share**$_{t-2}$	-1.553***	0.186	-8.353
	Δ**Wage Share**$_{t-3}$	-0.614***	0.170	-3.617
	Δ**Inequality**$_{t-1}$	2.496***	0.626	3.987
	Δ**Inequality**$_{t-2}$	1.711**	0.670	2.554
	Δ**Inequality**$_{t-3}$	1.304*	0.610	2.136
	Δ**Inequality**$_{t-4}$	2.164***	0.591	3.662
	Δ**Financialization**$_{t-1}$	0.024	0.062	0.391
	Δ**Financialization**$_{t-2}$	0.162**	0.059	2.754
	Δ**Financialization**$_{t-3}$	-0.148**	0.048	-3.096
	ECT$_{t-1}$	-1.064***	0.118	-8.984
Financial Value Added $R^2 = 0.858$ Adjusted $R^2 = 0.738$	Δ**Labor Productivity**$_{t-1}$	0.465***	0.149	3.126
	Δ**Labor Productivity**$_{t-2}$	0.430***	0.129	3.330
	Δ**Labor Productivity**$_{t-3}$	0.416***	0.133	3.135
	Δ**GDP**$_{t-1}$	-1.129***	0.203	-5.566
	Δ**GDP**$_{t-2}$	-0.787***	0.184	-4.267
	Δ**GDP**$_{t-3}$	-0.269	0.186	-1.443

ΔWage Share$_{t-1}$	-0.005	0.218	-0.021
ΔWage Share$_{t-2}$	-0.715***	0.226	-3.166
ΔInequality$_{t-1}$	0.589	0.794	0.743
ΔInequality$_{t-2}$	-0.027	0.659	-0.041
ΔInequality$_{t-3}$	-2.367***	0.698	-3.391
ECT$_{t-1}$	-1.249***	0.184	-6.804

Note: Δ is the operator of the first differences, *** indicates statistical significance at 1% level, ** indicates statistical significance at 5% level and * indicates statistical significance at 1% level

CHAPTER V

Conclusion

The aim of this dissertation was to ascertain the determinants of labor productivity in Portugal in between 1977 and 2016, through an econometric study. The work of Tridico and Pariboni (2017), which introduced a new productivity equation resulting from their own view on Labini's equation (1999), represents the basis which supports this study. The equation developed by the authors was applied to 26 OECD countries and demonstrated that labor productivity rises (decreases) when wages rise (decrease), GDP growth rates increases (decreases), inequality decreases (increases) and financialization decreases (increases).

In this study, an equation for labor productivity in Portugal is estimated, relating four variables, namely, GDP, inequality, wages, and financialization. The implemented econometric methodology was the ARDL since it contemplates the presence of integrated variables of both order zero and one. Given the natural complexity associated with the financialization variable, four proxies (credit, money supply, market capitalization and financial value added) were included so that it could be correctly analyzed.

The results of this study demonstrate that GDP and inequality are the most robust variables in the model, having a significant impact on labor productivity in Portugal. While a GDP growth leads to an increase in labor productivity, an increase in inequality results in a decrease in labor productivity. These results are consistent with the literature reviewed in section II. Thus, and to boost labor productivity, measures must be taken to promote economic growth and reduce income inequality in Portugal. Regarding wages, the results show some evidence in one of the analyzed models of a negative relation between wages and labor productivity, thus contradicting the authors of previously cited studies, who argue that wages contribute positively. Considering financialization, there is some indication in the money supply proxy model of a negative relation between financialization and labor productivity, which is in accordance with the literature mentioned in section II.

It is important to emphasize the significance of such results, not only due to the urgently needed boost in the labor productivity in Portugal, which has registered levels below the European average throughout the period under analysis, but also due to the scarcity of econometric studies in this area developed specifically about labor productivity in Portugal. Therefore, and to suggest a question for further investigation, it is considered relevant to study

a possible indirect impact of financialization on labor productivity in Portugal. The present study does not confirm a direct relation between these two variables, still, as evidenced by Barradas (2020), there is evidence that financialization contributes to GDP contraction and, also, according to Lagoa and Barradas (2020), to increase income inequality. If these relations can be verified for the Portuguese case, then, according to the results obtained in this study, financialization contributes indirectly to the decline of labor productivity. Hence, I propose a study about the possible indirect financialization effects on labor productivity in Portugal, using econometric methodologies such as the VAR or VECM models, as these allow to simultaneously analyze the relations between all the considered variables.

