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# **The value of financial data in GDP forecasting**

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## Resumo

As informações financeiras, divulgadas pelas empresas, permitem prever o comportamento futuro de vários agregados macroeconómicos (como o PIB, a inflação, o mercado de trabalho e os retornos dos mercados financeiros). O objetivo deste estudo é investigar se a informação financeira anual (representada pela variação agregada dos lucros contabilísticos e do rácio da rentabilidade do ativo), divulgada pelas empresas portuguesas, é capaz de prever a taxa de crescimento futura do PIB real português. Também se pretende testar a incrementalidade da informação financeira, face ao crescimento contemporâneo do PIB nesta previsão, e se os investigadores do Banco de Portugal incorporam este tipo de elementos no desenvolvimento das suas previsões do PIB. A análise empírica com dados anuais, para a série temporal de 1996 até 2021, permite documentar que a variação agregada dos resultados das empresas portuguesas é capaz de prever a taxa de crescimento futura do PIB real português, para um ano após a divulgação desta informação. No entanto, os investigadores do Banco de Portugal parecem não incorporar os lucros contabilísticos no desenvolvimento das suas previsões do PIB real, o que as poderia tornar mais precisas e rigorosas. Relativamente ao rácio da rentabilidade do ativo, nenhuma conclusão pôde ser obtida visto que a maioria dos modelos se mostraram globalmente insignificativos. Quanto à incrementalidade, apenas se provou que os lucros contabilísticos oferecem elementos adicionais para a estimação do crescimento futuro do PIB, relativamente ao seu crescimento contemporâneo. Por último, demonstra-se que a consideração separada dos períodos das crises torna os modelos de previsão ainda mais explicativos. A presente dissertação destaca-se dos restantes estudos nesta área, pela abordagem pioneira em contexto português e pela combinação de diferentes metodologias, já que permite a representação da informação financeira com dois tipos de variáveis diferentes.

**Palavras-chave:** Demonstrações financeiras; Previsão; PIB; Portugal.

## Abstract

Financial information disclosed by companies enables the prediction of future behavior of various macroeconomic indicators (such as GDP, inflation, labor market conditions, and financial market returns). This study aims to investigate whether the annual financial information (represented by the aggregate variation in accounting profits and in the earning power ratio), released by Portuguese companies, can forecast the future growth rate of Portuguese real GDP. Additionally, it seeks to test the incrementality of financial information compared to contemporaneous GDP growth in this forecast, and whether *Banco de Portugal's* researchers incorporate such elements into their GDP forecasts. The empirical analysis using annual data, spanning from 1996 to 2021, reveals that the aggregate variation in accounting earnings can predict the future growth rate of Portuguese real GDP, for the year following the release of this information. However, researchers at *Banco de Portugal* do not seem to integrate accounting earnings into the development of their real GDP forecasts, which could make them more rigorous and accurate. No conclusions could be drawn about the earning power ratio, as most models were globally insignificant. Regarding incrementality, it is only proven that accounting earnings provide additional elements in estimating future GDP growth compared to its contemporaneous growth. Finally, it is demonstrated that the separate consideration of crisis periods enhances the accuracy of forecasting models. This dissertation stands out from other studies in this area, due to its innovative approach in the Portuguese context and its combination of diverse methodologies, allowing for the representation of financial information with two different types of variables.

**Keywords:** Financial statements; Forecasting; GDP; Portugal.

## Table of Contents

Acknowledgments.....	i
Resumo .....	ii
Abstract .....	iii
1. Introduction.....	1
2. Literature review .....	4
3. Hypotheses development .....	10
4. Research design.....	15
4.1 Data and sample selection.....	15
4.2 Variables and measurements .....	18
4.3 Empirical strategy .....	21
5. Empirical results.....	26
5.1 Univariate analysis .....	26
5.2 Multivariate analysis .....	28
6. Additional analysis .....	39
7. Conclusion .....	42
8. References .....	44

## List of Tables

<b>Table 1</b> - Definition of variables related to the Portuguese real GDP .....	18
<b>Table 2</b> - Definition of variables related to the financial information, disclosed by Portuguese companies.....	20
<b>Table 3</b> - Descriptive statistics .....	26
<b>Table 4</b> - Correlation matrix.....	27
<b>Table 5</b> - Impact of the aggregate variation in accounting profits on future forecast of annual GDP growth rates (Eq. 3.1) .....	28
<b>Table 6</b> - Impact of the aggregate variation in earning power on future forecast of annual GDP growth rates (Eq. 3.2) .....	29
<b>Table 7</b> - Disaggregation of the impact of the aggregate variation in earning power on future forecast of annual GDP growth rates (Eq. 3.3) .....	30
<b>Table 8</b> - Predictive ability of the aggregate variation in accounting profits after the inclusion of contemporaneous GDP growth (Eq. 3.4).....	31
<b>Table 9</b> - Predictive ability of the aggregate variation in earning power after the inclusion of contemporaneous GDP growth (Eq. 3.5).....	32
<b>Table 10</b> - Predictive ability of the aggregate variation in accounting profits for GDP estimation errors (Eq. 3.6) .....	34
<b>Table 11</b> - Predictive ability of the aggregate variation in earning power for GDP estimation errors (Eq. 3.7).....	35
<b>Table 12</b> - Improvement of forecast models after the inclusion of crisis effect (Eq. 3.8 and 3.9).....	36
<b>Table 13</b> - Impact of the aggregate variation in earning power on future forecast of quarterly GDP growth rates (Eq. 5.1) .....	40

# 1. Introduction

The financial information provided by companies enables anticipation and explanation of decisions at both the corporate and investor levels. Recently, a new trend has emerged in the literature known as “Macro Accounting” (Lande, 2000) which examines the aggregate power of financial information in forecasting macroeconomic variables such as Gross Domestic Product (GDP), inflation, unemployment, and tax revenue (Green *et al.*, 2022; Hann *et al.*, 2017; Konchitchki and Patatoukas, 2014a,2014b; Shivakumar and Urcan, 2017). Therefore, the theme of this dissertation lies in investigating this relationship between financial information and the forecast of one of the macroeconomic aggregates, specifically GDP, within the Portuguese context. Thus, our research question is as follows: can annual financial information, disclosed by Portuguese companies, predict the future growth rate of Portuguese real GDP?

Gross domestic product (GDP) quantifies the economic activity of a country and serve as a metric for understanding the economic development of societies. Forecasting GDP is a crucial task, since these projections significantly influence numerous decisions of various economic agents, from company managers (who use these GDP forecasts to anticipate demand values and consequently set sales and production targets) to governments (which shape their budgetary policies based on these forecasts). Moreover, these projections have the potential to anticipate broader economic trends, such as recessions or expansions. The main motivation of this study is to provide additional information that enhances projections of this macroeconomic indicator, as it is necessary for GDP forecasts to be accurate and rigorous, given their impact on several domains of the economy.

As previously mentioned, numerous authors have delved into studying the relationship between financial information and GDP. The studies by Konchitchki and Patatoukas (2014a,2014b) were pioneering in proving that accounting profits and profitability ratios can anticipate quarterly growth rates of nominal and real GDP in the United States (U.S.). Furthermore, other authors have showcased this predictive power of future GDP behavior with other categories of variables representative of financial information, such as operational cash flows and accruals (Son and Jeong, 2022). On the other hand, another studies have sought to validate this relationship between financial information



and future GDP in countries beyond the United States, including Australia (Zhang and Fargher, 2021), and even with global datasets (Fargher and Zhang, 2023; Sumiyana, 2020; Yoshinaga and Nakano, 2021). However, none of these analyses have specifically focused on studying this relationship in a Portuguese framework. This dissertation aims to fill this gap in the literature by examining the predictive power of financial data, released annually by Portuguese companies, regarding the future growth rate of Portuguese real GDP. It is relevant to examine this possible association in a sample with Portuguese data due to the unique characteristics of this economy, such as the constitution of the business community (mostly represented by small and medium-sized enterprises), high levels of public debt, significant dependence on the tourism sector, and the substantial impact of international trade. These factors highlight the motivation and interest in studying this link between financial information and GDP in the Portuguese context.

To explore this predictive relationship between financial information and Portuguese GDP, the main objective of the study is to demonstrate that financial information (represented by the annual aggregate variation in accounting earnings and in the earning power ratio) can forecast the future growth rate of Portuguese real GDP. Once this relationship is confirmed, the analysis extends to evaluate the incremental contribution of financial information in this prediction, compared to contemporaneous GDP growth (that is, the growth rate of Portuguese real GDP for the year when financial information of companies is disclosed). Finally, the last objective of this research is to examine whether researchers at the *Banco de Portugal* incorporate financial information into the development of their forecasts for Portuguese real GDP.

This study provides several contributions to the economic and accounting literature. Firstly, it enhances the validity and utility of this type of research. No prior study has examined the relationship between financial information and GDP in the Portuguese context, and this dissertation seeks to address that gap in the literature. Additionally, the research aims to improve GDP forecasts, making them more timely, accurate, and reliable (Konchitchki and Patatoukas, 2014a), thus more useful for decision-making processes. Hence, this study is relevant for macroeconomic investigations. Finally, the research distinguishes itself from previous literature by combining different methodologies, employing two distinct types of variables to represent financial information, resulting in a more comprehensive analysis compared to the existing studies.

The results are partially consistent with the developed hypotheses. In the time series analyzed (1996-2021), we found that the aggregate variation in the accounting earnings can predict the growth rate of Portuguese real GDP, for the year following the disclosure of financial information. As for the predictive power of the earning power ratio, no conclusions can be made, as the estimated models were not globally significant. Additionally, the results indicate that the aggregate variation in accounting earnings has an incremental power in this forecast, relative to contemporaneous GDP growth. Finally, we observed that the aggregate variation in accounting earnings can predict the errors made in the GDP estimates created by *Banco de Portugal*. Thus, it is inferred that researchers at the *Banco de Portugal* do not seem to incorporate the accounting earnings of Portuguese companies when preparing their forecasts for Portuguese real GDP. Hence, the power of the aggregate variation in the accounting earnings in predicting Portuguese real GDP was proven; however, *Banco de Portugal* does not appear to integrate, at least sufficiently, these elements in its forecasts. This outcome is useful to reinforce one of the contributions of this dissertation, as the integration of financial information would reduce errors in GDP forecasting. In the section of the additional tests, the predictive connection between the earning power ratio and the Portuguese real GDP is confirmed using both quarterly and aggregated observations. This finding enables more robust conclusions, benefiting from the increased number of observations provided by the quarterly data.

