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of Economics
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MASTER

MONETARY AND FINANCIAL ECONOMICS

MASTER'S FINAL WORK

DISSERTATION

**CATASTROPHIC HEALTH EXPENDITURES IN FOUR EUROPEAN
COUNTRIES IN 2015: INCIDENCE, DETERMINANTS AND
ASSETS PERSPECTIVE**

ANA BEATRIZ MESQUITA COELHO

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ABSTRACT

This dissertation studies the incidence and the determinants of Catastrophic Health Expenditures for Portugal, Spain, Italy and Greece. The incidence is calculated from two different perspectives: the first uses the World Health Organization method; the second excludes all people with enough net financial assets to pay for health expenses for two years. This is important because someone with a low income but considerable financial assets is able to fund his/her health expenditures without falling into a catastrophic situation, at least for some time. For the determinants, a logit model is estimated. Nineteen explanatory variables are used. The results show that all variables chosen may have some impact on the Catastrophic Health Expenditures and that adding financial assets may strongly influence the incidence results.

Keywords: Catastrophic Health Expenditures; Out-of-pocket payments; Financial assets; Logit model

RESUMO

Esta dissertação estuda a incidência e os determinantes das Despesas Catastróficas de Saúde para Portugal, Espanha, Itália e Grécia. A incidência é calculada de duas perspectivas diferentes: a primeira utiliza o método da Organização Mundial de Saúde; a segunda exclui todas as pessoas com ativos financeiros líquidos suficientes para pagar as despesas de saúde durante dois anos. Isto é importante porque alguém com um rendimento baixo mas com ativos financeiros consideráveis é capaz de financiar as suas despesas de saúde evitando uma situação catastrófica, pelo menos durante um determinado período de tempo. Para os determinantes, é estimado um modelo logit. São utilizadas dezanove variáveis explicativas. Os resultados mostram que todas as variáveis escolhidas podem ter algum impacto nas Despesas Catastróficas de Saúde e que a adição de ativos financeiros pode influenciar fortemente os resultados da incidência.

Palavras-chave: Despesas Catastróficas de Saúde; Pagamentos *out-of-pocket*; Ativos financeiros; Modelo logit

GLOSSARY

CHE – Catastrophic Health Expenditures

OOP – Out-of-pocket health payments

WHO – World Health Organization

OECD – Organization for Economic Cooperation and Development

LTC – Long-Term Care

AME – Average Marginal Effects

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1. Introduction

People pay at the point they receive health services, for example, consultation fees, medication and hospital bills. The amount paid can be so high in relation to income that it results in a "financial catastrophe" or even impoverishment for the individual or the household. Catastrophic health expenditures (CHE) are incurred when a household spends a large part of its budget on health care and, therefore can affect its ability to keep a normal standard of living. CHE are defined as health spending that exceeds a predefined percentage of a household's ability to pay for health care. However, this ability to pay can be interpreted in different ways depending on the author. This paper focuses on the analyses of CHE for four European countries, mainly Portugal, Spain, Italy, and Greece in 2015.

Moreover, studies on this theme provide important insights in terms of policy-making. Over the years, CHE have been reduced due to the evolution of health systems and financial risk-pooling mechanisms. The main purpose of health systems is to guarantee access to health services for all citizens. Health systems and insurance can protect households from these costs and make a difference in people's health and life. To prove that, previous literature showed that the incidence of CHE decline when the GDP spent on health rises. The number of CHE changes over the country as the financial characteristics of the health systems are different. Yet, despite European countries having developed financial risk protection mechanisms, some households still face catastrophic payments (WHO, 2005).

This research has two primary objectives. The first one is to calculate the extent and the determinants of the CHE. Firstly, I calculate the statistical incidence of CHE according to the World Health Organization definition and then compare the numbers between the four countries. I also estimate a logit model to have a more consistent comparison between the countries. Later, I estimated the determinants of the CHE by analysing a logit model, which allowed me to test the statistical significance and economic effects of 19 variables on the incidence of CHE.