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Appendix

Figure A1 - *Gross domestic product at current prices per hour worked (annual %)*
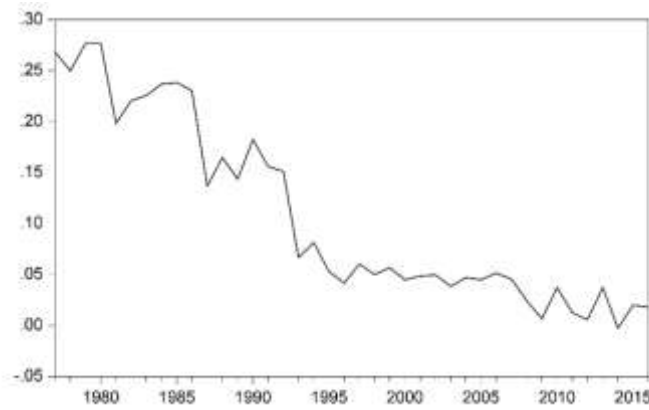
Figure A2 - *Gross domestic product at 2015 reference levels (annual %)*
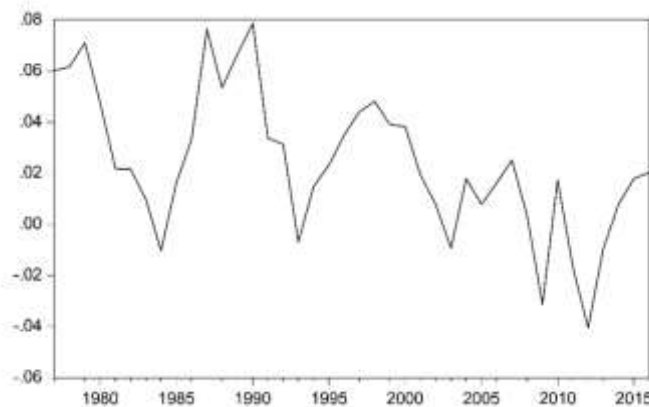
Figure A3 - *Income Inequality Top 1% Share (%)*
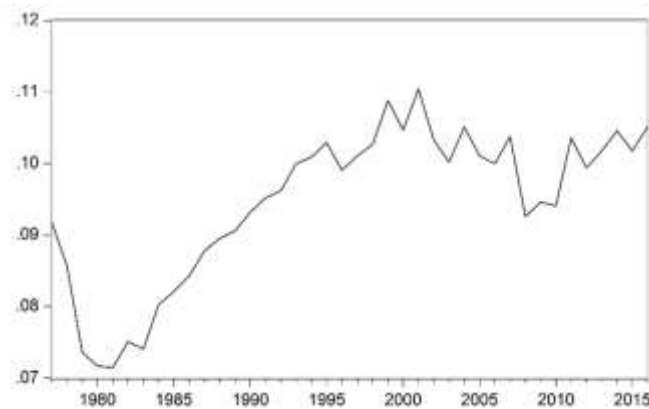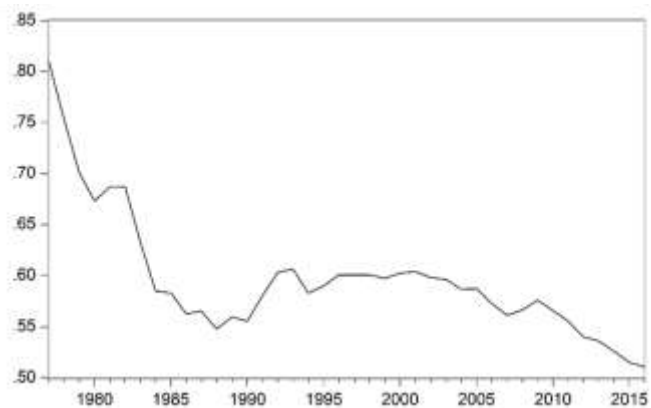
Figure A4 - *Adjusted wage share (% of GDP)*

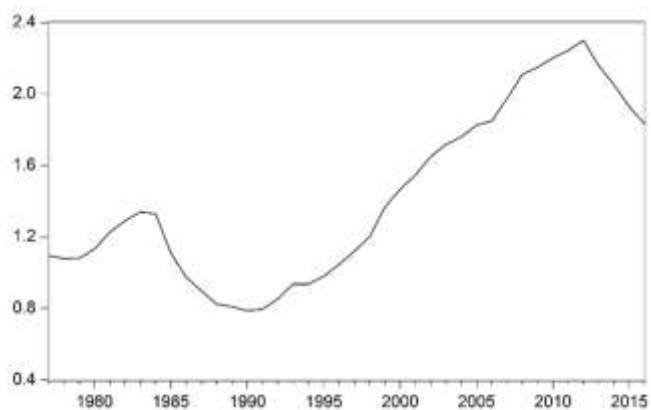**Figure A5 -** *Total credit to private non-financial sector (% of GDP)*

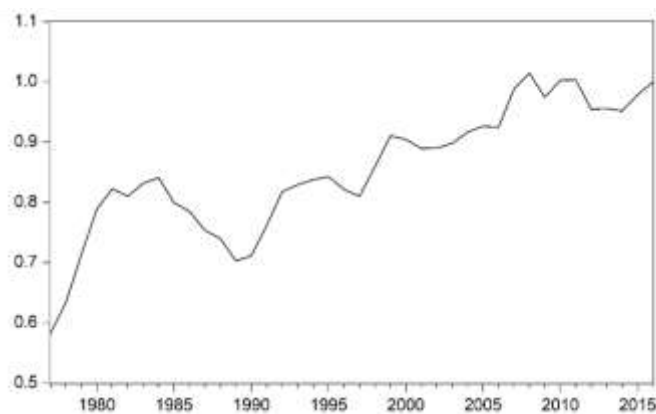**Figure A6 -** *Liquid liabilities (% of GDP)*