The current dissertation is structured into 6 sections from this point onwards. Initially, the literature review aims to understand the progression of research on these forecasting relationships between financial information and macroeconomic aggregates. Subsequently, the research hypotheses are defined for analysis, allowing the framing of this problem in the Portuguese context. In the next section, the methodology used is detailed, covering databases selection, variable descriptions, and econometric models definitions. Then, the results obtained through the estimation of the models are analyzed and discussed. The following section presents an additional analysis seeking to explore the predictive relationship with a larger number of observations (quarterly data), offering further insights. In the final section, the findings are summarized along with the main limitations of the study, and perspectives for future research are outlined.

## 2. Literature review

In this chapter, a brief review of the literature is presented, which allows contextualizing, in an aggregated way, the predictive power of financial information of several variables, including Gross Domestic Product (GDP), which is the subject of this dissertation.

Financial statements provide valuable information about companies' lives. Ball and Brown (1968) examined the usefulness of financial information, showing that financial statements serve as the basis for various economic decisions, including those made by investors in markets. In addition, financial information is also a good indicator of some aspects of business activity, such as production, and provides insight into the profitability of new investments (Ball and Sadka, 2015).

Previously, the focus was on studying the informative role of financial statements at the company level. Over the past decade, a new trend in literature has emerged, called "Macro Accounting" (Lande, 2000), which seeks to use the financial information, disclosed by companies, to predict the behavior of various macroeconomic variables at the aggregate level. The inverse relationship also exists, since macroeconomic data may be used to predict variables at the corporate level (Li *et al.*, 2012). However, this new perspective makes it possible to establish a link between the micro and macro domains of the economy (Atmini and Sumiyana, 2017; Sun *et al.*, 2022). McCloskey (1993) proves that accounting information explains numerous macroeconomic phenomena, evidencing this connection. In this field, it has been proven that financial information can forecast GDP (Konchitchki and Patatoukas, 2014a, 2014b; Moramarco, 2023), labor market (Hann *et al.*, 2017), inflation (Shivakumar and Urcan, 2017), and financial market returns (Heater *et al.*, 2021). Furthermore, financial information is also able to anticipate aspects related to monetary policy, which is beneficial as markets react negatively to these surprises (Gallo *et al.*, 2013).

The aggregate accounting income are positively related to future inflation levels, and inflation affects the returns of financial markets. Consequently, there seems to be evidence that aggregate earnings, stock market returns, and macroeconomic variables are related (Shivakumar, 2006). More recently, Shivakumar and Urcan (2017) offered a robust

explanation for the predictive association between aggregate profits and future inflation levels. They attribute this connection to the investment channel, as there will be a change in firms' investment driven by profit growth. They also show that the variation in consumption, induced by the wealth effect of profit growth, is a weak argument to explain the link between aggregate accounting income and inflation.

On the job market, Hann *et al.* (2017) establishes that the aggregate profits of American firms convey information about job creation and destruction. Moreover, the special items component can forecast unemployment up two quarters ahead. In the case of developing countries, this link is also evident. For instance, in Iran, it has been proven that financial information is able to anticipate quarterly unemployment rates (Salehi *et al.*, 2020). In addition, the dispersion of profit growth predicts adjustments in unemployment rate and GDP growth projections (Nallareddy and Ogneva, 2014). Thus, it seems clear to conclude that financial information can predict various macroeconomic indicators, such as (un)employment and inflation.

In addition to these areas, financial information is also capable of predicting taxable income (a value that is confidentially maintained by businesses). Green *et al.* (2022) proves that the incorporation of financial information, characterized by timeliness, improves the forecast of the taxable income of companies, especially after the inclusion of accruals. Thus, by using the information from the financial statements, it is possible to predict the tax revenue earned by the nations, specifically the revenues derived from personal income tax, corporate income tax, and consumption tax (Welsch *et al.*, 2022). On the returns of financial markets, Kothari *et al.* (2006) provide evidence of a negative relationship between stock market returns and aggregate growth of accounting profits; however, this relationship does not exist when changes in profits are unexpected (Bailey and Lai, 2020).

GDP is one of the most important macroeconomic indicators, allowing for the analysis of economic growth and performance (Henderson *et al.*, 2012; Sumiyana, 2020). GDP measures the total value of goods and services produced in an economy in each period (Jehu and Ibrahim, 2016). According to the *Instituto Nacional de Estadística* (INE), GDP can be calculated from three perspectives: output, expenditure, and income. Cai *et al.* (2022) have shown that the management of results by Chinese companies can be used to manipulate local

GDP values, reinforcing this link between financial reporting and GDP. However, the focus of this literature stream is the forecasting relationship between the two variables and not the influence of financial information on GDP values. Aggregate accounting earnings of firms are one of the main components of GDP, so it is expected that there is a relationship between these two variables (Ball *et al.*, 2018; Crawley, 2014).

Konchitchki and Patatoukas (2014a) document that the aggregate earnings of American firms can predict quarterly values of United States (U.S.) nominal GDP. On the other hand, when financial information is represented in the form of financial ratios (such as profitability drivers, for example, the return on net operating assets), these ratios are also able to predict the real growth of the American economy (Konchitchki and Patatoukas, 2014b). Thus, the investigations of Konchitchki and Patatoukas (2014a,2014b) were pioneers in showing this predictive relationship between financial information and GDP; however, they only used samples with U.S. data.

Other studies have been concerned with assessing whether this predictive relationship is also observed in other countries. Zhang and Fargher (2021) concluded that there is a positive association between changes in accounting profits and future GDP growth, using Australian data. They also demonstrated that this relationship is stronger in the post-IFRS<sup>1</sup> period. In addition, in the case of developed countries, all aggregate components of accounting profits can predict future GDP growth (Atmini and Sumiyana, 2017), mainly because in these countries, profit growth tends to be positive (Sumiyana, 2020). On the other hand, only the non-operational part of the profits can be indicative of future GDP growth in developing countries (Sumiyana *et al.*, 2019). Yoshinaga and Nakano (2021) studied this relationship in more depth, in developed and developing countries, and found that using financial information to predict GDP growth has become relevant in the valuation of stocks in developed countries and irrelevant in developing countries. In addition, the forecasting relationship between financial information and future GDP growth tends to be more evident in countries where there is greater investor protection (Fargher and Zhang, 2023).

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<sup>1</sup> IFRS – International Financial Reporting Standards, are the international accounting standards that have enabled the harmonization of accounting practices worldwide and enhanced the quality of financial reporting (Ahmed *et al.*, 2013).

Beyond geographical considerations, many authors have sought to understand which components of financial information can predict future GDP growth. Abdalla and Caraibas (2021), for instance, demonstrate that special items are more informative about the real growth of the U.S. GDP than aggregate profits before special items. They argue that special items (items that capture sporadic events in the financial statements and that are not expected to occur in future years, such as a gain after discontinuing a certain operation), reflect changes in economic agents' behavior in advance, which affect the values of investment and consumption and consequently impacts GDP. On the other hand, negative changes in accounting earnings are positively related to GDP, while positive variations lose this predictive power (Gaertner *et al.*, 2020). Thus, accounting conservatism (the principle of not anticipating potential revenues and recognizing all expected losses) has macroeconomic consequences, as this forecasting relationship is more sensitive to negative changes than to positive news (Crawley, 2014). When financial information is disaggregated into accruals and operational cash flows, both components are informative of future GDP growth (Son and Jeong, 2022; Sumiyana *et al.*, 2019). In Son and Jeong's study (2022) with Korean companies, it is also shown that the ability of financial information to anticipate GDP is explained (similarly to the forecasting relationship between financial information and inflation) through two channels: investment and consumption. Moreover, they prove that the investment channel has a greater significance and persistence than consumption, which allows us to conclude that the predictive relationship between financial information and GDP is predominantly explained by the investment component.

The utility of financial information in forecasting GDP is higher when there is better quality in financial reporting (Sumiyana *et al.*, 2019; Valentin *et al.*, 2020), and expenditures and depreciation items (expenses that do not constitute a cash flow) are unable to anticipate future GDP values (Atmini and Sumiyana, 2017). Finally, it should be noted that the predictive power of financial information is influenced by certain characteristics, such as market volatility, with higher volatility leading to a more evident positive relationship between financial information and GDP (Jehu and Ibrahim, 2016; Saini and White, 2015). Another characteristic that influences this association is the level of corporate debt: the higher the debt-to-equity ratio, the lower the ability to predict accounting profits. Therefore, factors such as market volatility and corporate debt can affect this predictive relationship (Saini and White, 2015).

It is also possible to assess how the share of innovation influences financial information and, consequently, its power to predict GDP. Collins and Nguyen (2021) separate accounting profits into two components, Pre-Research and Development (R&D) and Post-R&D profits and conclude that both forms can predict real GDP growth. However, the Post-R&D component has a longer lag structure, as it takes time for the desired effects of R&D to materialize, but its inclusion improves forecasting models. Beneish *et al.* (2022) seeks to understand the influence that financial reporting errors have on the predictive power of financial information. They conclude that incorrect reporting affects the real economy, as it represents misinformation, which will influence companies' investment and production decisions. So, as you can conclude from what has already been mentioned above, financial information with errors (with poorer quality) will have a lower ability to predict GDP and recessions.

Hence, all the articles are unanimous in the predictive power of financial information in relation to future GDP growth, across several variables and in multiple countries. Even in a dynamic factor model, in which financial information is updated weekly, it proves capable of forecasting various components of GDP, emphasizing the need for financial information to be timely (Abdalla *et al.*, 2021). Nonetheless, Mihai *et al.* (2023) argue that this empirical relationship only exists because some macroeconomic variables, that can simultaneously predict accounting earnings and future GDP, are omitted. Consequently, there remains a possibility that this predictive relationship is spurious.

Thus far, it has been well established that numerous studies show the association between financial information, released by companies, and future GDP growth. However, none of these studies have observed and examined this relationship in the Portuguese context. Throughout these studies, there has also been a concern about understanding whether this information is incorporated into the development of GDP forecasts by researchers in each country. Konchitchki and Patatoukas (2014a, 2014b) illustrated that accounting profits and financial ratios are not incorporated into the development of quarterly GDP forecasts in the United States, making errors in estimating this macroeconomic indicator predictable. Similarly, in the Australian case, it is also proven that researchers tend to underestimate financial information in the development of their GDP forecasts (Zhang and Fargher, 2021).