For the second objective, I innovate by contributing to the enrichment of the measure of CHE. I added the assets to the measure of the statistical incidence since it is an indicator that influences the household's welfare. Households that experience CHE

may face poverty and need to cut on other types of expenditure such as food, education, etc., or can have enough savings to pay for health care and also can borrow to finance the services. For that purpose, I improved the concept of CHE by excluding all households with enough financial assets to pay for health expenses for two years. At the end of the work, I compare the results between both incidences, mainly the CHE incidence without considering financial assets and this final one. Afterwards, I introduce one possible explanation for the differences between incidences by comparing countries' macro characteristics.

This dissertation is organised in the following way. Section 2 presents the literature review on the theme focusing on the explanation of the concepts and the ways to measure CHE. Section 3 provides the data and methodology where we have the description of the database used, the variables chosen, and the methodology adopted. Subsequently, section 4 contains the empirical results and their discussion. Finally, section 5 concludes.

2. Literature Review

CHE occur when households spend more than a given fraction of their resources on health care (Borges, 2013). According to the definition by the World Health Organization (WHO), CHE occur whenever a household's total out-of-pocket health payments (OOP) equal or exceed 40% of the household's capacity to pay (World Health Organization, 2005).

OOP are the payments made by households at the time they receive health services (WHO, 2005). Thus, all deductibles, coinsurance, and copayments are included in these expenses. From an OECD perspective, total OOP only include OOP for health care, mainly doctor's consultation fees, purchases of medication, and hospital bills. However, some authors include long-term care (LTC) when calculating total OOP. OOP for LTC is the sum of expenses for nursing home care, daycare, and home care services (Scheil-Adlung & Bonan, 2013).

Moreover, the majority of research showed that older people are more likely to have higher OOP than the rest of the population (Arsenijevic et al., 2016; Dallmeyer et al., 2020; Krutilová, 2016; Penders et al., 2017; Scheil-Adlung & Bonan, 2013). For obvious reasons, as people get older their health begins deteriorating, so they spend more on health. For example, Penders et al. (2017) even studied the OOP for older people's last year of life.

When analysing the distribution of CHE across income quintiles (Borges, 2013; Kronenberg & Barros, 2014; Pinhão, 2018), it is mainly concentrated amongst the poorer income quintiles, as expected. Some works on the theme also estimate the impact of CHE on impoverishment by analysing the population who was forced into poverty due to OOP (Borges, 2013; Dorjdagva et al., 2016; Wagstaff & Doorslaer, 2003).

It is important to note that high OOP do not necessarily mean that we are in the presence of CHE. There are two approaches in the literature to determine CHE: the "expenditure approach" and the "income approach" (Kockaya et al., 2021). The one most commonly used for CHE studies is the first one. For the income approach, CHE occurs when OOP exceed a certain percentage of the household income. Whereas, in the expenditure approach, CHE occur when the OOP exceed a specific ratio of the total expenditure apart from the subsistence expenditure.

Wagstaff & Doorslaer (2003) applied both approaches to their study by using two different denominators to calculate CHE. First, the authors set thresholds considering the OOP as a proportion of the pre-payment income. For the second denominator, the authors establish the concept of "capacity to pay" and define it as the total expenditures excluding actual food expenditure and other "necessities". Buigut et al. (2015) also apply these two methods to examine the differences in the sensitivity of CHE.

According to WHO, a household's capacity to pay is defined as the total consumption expenditure remaining after basic subsistence needs have been met. Subsistence expenditure is the minimum spending required to sustain basic life. As in chapter 39 of Murray & Evans's (2003) book, most literature considers food expenditure as a proxy for subsistence expenditure, including *The World Health Report 2000*, although some authors also consider clothing and shelter, for example. However, household food expenditure may not capture actual subsistence expenditure, as food spending by higher-income households may include non-essential food (Buigut et al., 2015). To overcome this limitation, Xu et al. (2003) contributed to the enrichment of the "capacity to pay" definition. Concerning equity, subsistence expenditure is defined as the average food expenditure of households whose food expenditure share is in the 45th to 55th percentile range of income.

