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DISTRIBUTIONAL EFFECTS OF THE 2012 CO-PAYMENT CHANGE IN SPAIN AND SIMULATED PROPOSALS FOR IMPROVEMENT

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We analyse the distributional effects of the 2012 co-payment reform and eleven simulated alternative schemes in the Canary Islands. A random sample of 41,962 residents covered by the Spanish National Health System together with their individual prescription information from one year before to one after the change was used. The Concentration index (CI) was used to compare inequality in private pharmaceutical spending over a distribution of incomes: CI increases from 0.03 to 0.07 for the working population, being simulation 11 the most progressive one (CI=0.20). The use of income ranges increases progressivity of the system slightly, although more suitable models could have been used, combining more progressivity with more sustainable pharmaceutical public expenditures.

Keywords: 2012 co-payment reform; inequality redistributive effects; progressivity; simulations.

JEL Codes: D.63; H.23; I.14

1. Introduction

In the Spanish National Health System (SNHS onwards), the finance of a publicly prescribed medicine price can be divided into two parts: the part financed publicly, and a co-payment part that is financed privately by the patient. The co-payment is normally implemented for efficiency reasons, i.e., to reduce moral hazard that may arise because of a reduced or zero price at the point of consumption. However, co-payments have consequences from an equity point of view. One way to approach this equity aspect is to analyse whether the distribution of the financial burden of the co-payment fulfils both horizontal equity -i.e. patients with the same ability to pay should face the same cost-sharing- and vertical equity -i.e., those patients with a higher ability to pay should contribute with higher cost-sharing [González López-Valcárcelet al. (2016a); Álvarez García (2004)]-. A cost-sharing scheme involving a departure from either or both principles would be deemed inequitable. In this paper, we focus on the distributive consequences of different co-payment schemes addressing the vertical equity perspective.

The 2012 Spanish pharmaceutical co-payment reform[1] (*Real Decreto-Ley* 16/2012, RDL 16/2012 onwards) was designed to comply with the vertical equity principle within each employment status (working and pensioner population), that is, categorising individuals not just according to their employment status but also according to their income range [RDL 16/2012; European Observatory on Health Systems and Policies website]. In fact, the working population (WP onwards) moved from 40% co-payment regardless of income to cost-sharing according to three income intervals. Moreover, most pensioners moved from full free coverage to 10% co-payment with monthly contribution ceilings

[1] Other relevant measures that accompanied this reform were the development of a new scheme in prescribing drugs and medical devices, the extension of the electronic prescription system and the exclusion of 426 drugs from pharmaceutical public coverage.

according to three income intervals (cf. Table 1) to reduce overconsumption derived from a zero co-payment [Rodríguez Martínez and Puig-Junoy (2012)][2].

The model prior to 2012 (*Real Decreto-Ley* 1030/2006) was based on the 1980 scheme [Simó Miñana (2015)][3]. This scheme introduced an aggravated moral hazard problem for pensioners (who benefited from completely free medicines in the context of lack of electronic control of doctors' prescriptions), generating more public health spending and, therefore, requiring more public revenue [Rodríguez Martínez et al. (1999); Puig-Junoy et al. (2016)]. In 2008, the economic crisis accentuated the need to control unsustainable health spending [Gallo and Gené-Badia (2013)]. Thus, the 2012 reform (RDL 16/2012) of public health spending was aimed at obtaining a long-term sustainable SNHS [*Real Decreto-Ley* 16/2012, 2012; Sánchez et al. (2014)].

We aim to analyse the distributive consequences of the 2012 Spanish co-payment reform, using the Canary Islands as a study setting (one of Spain's 17 autonomous regions)[4]. We compare the distribution of private pharmaceutical spending on drugs prescribed by the SNHS after the reform with the previous scheme. In addition, we also analyse eleven

[2] The Spanish Government implemented a reform in 2018 that maintains co-payments percentages and ceilings [*Real Decreto-Ley* 7/2018]. Furthermore, the Spanish Government included a co-payment reform in their Draft of the Law for the 2019 General State Budget in November 2018 (provision for free full coverage for groups of people considered most vulnerable: pensioners with annual incomes below EUR 11,200 and WP with annual incomes below EUR 9,000, but only in case of having at least one dependent child). However, finally this Draft Law was not approved [Vallejo Torres and Puig-Junoy (2019); *Plan presupuestario 2019 y remisión trimestral de información* (2018)].

[3] The beginning of the Spanish co-payment system took place in June 1967 (i.e. *Decreto* 3157/1966) as fixed co-payment, when both WP and pensioners had a homogeneous contribution [Simó Miñana (2015); *Decreto* 3157/1966 (1966)]. Specifically, this co-payment scheme consisted of a fixed co-payment of 3-euro cents when the drug price was lower than 18-euro cents and 3-euro cents plus 1 additional euro cent for every 6-euro cents, when the drug price was equal or higher than 18-euro cents. However, the amount paid per drug could not exceed 30-euro cents [*Decreto* 3157/1966 (1966)]. The differences started in 1978 (*Real Decreto* 945/1978): WP had 20% cost-sharing regardless of income as percentage of drug price, which increased over the years (20% (1978), 30% (1979) and 40% (1980)) and pensioners had no co-payment.