In summary, there appears to be some consensus on this matter, indicating that financial information is indeed capable of predicting future GDP growth (aside from Mihai *et al.* (2023), who argues that this relationship only exists due to the omission of relevant variables). However, researchers often fail to incorporate financial information into their GDP forecasts (Abdalla and Caraibas, 2021; Gaertner *et al.*, 2020; Valentin *et al.*, 2020), despite the importance of precision and rigor in these forecasts, given their significant impact on the entire economy.



### 3. Hypotheses development

The main objective of this study is to investigate whether the predictive relationship between financial information and GDP exists in the Portuguese context, aiming to fill this gap in the literature. Therefore, it is proposed to examine whether the annual financial information, disclosed by Portuguese companies, can forecast the future growth rate of Portuguese real GDP. Once this relationship has been proven, the analysis will expand to determine whether the predictive power of financial information in forecasting the Portuguese real GDP is incremental compared to contemporaneous GDP growth (that is, GDP growth for the same period as the financial information disclosure, with the aim of forecasting the growth rate for one or two years after that release). Additionally, it is also intended to ascertain whether this information is incorporated by researchers at *Banco de Portugal* when developing forecasts for Portuguese real GDP communicated in the *Boletins Económicos* (a crucial publication for economic analysis, outlining the institutional position of *Banco de Portugal* concerning the Portuguese economy and significant economic policy matters).

As mentioned in the literature review, numerous studies prove that there is a robust and significant positive association between financial information and future GDP growth. Konchitchki and Patatoukas (2014a) demonstrate that financial information, as represented by the aggregate variation in accounting earnings, disclosed by American companies, can predict the quarterly growth rate in U.S. nominal GDP, especially in the quarter immediately following the release of financial statements. This relationship between the two variables is also corroborated in other countries, such as Australia (Zhang and Fargher, 2021) and across developed nations (Atmini and Sumiyana, 2017; Sumiyana *et al.*, 2019). Hence, it is reasonable to expect that this association will also occur in the Portuguese context.

The first hypothesis will test whether financial information, disclosed by Portuguese companies, is predictive of the future growth rate of Portuguese real GDP. As mentioned by Son and Jeong (2022), it is expected that financial information holds this predictive power regarding GDP precisely because it affects several components of this macroeconomic indicator, such as investment and consumption. An increase in profits (or a more precisely company performance measured by financial ratios) allows companies to increase their

investment, which leads to GDP growth, *ceteris paribus*. On the other hand, increased profits in companies allow, through the effect of wealth, an increase in consumption values, which also leads to a growth in GDP. Therefore, the predictive power of financial information can be elucidated through these two channels, with the investment component having a greater significance and persistence and, therefore, being more responsible for explaining this predictive power. This first hypothesis will be disaggregated into two, according to the variables that represent the financial information. At an initial stage, it is intended to study the predictive relationship between accounting earnings and Portuguese real GDP.

**H1a:** Aggregate variations in annual accounting profits, disclosed by Portuguese companies, can predict the future growth rate of Portuguese real GDP.

Still aiming to demonstrate the predictive power of financial information, but now with a different variable to represent the information taken from the financial statements, it is intended to test the relationship between financial ratios, namely asset profitability, and the future growth of Portuguese real GDP. Konchitchki and Patatoukas (2014b) showed that the variation in the return on net operating assets of American companies can predict the quarterly real growth of the American economy. In addition to the U.S. economy, the predictive power of various financial indicators has also been proven, especially in developed countries (Yoshinaga and Nakano, 2021). Thus, it is expected that the variation in financial ratios, which are constructed from financial information, disclosed by Portuguese companies, will also be capable of predicting the future evolution of Portuguese real GDP, which leads to the next hypothesis that is intended to be tested. The earning power ratio (assets profitability, calculated as the quotient between operating income (earnings before interest and taxes, EBIT) and assets) is chosen because it represents the earnings generated by the company through the resources employed, whether they are current or non-current assets. Companies' management is interested in achieving the highest possible return with a minimum of assets. This ratio is highly significant in financial literature as it helps companies define their capital structure (Bonbright, 1921). If this ratio exceeds the cost of debt, it makes sense for the company to continue borrowing, as an increase in debt will improve the return on its equity. For these reasons, it makes sense to select the earning power, such as the ratio that represents the financial information for this hypothesis.

**H1b:** Aggregate variations in annual financial ratios (in this case, the earning power), disclosed by Portuguese companies, can predict the future growth rate of Portuguese real GDP.

So, by testing these two hypotheses we fulfill the main objective of the present study, which is to ascertain whether financial information, in the aggregate form of variations in accounting earnings and in financial ratios, is positively and significantly related to the future values of Portuguese real GDP.

Following the examination of this relationship, the objective is to understand whether financial information contributes incrementally to forecasting future Portuguese real GDP compared to its contemporaneous growth. Numerous studies have shown that financial information is incremental, in GDP forecasting, relative to contemporaneous GDP growth and other macroeconomic variables, such as treasury securities and spreads. (Fargher and Zhang, 2023; Konchitchki and Patatoukas, 2014a,2014b; Zhang and Fargher, 2021). In this research, the objective is to test the incremental power of financial information relative to contemporaneous GDP growth, that is, whether financial information's ability to predict the Portuguese real GDP for one and two years after its disclosure, adds additional elements to this prediction beyond the GDP growth rate in the year of disclosure. Thus, based on the literature mentioned, it is expected, in this case, that the information extracted from the financial statements of Portuguese companies will also be incremental relative to contemporaneous GDP growth rate, which leads to the development of the second research hypothesis.

**H2:** Aggregate variations in accounting profits and in earning power ratio of Portuguese companies are incremental, compared to contemporaneous GDP growth, in forecasting the future growth rate of Portuguese real GDP.

The final research aim is to study whether financial information is incorporated by researchers in the development of their GDP forecasts. In the Portuguese context, GDP forecasts are prepared by *Banco de Portugal* and published in the *Boletins Económicos* on a quarterly and annual basis. These forecasts are obtained from a comprehensive analysis of a wide range of both country-specific and Euro Area information to understand the direction

of the Portuguese and European economies. For instance, when developing real GDP forecasts, several macroeconomic indicators (such as private and public consumption, investment, export, and import values), interest rate developments, labor market information, and inflation rates are taken into consideration. They also consider fiscal and monetary policies adopted by the Portuguese government and the European Central Bank (ECB), as well as specific unforeseen events that may affect the accuracy of their forecasts (for example, the 2007/2008 financial crisis and the COVID-19 pandemic).

Konchitchki and Patatoukas, 2014a (2014b) demonstrated that, in the case of the United States, the aggregate growth of accounting profits (financial ratios) is positively related to the errors made in forecasting the future evolution of American nominal (real) GDP. Thus, this predictive relationship between financial information and forecast errors is read as evidence that American researchers tend not to use financial information when formulating forecasts for U.S. GDP. In the same vein, other studies confirm researchers' underestimation of this information when developing quarterly or annual GDP forecasts (Fargher and Zhang, 2023; Zhang and Fargher, 2021). Proving that financial information can predict Portuguese real GDP, it makes sense to integrate elements from the financial statements of Portuguese companies into real GDP forecasts, which is a contribution of these studies, since it can make the forecasts more accurate and rigorous. Therefore, akin to findings in other studies, in the Portuguese case, it is expected that financial information can predict errors made in forecasting GDP (difference between the observed and expected values), highlighting that researchers do not appear to incorporate this data, at least sufficiently, when producing their forecasts of Portuguese real GDP.

**H3:** Aggregate variations in accounting profits and in earning power ratio of Portuguese companies can predict errors in forecasting the future growth rate of Portuguese real GDP.

In addition to the hypotheses mentioned, it is important to emphasize the interest in studying the inclusion of a dummy variable representing crises (the financial crisis of 2007/2008 and the pandemic crisis) in the models that will be created. As mentioned earlier, financial crises are unforeseen events, tumultuous and specific periods of high uncertainty (Nallareddy and Ogneva, 2014) which undoubtedly complicates forecasts of Portuguese real GDP, an indicator reflecting the state of the economy. Doukakis *et al.* (2020) argue that

financial crises can change the relationship between macroeconomics and corporate profitability. Therefore, the inclusion of this variable, allowing for individual and separate consideration of crisis periods, is expected to make the created prediction models even more explanatory, as seen in the study by Yoshinaga and Nakano (2021).

## 4. Research design

### 4.1 Data and sample selection

To investigate the relationship between financial information and the future growth of real GDP in the Portuguese context, three databases will be used. It is worth noting that the two databases required for constructing the variables representing financial information were provided by *Instituto Nacional de Estatística* (INE) through the established protocol between *Direção-Geral de Estatísticas da Educação e Ciência* (DGEEC), INE, and *Fundação da Ciência e Tecnologia* (FCT). The other database was supplied by *Banco de Portugal*, which contains the observed and forecasted values of Portuguese real GDP.

The *Inquérito Anual às Empresas* (IEH) database provides information, reflecting the *Ficheiro de Unidades Estatísticas* (FUE), about the structure, activity, and some elements of the economic and financial nature of Portuguese companies with fewer than 100 employees and a turnover of up to 5 000 000 euros (values beyond these are considered exhaustive). This information is obtained through the response to one of two survey models, depending on the size of the companies: a simplified model for companies with less than 20 employees and a more comprehensive model for companies with more than 20 employees. Thus, the values of this database available from 1996 to 2004 are relevant for the present study.

For the period from 2004 to 2021, the database used will be the *Sistema de Contas Integradas das Empresas* (SCIE). The SCIE incorporates a wide range of annual information, drawn from companies' annual reporting through the *Informação Empresarial Simplificada* (IES), relevant for statistical, tax, and accountability purposes. This database includes all enterprises engaged in the production of goods and/or services, excluding financial companies, insurance companies, and non-market-oriented entities (for example, government units).

With the implementation of the *Sistema Normalização Contabilística* (SNC)<sup>2</sup> on January 1, 2010, significant changes were introduced in the recording of accounting information, which were reflected in the data even from 2004 onwards. In addition to this change, four other alterations can be enumerated compared to the data released before 2004:

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<sup>2</sup> Portuguese Accounting Standards System.