Cylus et al. (2018) do a more detailed analysis of the differences between these two methods. The research favours consumption over the income method as it is a better indicator of welfare and easier to measure accurately. Applying the household income as the denominator of CHE, we are assuming that the household has no other resources despite current income, which is not always true. On the contrary, Prinja & Verma (2011) defend that neither income nor consumption are good measures of welfare as it is possible to save from income and to finance consumption from borrowing. In addition, the poorest households may not have enough money to fund health expenditures and prefer not to consume. For that purpose, Anbari et al. (2014) and Nyman & Trenz (2016) include in their studies the assets of the households. Anbari et al. (2014) create a scale in which catastrophic costs are defined as payments over 40% of total household financial sources (income and savings) for taking inpatient care. While Nyman & Trenz (2016) examine the importance of health insurance by analysing how many respondents would have been beyond their disposable income and assets if they were uninsured.

Overall, to measure the incidence of CHE, the threshold set by WHO (2005) is 40% of the ratio of OOP relatively to capacity to pay. Nevertheless, it could be changed according to countries' specific situations or to analyse the different extents of CHE. For example, Dorjdagva et al. (2016) say that, in the literature, the threshold values most frequently used are 10 % for total household expenditure and 40 % for capacity to pay. Also, the authors use additional thresholds and show that when the threshold increases, the incidence falls.

Studies may look at regional, national, or multinational realities. At country and regional levels, we found studies, for example, for Portugal (Borges, 2013; Kronenberg & Barros, 2014; Pinhão, 2018), Kenya (Buigut et al., 2015), and Turkey (Yardim et al., 2010). At a multicountry level, Dallmeyer et al. (2020) focused on 16 European countries, while Wagstaff et al. (2018) and Xu et al. (2007) focused on a wider country analysis, 133 and 89, respectively. These last two studies also applied a panel data analysis to understand the evolution of CHE over the years.

Furthermore, to better understand the extent of CHE, most studies examine its determinants and/or estimate the impact of other variables on the incidence of CHE (Arsenijevic et al., 2016; Borges, 2013; Kronenberg & Barros, 2014; Naga & Lamiraud, 2008; Pinhão, 2018; Wagstaff et al., 2018; Xu et al., 2007; Xu et al., 2003). The factors chosen to predict CHE are micro variables, such as age, education, gender,... taken from household surveys. Nevertheless, if the research analyses more than one country, the authors also use macro variables (GDP, inflation,...) in order to compare and explain countries' CHE incidences differences. For example, Xu et al. (2011) showed that the OOP were lower in higher-income countries where government expenditure on health was higher. These findings demonstrate how important government expenditure is in decreasing the impact of OOP across households and therefore reducing CHE. All in all, the health system has an essential role in protecting households from the risk of impoverishment.

Finally, for the methodology of CHE works, the most used model among authors is the Logit Model. A logistic regression is generated to estimate the significance of the explanatory variables in predicting CHE. The dependent variable is binary taking a value of 1 or 0, with 1 denoting the presence of CHE and 0 denoting the absence of CHE.

3. Data and methodology

3.1 Survey description

Data was collected from wave 6 of the Survey of Health, Ageing and Retirement in Europe (SHARE), carried out in 2015. The countries included in this wave are Austria, Germany, Sweden, Spain, Italy, France, Denmark, Switzerland, Belgium, Israel, Czech Republic, Estonia, Luxembourg, Slovenia, Croatia, Greece, Poland, and Portugal. The respondents in SHARE are individuals aged 50 and above, and also micro-level information is available about their economic, social and health factors.

The unit of analysis was the household. This implies 91725 households sample, 29886 for Spain, 28829 for Italy, 24640 for Greece and 8370 for Portugal. The sampling weights developed by SHARE are used. Weights allow more consistent and unbiased results. Furthermore, to compare results between these countries a cross-country analysis is used.

3.2 Catastrophic health care expenditures (expenditure approach)

3.2.1 Measuring CHE

According to the definition, catastrophic health expenditures occur when a household's total OOP health payments equal or exceed 40% of the household's capacity to pay (WHO, 2005). We need two key variables to generate that variable: the household's OOP and their capacity to pay. The World Health Organization (2005) procedure was followed.