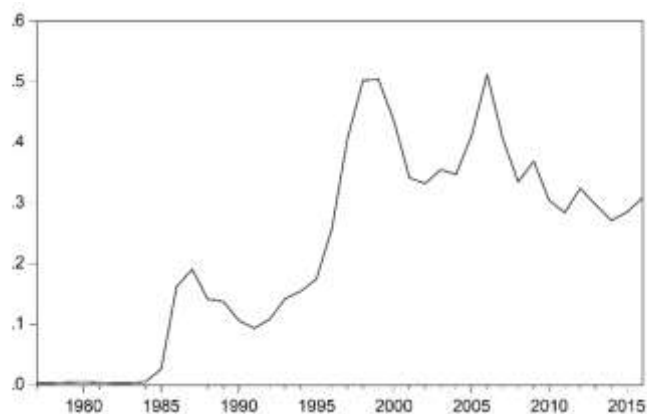**Figure A7 -** *Stock market capitalization (% of GDP)*

Figure A8 - *Gross value added of financial, insurance and real estate activities (% of total)*
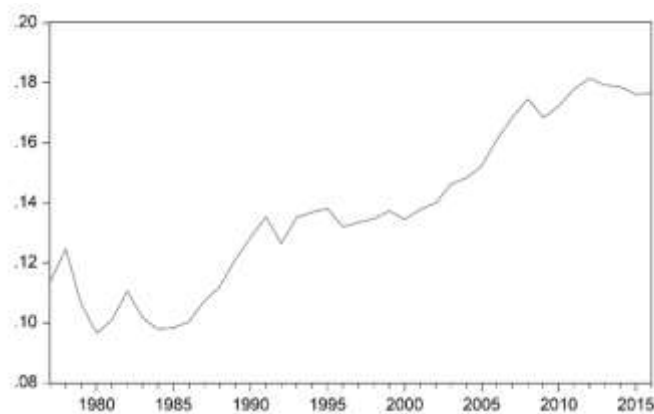

Table A1 – *Overview of the mentioned determinants*

GDP	**Smith** effect	- Associated with the market's size; - Adam Smith establishes a connection between labor productivity and the total economic output; - The relation between these two variables occurs through the division of labor, which, in turn, is a consequence of the market's expansion (that is, greater demand); - Kaldor states that the increase in the total output in response to the increase in demand, happens through increasing returns to scale; - Verdoorn concludes that the manufacturing industry is a fundamental part of a country's economy since it is the sector with the highest levels of productivity; - Verdoorn establishes a direct connection between production and labor productivity in the manufacturing industry; - The manufacturing industry operates through increasing returns to scale, this situation promotes technological progress,

		which makes this sector contribute more than the rest in terms of production and labor productivity; • Kaldor formulates three laws that summarize the results of his studies; • The second law, the so-called "Kaldor-Verdoorn law", states, more precisely, that the rate of growth of labor productivity in the manufacturing industry depends positively on the rate of growth of production in this sector; • The third law establishes that the productivity growth rate of all sectors, depends positively on the production growth rate of the manufacturing sector; • Thus, it is possible to conclude that there is a positive relation between production and labor productivity.
Relative Cost of Labor	**Ricardo** effect	• The relative cost of labor or, specifically, the cost of labor in relation to the price of investment goods, that is, machines; • According to Labini, the sign of this effect is positive, stating that when the relative cost of labor increases, labor productivity also increases; • An increase in the relative labor costs in relation to the price of machines may have implied a drop in its price, which is why employers prefer to replace workers with machines.
Financialization	-	• A negative relation between financialization and labor productivity is expected; • Giacché establishes 3 functions of financialization: providing credit to families, providing credit to companies and speculating about capital appreciation. • Companies were provided with easier access to credit and the firms themselves encouraged the granting of credit to consumers (who thus maintained consumption patterns, regardless of a decrease in wages); • Company managers are rewarded for short-term performance, representing a stimulus to reinvest eventual profits obtained with speculative investments, which is to say, the "downsize and distribute" ideology. This method hinders technological progress, which in turn directly influences labor productivity.
Inequality	-	• Labor flexibility (in particular, wage flexibility) allows managers to reduce wages, reduce the number of workers and promote precarious work easily, thereby increasing inequality in income distribution (measured by the Gini coefficient). The increase in both precarious work and inequality leads to a gradual decrease in production as workers receive insufficient incentives to produce. • A negative relation between inequality and labor productivity is expected.
Wages	**Webb-Sylos Labini** effect	• A decrease in wages would lead workers to produce less, that is, a positive relation between wages and labor productivity is expected; • Webb defended the establishment of a legal minimum wage, as a way to prevent excessive wage compression by company managers, representing, thus, a strong obstacle to labor flexibility; • Labini argues that a pressure on increasing labor costs through wages would strengthen the need to reorganize the production process, making it more efficient through a productive investment relatively convenient, so that the production

		volume would be increased without the need to increase the number of workers; • The Marshall effect confirms a positive relation between wages and labor productivity, since high wages attracts highly productive workers and encourage them to be more efficient.