- i. Companies classified in agricultural and forestry activities were excluded until 2004 and from thereafter, they are included;
- ii. The business universe, starting from 2004, takes into account the institutional sector instead of the legal form;
- iii. Exclusion of certain companies based in the *Zona Franca da Madeira*, which only have a legal representative in the region or an office that works as an auxiliary to a parent company;
- iv. New assumptions in the treatment of information for individual companies (for instance, from 2004 onwards, it is considered that these types of companies only engage in one type of activity, do not employ paid individuals, and have an organized accounting system).

Therefore, this new series cannot be directly compared with the information disclosed in previous databases, including the IEH database, as they do not share the same sample universe. Since the forecast relationship between financial information and the growth rate of Portuguese real GDP will be studied for the period 1996-2021 (25 years)<sup>3</sup>, and the two databases for constructing the variables representing the financial information are not directly comparable, there must be a partition of the data between 1996-2003 and 2004-2021, which will be explained later.

The third database provides the necessary information regarding Portuguese real GDP for the period 1996-2021. *Banco de Portugal* provided the observed and published values, as reported by the INE, of the annual growth rate of Portuguese real GDP at constant prices. Additionally, it also released the semi-annual predictions of the real GDP growth rate, drawn up by *Banco de Portugal* itself and published in the *Boletins Económicos*<sup>4</sup>. Since the entire analysis will be conducted on an annual basis, a midpoint will be made in the semi-annual forecasts for each year, obtaining the annual forecast by *Banco de Portugal* of the growth rate of Portuguese real GDP. With this information, it will be possible to calculate the error in the forecasts of real GDP (observed value – predicted value, for each year).

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<sup>3</sup> Econometric models will be estimated for only 25 observations, which represents a low number of observations for drawing robust conclusions.

<sup>4</sup> Currently, *Banco de Portugal* publishes quarterly forecasts. They provide half-yearly forecasts because, from 2000 to 2004, the *Boletins Económicos* were released at intervals, not quarterly.

Finally, for additional analyses where the forecast relationship will be scrutinized using quarterly data, two quarterly series extracted from *BPstat – Portal de Estatísticas do Banco de Portugal* are employed: the year-on-year growth rate of GDP at market prices and the aggregate values of the assets' profitability (the earning power ratio) for all Portuguese non-financial corporations, excluding forestry, agriculture, and fishing, from the first quarter of 2007 to the third quarter of 2022 (63 quarters).



## 4.2 Variables and measurements

After describing the selected time series to assess the relationship between the financial information, disclosed by Portuguese companies, and the future growth rate of Portuguese real GDP, it is crucial to present the variables that will be used in the estimation models.

In the case of the macroeconomic indicator,  $G_q$  represents the growth of Portuguese real GDP in year  $q$  (which corresponds to the same year as the disclosure of financial information by companies) thus, it represents the contemporaneous growth of GDP. As for the future growth of Portuguese real GDP,  $G_{q+k}$  will serve as the dependent variable in the models created for the first and second hypothesis, and it will be estimated for 1 and 2 years ahead, meaning  $k$  can assume the value of 1 or 2. Finally, the third hypothesis aims to test whether there is a relationship between financial information and the errors made in forecasting the Portuguese real GDP. Thus, it is necessary to calculate this error for each year of the time series. The error is determined by subtracting the observed value from the predicted value (where the annual forecast value arises from the midpoint between the two semi-annual forecasts) for the Portuguese real GDP, in each year of the sample:

$$G_{q+k} - E(G_{q+k})$$

**Table 1** - Definition of variables related to the Portuguese real GDP

Variables associated with GDP	Definition
$G_q$	Contemporaneous growth of Portuguese real GDP, is the annual growth rate of Portuguese real GDP for year $q$ .
$G_{q+k}, k = \{1, 2\}$	Future growth of Portuguese real GDP, is the annual growth rate of Portuguese real GDP for 1 or 2 years after year $q$ .
$G_{q+k} - E(G_{q+k}), k = \{1, 2\}$	Forecast error, measured by the difference between the real GDP growth rate and the forecasts of the <i>Banco de Portugal</i> .

As previously mentioned, the financial information, released by Portuguese companies, will be represented by two independent variables: the aggregate variation in accounting profits (relevant variable for hypothesis **H1a**) and the aggregate change in earning power (relevant variable for hypothesis **H1b**). Hence, values of items such as net income, sales, assets, and operating income will be extracted from the databases for the various years of the sample period (1996-2021). The companies to be included in the sample must have no missing values for each item. The aggregate accounting profits for each year will be divided by the aggregate sales value of the same year to prevent potential negative denominators (Konchitchki and Patatoukas, 2014a; Zhang and Fargher, 2021). In this way,  $X_q$  represents the ratio of the total net income to the total sales across all companies within the sample for each year.

$$X_q = \frac{\sum \text{net income}_q}{\sum \text{sales}_q}$$

Since the variable of interest is the aggregate change in accounting profits, it is necessary to calculate the difference over the various years:  $\Delta X_q = X_q - X_{q-1}$ . As for the aggregated earning power,  $EP_q$  will be calculated as the quotient between the sum of operating results (EBIT)<sup>5</sup> and the sum of assets for all companies in the sample for the various years. Once again, the variable of interest is the aggregate change in the assets' profitability, so the evolution of the earning power over the sample years is calculated as  $\Delta EP_q = EP_q - EP_{q-1}$ .

Finally, concerning hypothesis **H1b**, it is intriguing to disaggregate the financial ratio into two components and understand which of them will have a greater contribution to the predictive ability of financial ratio in forecasting Portuguese real GDP (Konchitchki and Patatoukas, 2014b). Therefore, the earning power will be separated into asset turnover (AT),

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<sup>5</sup> In most studies, earning power is typically derived by dividing earnings before interest, taxes, depreciation, and amortization - EBITDA (represents EBIT excluding depreciation and amortization) by assets (Konchitchki and Patatoukas, 2014b), since depreciation and amortization are not considered cash flows and therefore should not be included. However, in this case, the use of EBITDA becomes impossible as this type of information is not disclosed in the databases. Therefore, the ratio is given by the quotient of EBIT and assets.

through the quotient between sales and assets, and profit margin (PM), the quotient between operating income and sales.

$$\begin{aligned}
 EP_q &= \frac{\sum \text{operating income}_q}{\sum \text{assets}_q} = \\
 &= AT_q \times PM_q = \frac{\sum \text{sales}_q}{\sum \text{assets}_q} \times \frac{\sum \text{operating income}_q}{\sum \text{sales}_q}
 \end{aligned}$$

The treatment of these two new variables will be like the one described above, meaning that both ratios are calculated by summing each component across various companies for each year and, subsequently, their variations are calculated. Thus, the aggregate change in asset turnover,  $\Delta AT_q$ , and the aggregate change in profit margin,  $\Delta PM_q$ , are constructed for the various years of the selected time series.

**Table 2** - Definition of variables related to the financial information, disclosed by Portuguese companies

<b>Variables associated with financial information</b>	<b>Definition</b>
$\Delta X_q$	Aggregate variation in accounting profits, disclosed by Portuguese companies for year q.
$\Delta EP_q$	Aggregate variation in earning power ratio, based on information disclosed by Portuguese companies for year q.
$\Delta AT_q$	Aggregate change in asset turnover of Portuguese companies for year q. Allows the disaggregation of earning power.
$\Delta PM_q$	Aggregate change in profit margin of Portuguese companies for year q. Allows the disaggregation of earning power.

### 4.3 Empirical strategy

For all the reasons outlined in the previous subchapter, the two microdata sources (IEH and SCIE) used for creating variables representing financial information, differ for the intended study time series (1996-2021). Thus, it is necessary to include in the models a variable marking the different databases used in the analysis: *Inquérito Anual às Empresas* (IEH, with data available from 1996 to 2004) and the *Sistema de Contas Integradas das Empresas* (SCIE, with data available from 2004 to 2021). In this way, the sample partition will be achieved by including a "*IEH*" dummy in all models. The dummy will take the value 1 for the years before 2004, where the IEH microdata base will be employed (1996 to 2003, inclusive). In the following years, the variable will have the value 0, indicating the period for which the SCIE will be used.

Regarding hypothesis **H1a**, which aims to test whether the aggregate variation in accounting earnings of Portuguese companies can predict the future growth rate of Portuguese real GDP, the following econometric model is considered:

$$G_{q+k} = \alpha + \beta_1 \Delta X_q + \beta_2 IEH + \varepsilon_t \quad (3.1.)$$

As one may observe, the dependent variable describes the future growth rate of the Portuguese real GDP for 1 or 2 years after the disclosure of the financial information, which in this model is represented by the aggregate change in accounting profits. Once again, it should be noted that the "*IEH*" dummy is used to mark the different sources of financial information. Thus, the estimated equation allows us to ascertain whether the aggregate variation in accounting earnings can predict the future behavior of real GDP. In this regard, the coefficient of interest,  $\beta_1$ , is expected to be positive and significant, supporting the findings in the literature within the Portuguese context (Atmini and Sumiyana, 2017; Konchitchki and Patatoukas, 2014a; Zhang and Fargher, 2021). In other words, it is expected to be confirmed that the variation in the accounting earnings from Portuguese companies can predict the Portuguese real GDP. The significance of the coefficient  $\beta_2$  will help determine if the sample division influences the model's results. If  $\beta_2$  is insignificant, it suggests that the use of the two different databases does not influence the results.

For hypothesis **H1b**, the model created will be similar (only changing the independent variable), as the theme remains focused on studying the predictive power of financial information in forecasting the Portuguese real GDP. Therefore, it is intended to test whether the aggregate variation in the earning power ratio of Portuguese companies anticipates the future growth rate of Portuguese real GDP, which leads to the next model:

$$\mathbf{G}_{q+k} = \alpha + \beta_1 \Delta EP_q + \beta_2 IEH + \varepsilon_t \quad (3.2.)$$

Following the preceding econometric model, the coefficient of interest remains  $\beta_1$ . Similar outcomes to equation 3.1 are expected, indicating that the relevant coefficient is positive and significant. This suggests that the financial information, in the form of aggregated variation in the earning power ratio can also predict the Portuguese real GDP, thus confirming findings in this field (Konchitchki and Patatoukas, 2014b; Yoshinaga and Nakano, 2021). As this financial ratio can be deconstructed (as explained in the preceding section), it is interesting to understand the contribution of each of its components (asset turnover and profit margin) to forecasting the Portuguese real GDP, leading to the creation of the next model:

$$\mathbf{G}_{q+k} = \alpha + \beta_1 \Delta AT_q + \beta_2 \Delta PM_q + \beta_3 IEH + \varepsilon_t \quad (3.3.)$$

Considering the approach of Konchitchki and Patatoukas (2014b), we will examine the coefficients related to the aggregate variation in asset turnover and in profit margin to understand which component will be more useful in predicting the Portuguese real GDP.