Firstly, the overall amount spent on health by households is needed. The variable total OOP was calculated by summing all OOP for health care and long-term care during that year. OOP for health care is the sum of OOP for inpatient care, OOP for outpatient care, OOP for prescribed drugs and OOP for aids, appliances, and physical therapy. Additionally, OOP for long-term care was considered the sum of the OOP for nursing home care and the OOP for home care.

To compare those payments on household consumption expenditure, the variable capacity to pay is created. The household capacity to pay is defined as a household non-subsistence spending (WHO, 2005), meaning that the subsistence expenditure was

subtracted from the total household expenditure. Subsistence expenditure is the minimum requirement to maintain basic life in a society; in this case, it is considered to be food expenditure. For this purpose, the average of the share of food expenditure is calculated for the households whose total expenditure was within the 45th and 55th percentile of the total sample. Moreover, to avoid economies of scale, the household equivalence scale is used during the process and then is converted to the actual household size again. Finally, subsistence expenditure was subtracted from total household expenditure.

Lastly, the ratio of OOP relatively to capacity to pay is generated. I considered the threshold of 40%, set by the World Health Organization, to calculate if a household incurs CHE. Indeed, the variable the dependent variable CHE is constructed as a dummy variable with value 1 indicating a household with catastrophic expenditure, and 0 without catastrophic expenditure. Analytically, $CHE = 1$ if $OOP_h / CTP_h \geq 0.4$ and $CHE = 0$ if $OOP_h / CTP_h < 0.4$.

3.2.2 Incidence of CHE

The incidence of CHE is the fraction of households that exceed the 40% threshold of the share of OOP relative to capacity to pay. Table 2 and Table 5 show either the absolute frequency of CHE and the main percentage for all the countries in this study, individual and globally. Applying this measure was useful to compare the situation between countries and analyse which country has the worst catastrophic situation.

We chose Portugal as the base country category to make comparison easier with Borges (2013) and Pinhão (2018), which studies are all about Portugal and use a methodology close to ours.

3.3 Determinants of CHE

3.3.1 Description of the explanatory variables

I selected the main explanatory variables that could have interest and are hypothesised to influence the household's consumption of health. To facilitate the cross-country analysis, the set of variables used was collected from the generated variables provided by SHARE, which are monitored variables with no missings. The variables chosen are:

Household size → Number of individuals per household;

Gender → Dummy variable: Takes the value 1 if the individual is female and 0 if is male;

Marital Status → Dummy variable: Takes the value 1 if the individual is married, living with spouse, and married, not living with spouse and 0 if the individual is in one of the following situations: Registered partnership, never married, divorced or widowed;

Employed or self-employed → Dummy variable: Takes the value 1 if the individual is employed or self-employed and 0 if otherwise;

Retired → Dummy variable: Takes the value 1 if the individual is retired and 0 if otherwise;

Unemployed → Dummy variable: Takes the value 1 if the individual is in one of the following job situations: Not applicable, unemployed, permanently sick, homemaker or other, and 0 if otherwise;

Paid out-of-pocket for inpatient care → The amount paid by the individual for stays in hospitals last 12 months (in Euros);

Paid out-of-pocket for outpatient care → The amount paid by the individual for doctor visits last 12 months (in Euros);

Paid out-of-pocket for prescribed drugs → The amount paid by the individual for medication last 12 months (in Euros);

Paid out-of-pocket for nursing home care → The amount paid by the individual for nursing home stays last 12 months (in Euros);

Amount paid yourself for homecare → The amount paid by the individual for homecare last 12 months (in Euros);

Paid out-of-pocket for aids, appliances, physical therapy → Amount paid yourself for aids/appliances and physical therapy last 12 months (in Euros);

Total household income → Disposable annual income of the household (in Euros);

Age → Individual's age;

Education → Level of the individual education according to ISCED 97 coding;

Number of children → Number of children the individual has;

Number of chronic diseases → Number of chronic diseases the individual has;

Smoke daily → Dummy variable: Takes the value 1 if the individual ever smoked daily and 0 if not;

Physical inactivity → Dummy variable: Takes the value 1 if the individual does at least one type of exercise once or more times a week and 0 if does not do any type of exercise.