To examine the incremental value of financial information in forecasting real GDP (**H2**), the models that will be estimated are similar to those of the first and second equations, but with the addition of the variable representing contemporaneous GDP growth. Therefore, the objective is to test whether financial information (in both its forms) continues predictive of GDP even after adding the Portuguese real GDP growth rate, for the year in which the financial information is disclosed. The dependent variable remains the GDP growth rate for one or two years ahead:

$$\mathbf{G}_{q+k} = \alpha + \beta_1 \Delta X_q + \beta_2 G_q + \beta_3 IEH + \varepsilon_t \quad (3.4.)$$

$$\mathbf{G}_{q+k} = \alpha + \beta_1 \Delta EP_q + \beta_2 \mathbf{G}_q + \beta_3 IEH + \varepsilon_t \quad (3.5.)$$

The variable "IEH" continues to delineate the necessary sample partition. The coefficient of interest for each equation remains  $\beta_1$ . Consistent with the literature in this field, it is expected that these coefficients will remain positive and significant, even with the inclusion of the variable  $\mathbf{G}_q$ , which represents the contemporaneous growth of real GDP. Thus, the aim is to illustrate that financial information, when represented by the aggregate variation in accounting profits and in earning power ratio, contributes incrementally to forecasting the Portuguese real GDP, compared to contemporaneous GDP growth (Konchitchki and Patatoukas, 2014a; Zhang and Fargher, 2021).

Considering the calculation of the error made in forecasting the Portuguese real GDP, **H3** states that researchers at the *Banco de Portugal* do not appear to incorporate various types of financial information when constructing their real GDP forecasts. Hence, it is intended to study the relationship between the two representative forms of financial information and the errors committed in forecasting the Portuguese real GDP:

$$\mathbf{G}_{q+k} - E(\mathbf{G}_{q+k}) = \alpha + \beta_1 \Delta X_q + \beta_2 \mathbf{G}_q + \beta_3 IEH + \varepsilon_t \quad (3.6.)$$

$$\mathbf{G}_{q+k} - E(\mathbf{G}_{q+k}) = \alpha + \beta_1 \Delta EP_q + \beta_2 \mathbf{G}_q + \beta_3 IEH + \varepsilon_t \quad (3.7.)$$

In this scenario, the dependent variable becomes the error incurred in forecasting the Portuguese real GDP, and "IEH" once more controls for the sample partition. As for the variable representing the contemporaneous GDP growth,  $\mathbf{G}_q$ , it will be maintained as a control variable. This is because controlling for GDP growth during the period of financial information disclosure, helps mitigate potential concerns that the possible relationship between financial information and GDP may be explained by asymmetries in GDP estimates (Gaertner *et al.*, 2020; Yoshinaga and Nakano, 2021).

The coefficient of interest will be  $\beta_1$ , and it is expected to be positive and significant, showing that financial information is positively related to the errors in predicting the Portuguese real GDP. Thus, similar to findings in several studies within this area (Fargher and Zhang, 2023; Konchitchki and Patatoukas, 2014a,2014b; Zhang and Fargher, 2021), this

significant positive relationship will allow us to conclude that financial information, in the form of aggregate changes in profits and in financial ratios is not adequately incorporated, at least to a sufficient extent, by *Banco de Portugal's* researchers in the development of their Portuguese real GDP forecasts. Consequently, these forecasts could potentially be improved through the inclusion of these elements extracted from the financial statements.

In the selected time series, there have been periods of heightened turbulence and significant uncertainty (Nallareddy and Ogneva, 2014), such as the 2007/2008 financial crisis and the pandemic crisis. Therefore, to the models developed for the second hypothesis (Eq. 3.4 and 3.5), a dummy variable "*crisis*" will be added and related to the other variables. This dummy will take on the value of 1 for the years considered more tumultuous:

$$G_{q+k} = \alpha + \beta_1 \Delta X_q + \beta_2 G_q + \beta_3 \text{crisis} + \beta_4 \Delta X_q \text{crisis} + \beta_5 G_q \text{crisis} + \beta_6 IEH + \varepsilon_t \quad (3.8.)$$

$$G_{q+k} = \alpha + \beta_1 \Delta EP_q + \beta_2 G_q + \beta_3 \text{crisis} + \beta_4 \Delta EP_q \text{crisis} + \beta_5 G_q \text{crisis} + \beta_6 IEH + \varepsilon_t \quad (3.9.)$$

The objective of these two new models is to assess whether incorporating the "*crisis*" dummy variable (which takes on the value 1 for the years 2007, 2008, 2009, and 2020) enhances the explanatory power of the previously established models by separately considering these periods. Therefore, we will compare the adjusted- $R^2$  values<sup>6</sup> of the models developed for the **H2** (Eq. 3.4 and 3.5) with those of two new econometric models will be conducted to understand how the explanatory power behaves after including this variable. It is expected that the adjusted- $R^2$  of these new models (Eq. 3.8 and 3.9) will be higher, indicating that the separate inclusion of crisis periods improves the explanatory power of the models. This is because these periods are characterized by increased uncertainty and

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<sup>6</sup> The comparison is made using the adjusted coefficient of determination because it reflects the predictive power of the new variable, rather than just the increase in the number of variables. The  $R^2$  would invariably increase with more variables, but this doesn't necessarily reflect the explanatory power of the new variables (in this case, the dummy).

numerous adjustments in the estimates of various macroeconomic indicators, including GDP, as observed in the study by Yoshinaga and Nakano (2021).

For the estimation of all econometric models, for  $k = \{1,2\}$  (models are fitted for two-time horizons – 1 and 2 years), the Ordinary Least Square (OLS) method is employed as it provides the best fit by minimizing the sum of squared differences between the observed and predicted values. Additionally, the models will be estimated using the Newey-West procedure, allowing for a proper interpretation of the results (Konchitchki and Patatoukas, 2014a). This approach solves potential issues of heteroskedasticity and autocorrelation among observations (Newey and West, 1987), which are common characteristics when analyzing time series data, as in this case.



## 5. Empirical results

In this section, we provide and discuss the main results obtained. Initially, the univariate results such as descriptive statistics and correlation matrix will be demonstrated. Subsequently, in the multivariate analysis, we will present the results obtained through the estimation of the models explained above, allowing the debate on the validity of the research hypotheses.

### 5.1 Univariate analysis

**Table 3** - Descriptive statistics

	Mean	Std. dev.	Min	Q1	Median	Q3	Max
$X_q$	0,032	0,012	0,006	0,025	0,032	0,039	0,059
$\Delta X_q$	0,001	0,015	-0,048	-0,004	0,0007	0,008	0,033
$EP_q$	0,043	0,010	0,024	0,036	0,044	0,05	0,063
$\Delta EP_q$	-0,0003	0,011	-0,0299	-0,006	-0,0001	0,004	0,023
$AT_q$	0,735	0,0699	0,627	0,691	0,7199	0,793	0,875
$\Delta AT_q$	-0,005	0,034	-0,0796	-0,024	-0,005	0,017	0,064
$PM_q$	0,059	0,012	0,037	0,055	0,0604	0,065	0,091
$\Delta PM_q$	-0,00003	0,015	-0,047	-0,006	0,0007	0,006	0,034
$G_q$	0,01048	0,03	-0,084	0,002	0,015	0,031	0,058
$G_{q+1}$	0,01164	0,032	-0,084	0,002	0,015	0,031	0,068
$G_{q+2}$	0,01076	0,031	-0,084	0,002	0,015	0,03	0,068
$G_{q+1} - E(G_{q+1})$	0,00294	0,0059	-0,00105	0,001	0,003	0,006	0,0014
$G_{q+2} - E(G_{q+2})$	0,00275	0,0061	-0,00105	-0,001	0,003	0,006	0,0014

The table presents the descriptive statistics for the key variables. Aggregate accounting earnings of Portuguese companies alternate between 0,6% and 5,9%. Additionally, the average growth in accounting profits is 0,1%, with a standard deviation of 1,5%. The earning power ratio also undergoes substantial changes throughout the sample period, varying from 2,4% and 6,3%, with an average variation of -0,03% and a standard deviation of 1,1%. Furthermore, variations in the asset profitability ratio can be decomposed into changes in asset turnover, with an average of -0,5%, and the variation in profit margin, with an average of -0,003%.

The contemporaneous growth rate of Portuguese real GDP shows an average variation of 1,048%, with a standard deviation of 3%. For the one-year-ahead forecasting horizon, the average error in the predictions of the Portuguese real GDP growth rate made by the *Banco de Portugal* (the difference between the observed and predicted values of the real GDP growth rate) is 0,294%, with a standard deviation of 0,59%.

**Table 4** - Correlation matrix

	$\Delta X_q$	$\Delta EP_q$	$\Delta AT_q$	$\Delta PM_q$	$G_{q+1}$	$G_{q+2}$
$\Delta X_q$	1,000	0,888	0,074	0,932	0,399	-0,047
$\Delta EP_q$		1,000	0,264	0,978	0,298	-0,071
$\Delta AT_q$			1,000	0,0899	0,0199	-0,162
$\Delta PM_q$				1,000	0,303	-0,057
$G_{q+1}$					1,000	0,071
$G_{q+2}$						1,000

Table 4 reports the correlations between the changes in the variables representing financial information and the future growth rates of Portugal's real GDP. These results demonstrate a positive correlation between the variations in profit growth and in earning power with the future real GDP growth rate for one year ahead (0,399 and 0,298, respectively). Thus, there is preliminary evidence that financial variables provide valuable insights into the real growth of the Portuguese economy. Among the financial variables, it is important to highlight the growth of accounting profits, as it exhibits the strongest correlation with future GDP growth (0,399). In the decomposition of the earning power ratio, the variable with the highest correlation is the variation in profit margin (0,303). Finally, negative correlations between financial variables and future GDP growth two years after the release of financial information are also emphasized, suggesting that the positive correlation between financial information and future GDP growth weakens as the forecast horizon increases.

## 5.2 Multivariate analysis

At this stage, it is crucial to identify and analyze the econometric outcomes of the models presented in the preceding section.

**Table 5** - Impact of the aggregate variation in accounting profits on future forecast of annual GDP growth rates (Eq. 3.1)

	<b>k=1</b>	<b>k=2</b>
<b>Intercept</b> ( <i>t-statistic</i> )	0,8699 (1,327)	1,0242 (1,253)
<b><math>\Delta X_q</math></b> ( <i>t-statistic</i> )	85,4940** (2,410)	-10,2277 (-0,293)
<b>IEH</b> ( <i>t-statistic</i> )	0,7059 (0,676)	0,2260 (0,199)
<b>Observations</b>	25	25
<b><math>R^2</math></b>	0,1696	0,0033
<b>Adj-<math>R^2</math></b>	0,0941	-0,0873
<b><i>F-statistic</i></b>	2,2462**	0,0363

\*\*\*, \*\*, and \* represent significance levels of 1%, 5%, and 10%, respectively. T-statistics are shown in parentheses.

As evident by the results in table 5, it confirms the research hypothesis **H1a**. The coefficient of the variable  $\Delta X_q$  is positive and statistically significant at the 5% level (for k=1), indicating a positive and significant relationship between the aggregate variation in accounting earnings and the future growth rate of the Portuguese real GDP. The variable has a t-statistic of 2,410. Thus, financial information represented by the aggregate variation in profits of Portuguese companies can predict the future growth rate of real GDP, one year ahead (as seen in Konchitchki and Patatoukas, 2014a; Zhang and Fargher, 2021).

However, it is worth noting that when attempting to forecast the GDP growth rate for two years following the disclosure of the financial information (k=2), the coefficient of  $\Delta X_q$  becomes negative and loses significance. The model even becomes globally insignificant. Consequently, it is evident that two years after the financial information disclosure, the aggregate variation in accounting earnings is no longer able to predict the future growth rate of Portuguese real GDP. Therefore, it is necessary to emphasize that the

relevance of accounting profits in predicting future real GDP decreases as the forecasting horizon increases, which was expected due to the timeliness<sup>7</sup> of financial information (Abdalla *et al.*, 2021). Thus, confirming the first research hypothesis, the study's focus shifts to **H1b**.

**Table 6** - Impact of the aggregate variation in earning power on future forecast of annual GDP growth rates (Eq. 3.2)

	<b>k=1</b>	<b>k=2</b>
<b>Intercept</b> <i>(t-statistic)</i>	0,9516 (1,358)	1,0125 (1,220)
<b><math>\Delta EP_q</math></b> <i>(t-statistic)</i>	87,5537* (1,982)	-20,1412 (-0,379)
<b>IEH</b> <i>(t-statistic)</i>	0,8651 (0,740)	0,2024 (0,181)
<b>Observations</b>	25	25
<b><math>R^2</math></b>	0,1045	0,0059
<b>Adj-<math>R^2</math></b>	0,0231	-0,0844
<b>F-statistic</b>	1,2839	0,0658

\*\*\*, \*\*, and \* represent significance levels of 1%, 5%, and 10%, respectively. T-statistics are shown in parentheses.

As can be observed, the models estimated for k=1 and k=2 are not globally significant, as indicated by the F-statistic values (1,2839 e 0,0658, respectively). Therefore, it is not possible to draw conclusions about the predictive capacity of the earning power. However, it is noteworthy that the coefficient of the variable  $\Delta EP_q$  is positive and statistically significant at a 10% significance level (for k=1), which suggests that the aggregate variation in the financial ratio is positively related to the future growth rate of Portuguese real GDP. This would align with the findings in the literature of this field. Thus, if the model were globally significant, it would be possible to conclude that the aggregate change in earning power can predict the future growth of Portuguese real GDP for one year following the disclosure of financial information. Similar to the previous table, this forecasting ability diminishes as the forecast horizon increases, as for k=2 the coefficient of the variable becomes negative and insignificant in predicting future GDP. Combining the results from

<sup>7</sup> Quality of financial information be disclosed promptly.

the two previous tables, we can potentially conclude the existence of a positive relationship between financial information (in its two aggregate forms, either the variation in accounting profits or in earning power) and the future growth of Portuguese real GDP for the year after the disclosure of this financial information<sup>8</sup>, provided that the models associated with the earning power ratio were globally significant. Thus, **H1a** is verified, and no conclusion was reached for **H1b**.

Lastly, as mentioned in the research design, we decompose earning power into the aggregate variation in asset turnover and in profit margin, as it provides additional information about the components useful for forecasting the real economy.

**Table 7** - Disaggregation of the impact of the aggregate variation in earning power on future forecast of annual GDP growth rates (Eq. 3.3)

	<b>k=1</b>	<b>k=2</b>
<b>Intercept</b> ( <i>t-statistic</i> )	0,9298 (1,258)	0,95899 (1,120)
<b><math>\Delta AT_q</math></b> ( <i>t-statistic</i> )	-0,1051 (-0,008)	-14,4588 (-0,676)
<b><math>\Delta PM_q</math></b> ( <i>t-statistic</i> )	63,5736* (1,941)	-8,7851 (-0,267)
<b>IEH</b> ( <i>t-statistic</i> )	0,84199 (0,711)	0,1543 (0,132)
<b>Observations</b>	25	25
<b><math>R^2</math></b>	0,1068	0,0286
<b>Adj-<math>R^2</math></b>	-0,0208	-0,1101
<b><i>F-statistic</i></b>	0,8372	0,2064

\*\*\*, \*\*, and \* represent significance levels of 1%, 5%, and 10%, respectively. T-statistics are shown in parentheses.

In these estimation models, the aggregate variation in earning power is replaced by the aggregate variation in asset turnover and in profit margin to assess their predictive power

<sup>8</sup> In unreported results, models for hypotheses **H1a** and **H1b** were estimated with a new dependent variable – the future growth rate of Portuguese nominal GDP (using both real GDP and Consumer Price Index). It was demonstrated that the use of nominal GDP, which considers inflation, does not affect the obtained results (as in Yoshinaga and Nakano, 2021).

for the Portuguese real GDP. As observed, the models are not globally significant, which makes it impossible to reach conclusions about the predictive power of the financial ratio components.

Thus, the ability of the aggregate variation in accounting earnings of Portuguese companies to forecast future GDP growth, for the year following its disclosure, has been demonstrated. In the three tables of this section, the “*IEH*” dummy variable is not significant for the models under consideration, indicating that the partition made in the sample, motivated by the databases used, does not affect the results in question.

Moving on to the second hypothesis, the aim is to test the incremental value of financial information in predicting the real activity of the Portuguese economy.

**Table 8** - Predictive ability of the aggregate variation in accounting profits after the inclusion of contemporaneous GDP growth (Eq. 3.4)

	<b>k=1</b>	<b>k=2</b>
<b>Intercept</b> <i>(t-statistic)</i>	0,9115 (1,315)	1,1303 (1,270)
<b><math>\Delta X_q</math></b> <i>(t-statistic)</i>	89,8272* (1,903)	0,8447 (0,023)
<b><math>G_q</math></b> <i>(t-statistic)</i>	-0,0700 (-0,245)	-0,1789 (-0,839)
<b>IEH</b> <i>(t-statistic)</i>	0,8023 (0,660)	0,4721 (0,389)
<b>Observations</b>	25	25
<b><math>R^2</math></b>	0,1734	0,0290
<b>Adj-<math>R^2</math></b>	0,0553	-0,1098
<b>F-statistic</b>	1,4679*	0,2087

\*\*\*, \*\*, and \* represent significance levels of 1%, 5%, and 10%, respectively. T-statistics are shown in parentheses.

As observed, the coefficient of the variable  $\Delta X_q$  remains positive and significant in the one-year-ahead forecasting horizon, even after including the contemporaneous GDP growth, that is, the real GDP growth rate for the same year as the disclosure of financial information. The variable has a t-statistic of 1,903. Therefore, the predictive value of the

aggregate variation in accounting profits is incremental in predicting real GDP for the year following the disclosure of financial information ( $k=1$ ). Similarly to the results of the models mentioned above, when examining GDP forecasting for 2 years after the disclosure of financial information, the coefficient associated with the aggregate variation in earnings is positive but statistically insignificant, which was expected since it has already been demonstrated for the first hypothesis that accounting profits do not have predictive power for  $k=2$ . Thus, **H2** is partially supported, as it has been proven that the variation in accounting profits provides additional information for forecasting the growth of Portuguese real GDP.

**Table 9** - Predictive ability of the aggregate variation in earning power after the inclusion of contemporaneous GDP growth (Eq. 3.5)

	<b>k=1</b>	<b>k=2</b>
<b>Intercept</b> <i>(t-statistic)</i>	0,9911 (1,313)	1,12698 (1,235)
<b><math>\Delta EP_q</math></b> <i>(t-statistic)</i>	93,5043 (1,383)	-2,8791 (-0,058)
<b><math>G_q</math></b> <i>(t-statistic)</i>	-0,0598 (-0,183)	-0,1736 (-0,832)
<b>IEH</b> <i>(t-statistic)</i>	0,9554 (0,680)	0,4642 (0,399)
<b>Observations</b>	25	25
<b><math>R^2</math></b>	0,1072	0,0290
<b>Adj-<math>R^2</math></b>	-0,020	-0,1097
<b>F-statistic</b>	0,8401	0,2092

\*\*\*, \*\*, and \* represent significance levels of 1%, 5%, and 10%, respectively. T-statistics are shown in parentheses.

Contrary to the results outlined in the previous table, the models estimated for  $k=1$  and  $k=2$  are not globally significant, so it is not possible to draw conclusions about the incremental value of this financial ratio in predicting the Portuguese real GDP. Similarly to the models estimated for **H1b**, the regressions calculated to study the incremental predictive power of this financial ratio are not statistically significant. Therefore, **H2** is partially verified, as the variation in accounting earnings provides incremental information for forecasting real GDP, but when examining the variation in earning power, we cannot conclude anything

about this incremental power (unlike what occurs in the study of Konchitchki and Patatoukas, 2014b). This result appears surprising, as it was expected that both accounting profits and earning power would contribute incrementally to predicting Portuguese real GDP.