To complement the description of the variables, Table 1 represents the descriptive statistics for all these determinants.

3.3.2 The model

Since our dependent variable, the presence of CHE, is binary, taking a value of 1 or 0, we will follow Kronenberg & Barros (2014) and the general literature on the topic, and use a logit model. To estimate the regression model, we considered that the probability p_i of individual i incurring CHE is

$$p_i = P(y_i = 1 | x) = F(x'_i \beta) = \frac{e^{x'_i \beta}}{1 + e^{x'_i \beta}} \quad (1).$$

The equation represents what is known as the cumulative logistic distribution function (Gujarati & Porter, 2010). To estimate the parameters, first, we take the log of the odds ratio. The odds ratio is simply the probability of having CHE in favor of the probability of not incurring in CHE: $\frac{Pi}{1-Pi}$ (2).

Now, taking the log of the odds we have our logit model:

$$L = \ln \left(\frac{Pi}{1 - Pi} \right) = B_1 + B_2 X_i + u_i \quad (3)$$

where we have Pi which is the probability of incurring CHE ($Pi = [0, 1]$), X_i characterising the main explanatory variables and u_i that is the error term. The index i ($i = 1, \dots, N$) represents the individual. Moreover, B_2 is the slope, measuring the change in L for a unit change in X_i , meaning that how the log-odds in favor of incurring CHE change as X_i changes one unit. The parameter B_1 is the value of the log-odds if X_i equals zero.

The logit model assumes that the log of the odds is linear in relation to X_i . Consequently, the interpretation of the logit model is as follows: if L is positive, it means that when the main explanatory variable increases, the odds that $CHE = 1$ increase. On the other hand, if L is negative means that the value of the odds that $CHE = 1$ decreases as the main X increases.

To obtain more consistent results, the average marginal effects (AMEs) were reported to analyse the magnitude of the given regression. Marginal effects are the partial derivatives of the regression equation concerning each variable in the model. The AMEs

are the mean of these partial derivatives over the sample: $\frac{\sum_{i=1}^N \left(\frac{\partial P(y_i=1 | x_i)}{\partial x_i} \right)}{N}$ (4).

3.4 The new variable of CHE

To further analyse the theme of CHE, we extended the expenditure approach and added more criteria. The main idea was to exclude from the set of people who incur CHE those with enough net financial assets to pay for health expenses for two years¹. If the household's net financial assets were higher than the health expenses for two years, we considered that household to be in a less catastrophic situation.

For that purpose, we generated a new variable of CHE. First, we duplicated the total OOP of the households. Then we created a dummy variable that equals 1 if the household incurs CHE, and equals 0 if the household does not incur CHE and the household's net financial assets are equal or higher than the total OOP for two years.

Additionally, the incidence of this new variable was calculated in order to compare the results obtained with the previous CHE variable. Comparing the results between the incidences, we can notice the difference considering the financial assets in CHE.

¹ This time interval is mainly arbitrary as we did not find evidence in the literature that explored CHE in this way

4. Results

4.1 Incidence of CHE

The results demonstrate that financial constraints in access to health care exist and the number of catastrophic cases differs over the country. By looking at the descriptive statistics in Table 1, we can observe that the mean of income is higher than the mean of the total household expenditure. On the contrary, Buigut et al. (2015) study for Kenya showed that households are negative savers as the mean of income is lower than the total household expenditure. Consequently, it was expected that the incurrence of CHE results in our study should be lower than this last one; however, it did not.

Table 2 shows the results of CHE incidence, mainly the frequency and the percentage per country and globally of the sample. We can observe that Spain has the higher percentage of CHE (23.37%), considering the absolute frequency over all households and Greece has the lowest (20.66%). The percentage mean of the incurrence of CHE for all countries is 22.55% and except for Spain, all countries' percentages are smaller than the mean of the population of the four countries.