Delving into this issue, it is believed that the models associated with the earning power ratio are globally insignificant (for **H1b** and **H2**) because the ratio is given by the division between operating income (EBIT) and assets. As mentioned in the methodology, unlike other studies in this area, it was not feasible to construct the ratio using EBITDA divided by assets, due to the lack of items in the databases to calculate EBITDA. Therefore, employing EBIT instead of EBITDA may have influenced these results, as operating income includes depreciation and amortization, which do not constitute cash flows and are unable to predict the future evolution of GDP (Atmini and Sumiyana, 2017). We can thus conclude that the second hypothesis is partially validated since, in this study, only accounting earnings are incremental in predicting the future growth rate of Portuguese real GDP<sup>9</sup>.

Turning to the final research hypothesis, **H3**, it is important to observe the outcomes of the models that relate the errors in forecasting GDP by *Banco de Portugal* with the two types of financial information (aggregate variation in accounting profits and in earning power).

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<sup>9</sup>The findings for this hypothesis were similarly validated for forecasting the future growth of Portuguese nominal GDP (as in Yoshinaga and Nakano, 2021).



**Table 10** - Predictive ability of the aggregate variation in accounting profits for GDP estimation errors (Eq. 3.6)

	<b>k=1</b>	<b>k=2</b>
<b>Intercept</b> ( <i>t-statistic</i> )	0,4794*** (3,323)	0,4359** (2,738)
<b><math>\Delta X_q</math></b> ( <i>t-statistic</i> )	18,4647*** (3,963)	-15,3653 (-1,666)
<b><math>G_q</math></b> ( <i>t-statistic</i> )	-0,0522 (-1,694)	0,0116 (0,438)
<b>IEH</b> ( <i>t-statistic</i> )	-0,5429** (-2,221)	-0,5581* (-1,861)
<b>Observations</b>	25	25
<b><math>R^2</math></b>	0,4019	0,3031
<b>Adj-<math>R^2</math></b>	0,3164	0,2035
<b><i>F-statistic</i></b>	4,7031***	3,0440**

\*\*\*, \*\*, and \* represent significance levels of 1%, 5%, and 10%, respectively. T-statistics are shown in parentheses.

Table 10 reports the results of the regression models that link the aggregate variation in profits with the errors in forecasting Portuguese real GDP made by *Banco de Portugal*, when publishing its forecasts in the *Boletins Económicos*. The key finding is that the variation in the accounting earnings of Portuguese companies positively and significantly predicts (with a coefficient of 18,4647 and a significant level of 1%) the errors in estimating the future growth rate of Portuguese real GDP for one-year-ahead, while controlling for contemporaneous GDP growth, similar to the findings of Konchitchki and Patatoukas, 2014a. However, like the other results, for two years after the disclosure of the financial information (k=2), the predictive ability diminishes as the forecasting horizon extends.

It can be concluded that accounting earnings are a significant factor in predicting future GDP growth, but they do not appear to be incorporated into the development of forecasts made by *Banco de Portugal*. Consequently, errors in estimating the future growth of Portuguese real GDP could be reduced, making forecasts more accurate and precise, by incorporating financial information from Portuguese companies (in this case, accounting profits). Therefore, **H3** is partially confirmed, thereby advancing to the question of whether

aggregate variation in earning power ratio is also capable of predicting GDP estimation errors.

**Table 11** - Predictive ability of the aggregate variation in earning power for GDP estimation errors (Eq. 3.7)

	<b>k=1</b>	<b>k=2</b>
<b>Intercept</b> ( <i>t-statistic</i> )	0,4911*** (3,302)	0,4262** (2,638)
<b><math>\Delta EP_q</math></b> ( <i>t-statistic</i> )	14,9892 (1,715)	-12,3768 (-0,685)
<b><math>G_q</math></b> ( <i>t-statistic</i> )	-0,0443 (-1,341)	0,0049 (0,136)
<b>IEH</b> ( <i>t-statistic</i> )	-0,5219* (-1,947)	-0,5753* (-1,947)
<b>Observations</b>	25	25
<b><math>R^2</math></b>	0,2828	0,2230
<b>Adj-<math>R^2</math></b>	0,1804	0,1120
<b>F-statistic</b>	2,7605**	2,0091*

\*\*\*, \*\*, and \* represent significance levels of 1%, 5%, and 10%, respectively. T-statistics are shown in parentheses.

In contrast to the aggregate variation in accounting profits, the coefficient of the aggregate growth of earning power is positive but insignificant (with a coefficient value of 14,9892) in forecasting errors in estimating real GDP, partially rejecting **H3**. Therefore, it appears that earning power is not capable of predicting GDP estimation errors, indicating that this information is already considered by *Banco de Portugal* in its GDP forecast development. This result diverges from existing literature, such as the study by Konchitchki and Patatoukas, 2014b, where they demonstrate, using American and quarterly data, that the variation in the return on net operating assets is not incorporated in the development of forecasts for the U.S. real GDP.

Once more, it is believed that this outcome is justified using operating income divided by assets rather than EBITDA divided by assets, as in the latter case, the models are already significant. Using operating income involves the inclusion of certain items from the

income statements that do not represent cash flows (Atmini and Sumiyana, 2017), and this influences the results of the regression in question. It would be interesting to examine the model with the earning power represented by the ratio of EBITDA by assets to ascertain whether the conclusion that - GDP estimation errors cannot be predicted through the aggregate variation in earning power - stems from the use of this ratio (that is, changing the method of constructing earning power leads to a positive and significant relationship) or if the *Banco de Portugal* already tends to incorporate this type of financial information into the development of its forecasts for the Portuguese real economy.

Therefore, the third hypothesis is partially confirmed, as only the aggregated variation in accounting profits shows a positive and significant relationship with errors in estimating real GDP. This suggests that the *Banco de Portugal* researchers does not appear to incorporate this type of financial information into the development of its forecasts for Portuguese real GDP. Regarding earning power, no significant relationship was found with the errors in estimating GDP, making it unclear whether this type of information is already included in the preparation of forecasts for this macroeconomic aggregate.

**Table 12** - Improvement of forecast models after the inclusion of crisis effect (Eq. 3.8 and 3.9)

	<b>k=1</b>	<b>k=2</b>
<b>Intercept</b> ( <i>t-statistic</i> )	0,0478 (0,062)	0,8306 (1,007)
<b><math>\Delta X_q</math></b> ( <i>t-statistic</i> )	60,1141 (1,203)	-10,0183 (-0,259)
<b><math>G_q</math></b> ( <i>t-statistic</i> )	0,4786* (1,775)	0,1586 (0,815)
<b>crisis</b> ( <i>t-statistic</i> )	0,4276 (0,456)	-3,2367*** (-4,134)
<b><math>\Delta X_q</math>crisis</b> ( <i>t-statistic</i> )	151,5503 (1,623)	-366,345*** (-7,921)
<b><math>G_q</math>crisis</b> ( <i>t-statistic</i> )	-1,1394*** (-3,775)	-0,9557*** (-4,545)

<b>IEH</b> ( <i>t-statistic</i> )	0,5769 (0,552)	0,0862 (0,077)
<b>Observações</b>	25	25
<b><math>R^2</math></b>	0,3868	0,2582
<b>Adj-<math>R^2</math></b>	0,1824	0,0109
<b>F-statistic</b>	1,8922*	1,0440
	<b>k=1</b>	<b>k=2</b>
<b>Intercept</b> ( <i>t-statistic</i> )	0,0594 (0,074)	0,8346 (1,009)
<b><math>\Delta EP_q</math></b> ( <i>t-statistic</i> )	70,9690 (1,049)	-8,1411 (-0,143)
<b><math>G_q</math></b> ( <i>t-statistic</i> )	0,5134* (1,932)	0,1465 (0,793)
<b>crisis</b> ( <i>t-statistic</i> )	0,8018 (1,056)	-2,6885** (-2,676)
<b><math>\Delta EP_q</math> crisis</b> ( <i>t-statistic</i> )	564,0060*** (9,266)	-501,6500*** (-4,075)
<b><math>G_q</math> crisis</b> ( <i>t-statistic</i> )	-1,7690*** (-6,812)	-0,4530 (-1,486)
<b>IEH</b> ( <i>t-statistic</i> )	0,6679 (0,576)	0,0808 (0,077)
<b>Observações</b>	25	25
<b><math>R^2</math></b>	0,3983	0,2109
<b>Adj-<math>R^2</math></b>	0,1977	-0,0522
<b>F-statistic</b>	1,9857*	0,8016

\*\*\*, \*\*, and \* represent significance levels of 1%, 5%, and 10%, respectively. T-statistics are shown in parentheses.

As outlined in the empirical strategy, the models estimated in table 12 aim to understand whether the inclusion of the crisis effect increases the accuracy of forecasting models for the future growth of Portuguese real GDP. Thus, the results of this table should be compared with two previous tables (8 and 9), as the only difference between the models is the inclusion of the crisis dummy and its interaction with existing variables. The findings reveal that the adjusted- $R^2$  increases after incorporating the crisis effect, both for the aggregate variation in profits and in earning power. When predicting real GDP growth using information derived from the variation in accounting earnings, the adjusted- $R^2$  increases by

12,71% (0,1824 – 0,0553) for one year ahead and increases by 12,07% (0,0109 - (-0,1098)) for two years after the disclosure of financial information. For forecasting the real GDP growth rate using earning power variation, the adjusted- $R^2$  increases by 21,77% (0,1977 - (-0,020)), for one year ahead and increases by 5,75% (-0,0522 - (-0,1097)) for two years after the disclosure of financial information. These results indicate that considering the effect of crises significantly enhances the predictive power of the models (as in Yoshinaga and Nakano, 2021), given that crises are periods of heightened uncertainty leading to greater adjustments in the forecasts of various macroeconomic factors.

The main results lead to the conclusion that financial information, represented by the aggregate growth of accounting profits can predict the future growth rate of Portuguese real GDP, for one year following the disclosure of financial data, confirming **H1a**. Regarding the predictive power of the financial ratio, conclusions could not be drawn as the models were not globally significant, although their outcomes appeared consistent with the existence literature (indicating that the aggregate variation in earning power can predict the future growth rate of Portuguese real GDP, for one year ahead). Therefore, hypothesis **H1b** does not hold true. When decomposing the financial ratio, no conclusions were found due to the statistically insignificant models. Accounting earnings provide incremental information for forecasting Portuguese real GDP for one year ahead, as the coefficient of the variable remains positive and significant even after including contemporaneous GDP growth. The same conclusion cannot be drawn for earning power ratio, partially validating **H2**. Furthermore, the aggregate variation in accounting earnings of Portuguese companies is positively and significantly related to the estimation errors of the Portuguese real GDP for one year ahead. Thus, it is demonstrated that *Banco de Portugal* investigators appear not to incorporate such financial information in the development of their forecasts, despite the proven significance of profits in predicting real GDP growth and their potential to improve forecast accuracy. This relationship is not observed with earning power variation, also partially validating **H3**. Moreover, it is also worth mentioning that when a dummy variable is added to the models to separately consider periods of crises, the models become more explanatory. Finally, when studying the capacity of financial information to forecast future growth of Portuguese real GDP two years after financial information disclosure, no predictive relationship was found due to the timeliness of financial information. Hence, it is evident that as the forecasting horizon extends, the predicting capacity of financial information decreases.

## 6. Additional analysis

As mentioned earlier, the forecasting relationship between financial information, disclosed by Portuguese companies, and the future growth rate of Portuguese real GDP was studied using annual observations. Therefore, since data were only available from 1996 onwards, econometric models were estimated for a time series of 25 years (1996-2021), which is a limited number of observations to draw robust conclusions about the predictive relationship between financial information and GDP. This is a limitation of the current study, and it would be valuable to explore this connection between financial statement components and future real GDP growth using quarterly data, which would expand the available number of observations.

The *BPstat – Portal de Estatísticas do Banco de Portugal* provides several aggregated quarterly series, including the two necessary series for this additional analysis: quarterly values of the year-on-year growth rate of GDP at market prices and quarterly values of the earning power ratio of Portuguese non-financial corporations<sup>10</sup> (excluding companies in the agricultural, forestry, and fisheries sectors). The advantage of using this data lies in studying this relationship on a quarterly observation basis, as well as utilizing values already aggregated by the *Banco de Portugal* (eliminating the need to construct the aggregate ratios, as was done in the main analysis). Since it is intended to study the relationship between the variation in the earning power ratio and future GDP growth, it is only necessary to calculate the changes in the aggregate earning power values over the quarters:  $\Delta EP_q = EP_q - EP_{q-1}$ .

After investigating the relationship between annual financial information (in the form of aggregate variation in accounting profits and in asset profitability), reported by Portuguese companies, and the annual growth rate of Portuguese real GDP, this section aims to examine this relationship with quarterly data. The objective of this additional test is to assess whether the fluctuations in quarterly aggregate values of the earning power (a ratio representing financial information) of Portuguese companies can forecast the quarterly growth rate of Portuguese real GDP, from the first quarter of 2007 to the third quarter of 2022, allowing a time series of 63 quarters. This expanded dataset allows for a more extensive model with a larger number of observations.

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<sup>10</sup>This ratio is computed by dividing EBITDA by assets.

To assess the predictive power of the quarterly variation in earning power values for forecasting quarterly real GDP growth, up to 4 quarters ahead, the following econometric model is formulated:

$$\mathbf{G}_{q+t} = \alpha + \beta_1 \Delta EP_q + \varepsilon_t \quad (5.1.)$$

The values of future quarterly growth ( $t = \{1,2,3,4\}$ ) of Portuguese real GDP, denoted as  $G_{q+t}$ , serve as the dependent variable that will be related to the quarterly aggregate variation in earning power ratio,  $\Delta EP_q$ . Following the methodology employed throughout the study, this model will be estimated using the Ordinary Least Squares (OLS) method with the Newey-West procedure, allowing for potential problems of heteroskedasticity and autocorrelation to be addressed (Newey and West, 1987). It is expected that  $\beta_1$  will be positive and significant, showing that financial information, in this case, the aggregate variation in the financial ratio, can predict the quarterly values of future growth in Portuguese real GDP (Konchitchki and Patatoukas, 2014b; Yoshinaga and Nakano, 2021). The results of this model are summarized in the following table.

**Table 13** - Impact of the aggregate variation in earning power on future forecast of quarterly GDP growth rates (Eq. 5.1)

	<b>t = 1</b>	<b>t = 2</b>	<b>t = 3</b>	<b>t = 4</b>
<b>Intercept</b> ( <i>t-statistic</i> )	0,763 (1,157)	0,774 (1,097)	0,785 (0,996)	0,802 (0,907)
<b><math>\Delta EP_t</math></b> ( <i>t-statistic</i> )	4,709*** (3,507)	4,099*** (3,719)	3,070** (2,626)	1,188 (0,672)
<b>Observations</b>	63	63	63	63
<b>R<sup>2</sup></b>	0,256	0,194	0,109	0,016
<b>Adj- R<sup>2</sup></b>	0,244	0,181	0,094	0,000
<b>F-statistic</b>	21,032***	14,698***	7,452***	1,003

\*\*\*, \*\*, and \* represent significance levels of 1%, 5%, and 10%, respectively. T-statistics are shown in parentheses.

Table 13 presents the results of the econometric model described in equation 5.1. As expected, the interest coefficient ( $\beta_1$ ) is positive and significant at the 1% level (4,709; 4,099), for the two quarters following the disclosure of financial information by Portuguese

companies. For the third quarter, although there was a decrease in the coefficient value (3,070), it remains significant at the level of 5%. The results of this model show that the aggregate variation in the earning power ratio can predict the future growth of Portuguese real GDP, especially in the three subsequent quarters. Thus, it is possible to conclude that the aggregate variation in earning power is an important indicator of quarterly GDP growth<sup>11</sup>, especially for 1 or 2 quarters forecast horizon, as evidenced by the magnitude and significance of the coefficients. Looking at the fourth quarter, it is possible to understand the decrease in the coefficient and its loss of significance, due to the timeliness of the financial information. As known, financial information should be disclosed and used in a timely manner (Abdalla *et al.*, 2021), so it is normal for the predictive contribution of this financial ratio to gradually decrease as the forecast horizon is extended, just as it occurred in all models of the main analysis. Therefore, it is evident that in contrary to the main analysis, the estimation models employed to assess the predictive capacity of this financial ratio are globally significant and produce positive results consistent with the literature. Thus, it further suggests that the construction of the financial ratio in the central analysis, including items that are not cash flows, may have influenced the outcomes.

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<sup>11</sup> In undocumented findings, it was also discovered that the quarterly aggregated variation in this financial ratio is incremental in predicting the quarterly future growth rate of Portuguese real GDP, relative to contemporaneous quarterly GDP growth.



## 7. Conclusion

There is a wide range of literature exploring the relationship between financial information and the forecasting of future GDP behavior. Nonetheless, the ability of financial information to predict future growth rates of real GDP remains unknown within the Portuguese economy. In this vein, the present research examined the predictive relationship between the aggregate annual variation in accounting earnings and in the asset profitability ratio (variables representing financial information) and future growth rates of Portuguese real GDP. Additionally, it was explored whether this predictive ability is incremental in comparison to contemporaneous GDP growth (that is, the GDP growth rate for the year in which financial information is disclosed, with the models aiming to predict the GDP growth rate for one or two years after the disclosure) and whether researchers at *Banco de Portugal* integrate financial information disclosed by Portuguese companies into their forecasts of future real GDP growth rates, which are published in the *Boletins Económicos*.

Considering the methodology employed to analyze the time series from 1996 to 2021, it was possible to deduce that the aggregate variation in earnings is indeed capable of predicting the future growth rate of Portuguese real GDP, for the subsequent year following the disclosure of financial information by Portuguese companies. Regarding the predictive power of the earning power ratio and its components, no conclusions could be made as the estimated models were not globally significant. Furthermore, only the aggregate variation in accounting income provides additional insights for this forecast compared to the contemporaneous growth of Portuguese real GDP. Therefore, the incremental contribution of this predictive power was not confirmed for the aggregate variation in earning power. Furthermore, it was proven that the aggregate variation in accounting earnings is positively and significantly related to errors in the forecasts of GDP growth by *Banco de Portugal*. Thus, it can be inferred that *Banco de Portugal's* researchers do not appear to incorporate accounting earnings, disclosed by Portuguese companies, into the development of their GDP forecasts. On the other hand, no statistical relationship was identified between the aggregate variation in earning power and the errors in GDP estimations.

The results revealed unexpected evidence when employing the earning power ratio, in contrast to the developed hypotheses and the insignificance of the models. It is believed

that these conclusions can be justified by the composition of the ratio, which was calculated by dividing operating income by assets. The numerator of the ratio includes components, such as depreciation and amortization, which do not represent cash flows and may influence these findings. Finally, when a dummy indicating crisis years is incorporated into the models, they become more explanatory, as these periods are characterized by heightened uncertainty and greater difficulty in estimating the Portuguese real GDP.

While the conclusions drawn allow for reflections on the predictive ability of financial information, disclosed by Portuguese companies, in forecasting the future trajectory of Portuguese real GDP, it is essential to highlight several limitations stemming from the conducted analysis. The models were estimated for a time series spanning 25 years, specifically from 1996 to 2021, reflecting the annual disclosure of financial information by Portuguese companies. Thus, the main limitation of the study in question lies in the annual reporting of financial data. If such information were released quarterly, the results would likely exhibit more consistency, given the models would be estimated over a larger number of observations. In addition, there was no industry control implemented, as the number of companies included in the sample was relatively low and inconsistent over the studied years. Implementing this control would lead to very small subsamples. Consequently, it could be interesting to examine this relationship in a new sample with a larger number of Portuguese companies and apply industry control. As mentioned earlier, constructing the earning power ratio using EBIT instead of EBITDA is a limitation of the study, as the inclusion of non-cash flow elements in the profitability ratio seems to have influenced the results at hand.

For future research, it would be useful to examine the predictive relationship between financial information and other macroeconomic aggregates, besides GDP, within the Portuguese context. As this is the first study to explore the association between financial information and the future forecast of Portuguese real GDP, it remains unknown whether there is a predictive link between financial information and Portuguese inflation or unemployment levels, for example. Given the obtained results, future investigations could also explore the forecasting relationship between the earning power ratio, calculated as the ratio of EBITDA to assets, and the future values of the Portuguese real GDP growth rate. This exploration would help ascertain whether the conclusions drawn in the present dissertation were influenced by the type of ratio used.

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