Compared to previous results for the same year, more precisely to Pinhão's (2018) work, Portugal has a higher percentage of CHE in our study. In our work, the CHE incidence for Portugal is 22.15%, while in Pinhão (2018) is only 1.43%. Likewise, in Xu et al. (2007) work, they found a median level of 1.47% for the 89 countries' analysis. This substantial difference can be due to the fact that the database used is different. In this study, the respondents are mainly older than 50 years who are more likely to spend more on health than younger people.

4.2 Econometric modelling of CHE determinants

Table 3 presents the results of the estimation of the logit model which shows the results of the impact of the explanatory variables on our dependent variable. Next, we will proceed with an analysis of the coefficients and the average marginal effects (AME).

4.2.1 Financial determinants

Income is a statistically significant factor. As expected, **Income** has a negative relation with CHE, meaning that when **Income** increases, the proportion of households incurring CHE decreases. However, its economic impact on CHE is relatively small. More precisely, by looking at the AME, we can interpret that on average, when the total household **Income** increases by 1 unit, the probability of that person to spend more than 40% of their total expenditures on health decreases by 0,0128 percentage points, *ceteris paribus*. This result is similar to Borges (2013) and Kronenberg & Barros (2014) in which the variable **Income** has a negative relation with CHE, implying a lower probability of CHE for more affluent households. Kronenberg & Barros (2014) have done a more detailed analysis of **Income**, they divided income in quintiles and showed that the highest probabilities are more concentrated among the poorest individuals. However, it is interesting to see that by looking at very low-income levels, the predicted probabilities are lower, meaning that the poorest people prefer not to consume on health but rather prefer to consume other goods. Kang & Kim (2021) who studied the relationship between unmet healthcare needs due to financial reasons and the experience of CHE, showed that people aged between 20 and 64, who repeatedly experienced CHE were less likely to experience unmet healthcare needs than those who did not experience catastrophic health expenditures for two years. However, people older than 65, who repeatedly incurred CHE were more likely to experience unmet healthcare needs due to financial reasons than those who did not experience CHE for two years.

As predictable, the more the out-of-pocket payments on health care and long-term care, the more likely the household is to incur CHE. The variables: ***Paid out-of-pocket for inpatient care, Paid out-of-pocket for outpatient care, Paid out-of-pocket for prescribed drugs, Paid out-of-pocket for aids, appliances, physical therapy*** are all significant and positively related to CHE. For instance, the amount paid for prescribed drugs has more impact on the dependent variable than the others. This result is supported by Krutilová (2016) findings, as the author also showed that among all health care variables in the model, out-of-pocket payments for drugs contributed the most to the burden of the elderly. This could be useful in what concerns making new policies in reducing the incurrence of CHE, for example, by reducing pharmaceutical prices.

The variables of long-term health care, ***Paid out-of-pocket for nursing home care*** and ***Amount payed yourself for homecare*** are also significant, so it is useful to include the LTC in the model.

4.2.2 Household characteristics

In this category, all variables are statistically significant at the 5% level. Analysing the **Gender** variable, a female individual is more likely to incur CHE than if it is male. In this case, a switch from a male to a female household head increases the probability of catastrophe by 2,31 percentage points.

Concerning **Age**, the result is consistent with the expected, although the magnitude is small. It has a positive sign meaning that elderly people have a higher probability of spending more on health, thus incurring CHE. In the same way, **Household size** and the **Number of children** also show progressive results as when these variables increase, the probability of facing CHE are higher as households tend to have more expenses.

By looking at the **Marital status** in our model, we can observe that a married person is less likely to incur CHE than others (being single, divorced, and widowed). This variable has the biggest predicted probability impact on the model. On average, when the person is married, the probability of that person spending more than 40% of their total expenditures on health compared to the others, decreases by 10,52 percentage points.

Moreover, analysing the household job situation, being **Retired** and **Unemployed** have a significantly higher probability of catastrophe than being **Employed**. The findings also showed that being **Unemployed** has a higher impact on CHE than being **Retired**. Similar economic effects have been found by Krůtilová's (2016) study that a working status is a preventing factor and protects households from a high burden. Also, being retired on the study has a higher probability of CHE than being employed or unemployed.

Finally, for the variable **Education**, a degree of education decreases the likelihood of incurring CHE. This result is similar to Borge's (2013) and Pinhão's (2018) works.

4.2.3 Health-related factors

Regarding the **Number of chronic diseases**, the variable has a positive relation with CHE for obvious reasons.

Smoke daily is another factor that increases the incurrence of CHE. Smoking prejudices health so a household that does not smoke is more protected from this financial burden.

Physical inactivity also induces more people to face CHE. This positive relation with the dependent variable is in line with the paper of Dallmeyer et al. (2020). The author concludes that all levels of physical activity frequency are associated with a lower amount of OOP compared to someone who is never active.

4.2.4 Country comparison

In order to compare CHE between countries, we generated another logit model only with the country variables to obtain more precise results. In Table 4 we can see the results from this model. These variables are all dummies and statistically significant.

By looking at the coefficients, Greece is the only country that has a negative signal so a person who lives in Greece has less probability to spend more than 40% of the capacity to pay on health than a person who lives in Portugal. On the contrary, Spain and Italy have a positive signal and so, a person who lives in these two countries is more likely to face CHE than a person who lives in Portugal. These results are consistent with the results from the incidence of CHE, shown in Table 2.

4.3 New dependent variable

By excluding all people who have enough net financial assets to pay for health expenses for two years, it is expected that the proportion of people with catastrophic expenditures reduces, since we are being more selective.

In Table 5 we have the incidences for the new restricted CHE variable per country. Comparing with the previous results from Table 2, it is interesting to observe that, apart from Greece, all countries' CHE percentage was reduced to half. By looking at the global mean, we can also see that reduction. Furthermore, only Portugal and Spain's percentages are under the global mean while Italy and Greece have higher percentages. Also, Greece

becomes the country with higher CHE incidence and Spain the lowest. This is curious as it is the opposite of the results without the net financial assets considered.

To help explain this result, we have Table 6 which shows the number of households with negative and 0 financial assets and its percentage for each country. As we can observe, Greece not only has the largest number of households with 0 or lower net financial assets but also more than half of the households are in that condition (52.95%). On the other hand, Spain has the lowest percentage of all countries (11.81%).

Additionally, to compare with a macro perspective, Table 7 presents the household financial assets and liabilities (in % of GDP) for 2015, according to EUROSTAT. In this table, the relation between assets and liabilities for Greece's families is worse than that of Spain. This ratio for Greece's households is about 2.1 while for Spain's is near 3. This means that, on average, for the same amount of liabilities, the households from Spain have more assets than Greece's households.

5. Conclusions

The objective of this dissertation was to study CHE determinants and incidences in four European countries and also to study the influence of using a different approach to calculate CHE, mainly by adding financial assets.

Concerning the econometric approach, we used a logit model based on 19 microeconomic variables to determine the economic significance of potential factors associated with CHE. All variables in the model are statistically significant. We noticed that marital status has a substantial impact on CHE and also that OOP for prescribed drugs has the highest impact compared to other health expenses.

We find that adding financial assets to measure CHE has a meaningful impact on the incidences. By following the WHO method, the CHE incidence in Spain is the highest of all countries while Greece is the lowest. However, considering financial assets, the results invert as Greece becomes the country with higher CHE incidence and Spain the lowest. This is an important contribution to the literature because it means that it is relevant to consider financial assets when studying CHE, potentially changing the perspective on who is experiencing more difficulties, and this is usually not done.

Furthermore, to support this last idea, we used a broader perspective and the results showed that the relation between the assets and liabilities of Greece and Spain is substantial. This relation was higher for Spain's households than for Greece's households. Further research should consider the financial assets and liabilities ratio, especially in developed countries.

As a limitation, the exclusion of all households that had enough net financial assets to pay for health expenses for two years is open to critic, as this time interval is mainly arbitrary. Future studies on the topic may consider different time intervals and analyse how the conclusions are affected.

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ANNEXES

Table 1- Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Household size	91725	2.3984	1.0610	1	15
Gender	91725	0.5578	0.4967	0	1
Marital Status	91725	0.7562	0.4294	0	1
Employed	91725	0.1983	0.3987	0	1
Retired	91725	0.4980	0.5	0	1
Unemployed	91725	0.3036	0.4598	0	1
Paid out-of-pocket for inpatient care	91725	8.6572	218.227	0	18000
Paid out-of-pocket for outpatient care	91725	227.453	608.398	0	8200
Paid out-of-pocket for prescribed drugs	91725	131.695	213.3	0	3000
Paid out-of-pocket for nursing home care	91725	110.438	785.619	0	18000
Amount paid yourself for homecare	91725	96.5298	1651.384	0	168504
Paid out-of-pocket for aids, appliances, physical therapy	91725	20.7943	157.615	0	5060
Income	91725	17332.73	19797.78	0	1841659
Age	91725	68.2413	10.4675	25	106
Education	91725	1.8994	1.5407	0	6
Number of children	91725	2.0135	1.3281	0	19
Number of chronic diseases	91725	1.8255	1.6444	0	13
Smoke daily	91725	0.4012	0.4901	0	1
Physical inactivity	91725	0.179	0.3833	0	1
Total household expenditure	91725	7296.9	3951.6	0	55820
Household net financial assets	91725	12953.7	41357.86	-200000	1966849

Table 2 - Incidence of CHE per country

Country	Frequency (nr of individuals)	Percent
Spain	18096242.4	23.37
Italy	28382860.4	22.39
Greece	4104820	20.66
Portugal	3483604	22.15
Total	54067527.6	22.55

Notes: weighted data was used.

Table 3 - Determinants of catastrophic health expenditures - multivariate logit model

Characteristics	Coefficients	AME
Financial determinants		
Income	-9.99e-06***	-1.28e-06***
Paid out-of-pocket for inpatient care	0.0008***	0.0001***
Paid out-of-pocket for outpatient care	0.0012***	0.00015***
Paid out-of-pocket for prescribed drugs	0.0018***	0.0002***
Paid out-of-pocket for nursing home care	0.0008***	0.0001***
Amount payed yourself for homecare	0.0018***	0.0002***
Paid out-of-pocket for aids, appliances, physical therapy	0.0010***	0.0001***
Household Characteristics		
Gender	0.1804***	0.0231***
Age	0.0077***	0.001***
Household size	0.0485***	0.0062***
Marital status	-0.8212***	-0.1052***
Retired	0.1809***	0.02316***
Unemployed	0.3443***	0.0441***
Employed	Employed is the reference category	
Education	-0.0831***	-0.01064***
Number of children	0.0143***	0.0018***
Health related factors		
Number of chronic diseases	0.1750***	0.0224***
Smoke daily	0.1928***	0.0247***
Physical inactivity	0.0535***	0.0069***
Constant	-2.5182***	

Notes: *p < 0.10; **p < 0.05; ***p < 0.01; weighted data was used.

Table 4 - Countries CHE comparison with Portugal in the logit model

Countries	Coefficients	AME
Spain	0.0699***	0.0122***
Italy	0.0143***	0.0025***
Greece	-0.0882***	0.00014***
Constant	-1.2572***	

Notes: *p < 0.10; **p < 0.05; ***p < 0.01; weighted data was used.

Table 5 - New variable of CHE incidence

Country	Freq.	Percent
Spain	7085549	9.15
Italy	14475984.9	11.42
Greece	3296751	16.6
Portugal	1633856	10.39
Total	26492141.1	11.05

Notes: weighted data were used.

Table 6 - Number of households with negative and 0 financial assets

Country	Freq.	Percent
Spain	9139917	11.81
Italy	31186942.2	24.61
Greece	10518651.3	52.95
Portugal	2118185.7	13.47
Total	52963696.1	22.09

Notes: weighted data were used.

Table 7 - Household financial assets and liabilities for 2015 (in % of GDP)

Country	Assets (% of GDP)	Liabilities (% of GDP)
Spain	215.3	72.2
Greece	146.4	69.8

Data source: EUROSTAT