[4] The Canary Islands consist of eight islands: Tenerife, La Palma, El Hierro, La Gomera, Gran Canaria, Fuerteventura, Lanzarote and La Graciosa. Although each Spanish region manages its health care resources autonomously, the State is responsible for and manages the co-payment system.

alternative schemes aimed at improving progressivity in the distribution of private pharmaceutical spending. We hypothesise that the 2012 co-payment system is more progressive than the previous one because of the consideration of income, but there are more convenient alternatives. Our study contributes to the limited evidence about the distributive consequences of medicine co-payment changes using individuals' prescription information. In addition, the simulations proposed are innovative.

2. Evidence of cost-sharing effects according to income

Previous work on the effects of pharmaceutical co-payment shows that vulnerable groups(e.g. low-income individuals) are more sensitive to co-payments than the rest of population, and this generates vertical inequity problems [González López-Valcárcel et al. (2016a)]. Accordingly, in the 1970s, the classic RAND Health Insurance Experiment highlighted that low-income individuals with chronic diseases were more sensitive to co-payment increases and this promoted adverse health effects [Chernew and Newhouse (2008)]. Regarding evidence from the United States, [Gallo and Gené-Badia (2013)] used a database between 2001 and 2004 and concluded that low-income patients were more sensitive to co-payment changes than high or middle-income patients, especially, among people with chronic illnesses. On the other hand, a study in Alabama (using administrative database between 1999-2009) reflected that small co-payments were effective in reducing drug utilization by low-income individuals, who had free full coverage before the reform [Sen et al. (2012)]. In Europe, [Skipper (2013)] used micro-data of the Danish population (2000) and observed that vulnerable groups (with low-incomes) presented higher price-elasticity of demand than the rest of population. Finally, [Terraneo et al. (2014)] used data from between 2001 and 2010 for three Italian regions with different co-payment policies and detected that low-income families (exempt from co-payment) maintained their spending and middle-income families (who faced co-payment rates because of the 2007 economic crisis) reduced it. Accordingly, the economic crisis, which coincided with the co-payment rate increase, led to middle-income families becoming low-income thus increasing medication adherence risk.

Regarding the Spanish case, evidence about the reform's effect (with aggregated data) supports that the 2012 co-payment scheme reduced pharmaceutical consumption [Sánchez et al. (2014); IMS. Evolución del mercado farmacéutico desde la implantación del copago; Antoñanzas Villar et al. (2014); Puig-Junoy et al. (2014); Puig-Junoy et al. (2016)]. However, some of these studies revealed that the reduction seemed temporary [Sánchez et al. (2014); IMS. Evolución del mercado farmacéutico desde la implantación del copago; Puig-Junoy et al. (2016)]. A study in Valencia [González López-Valcárcel et al. (2016b)] used individual data (between 2009 and 2013) and observed (through the differences-in-differences estimation method) a temporary reduction in high price essential medication adherence, especially, among low-income pensioners. The 2013 Spanish Health Barometer evaluated the reform's perception among the Spanish population in terms of equity. Forty percent of interviewees considered the current model more concerned about vulnerable groups than the previous one. Seventy-three percent agreed that the Spanish co-payment system should expand the number of income intervals. Also, 5.3% had stopped buying medicines in the last twelve months because of their cost. There is some evidence of access barriers caused by economic factors [González López-Valcárcel et al. (2016a); MSSI. Barómetro Sanitario, 2013]. A recent study, also using the Spanish Health Barometer data for the years 2013 to 2017, concludes that the current co-payment system is perceived as a barrier to access medicines prescribed by a public healthcare system doctor, particularly for the poorest users, as well as the working ones and those with worst health [Rodríguez-Feijoo and Rodríguez-Caro (2021)].

3. Methodology

3.1. Data

We used a random sample (from the Canary Island Health Service) of 41,962 people covered by the SNHS in the Canary Islands, who had some pharmaceutical consumption in the period analysed. The database contains individuals' information on all the dispensed medications prescribed to them by the SNHS from a year before to a year after the reform's implementation (July 2012). We had 24 observations per individual, one for each month of the analysis. The dataset included information on individuals[5]; changes produced[6] and prescriptions[7]. With this information, we were able to compute the monthly number of dispensed prescriptions, monthly private pharmaceutical expenditure, and monthly public pharmaceutical expenditure for each patient. We recorded a zero value for consumption and expenditure variables for the months without consumption by users[8].

Individuals in our sample are classified according to the groups defined in Table 1. We only included individuals whose contribution codes have income intervals assigned (cf.

[5] Age, sex, island of residence, health centre, municipality, simulated income, working population or pensioner status, contribution code and contribution ceiling.

[6] Employment status or income interval changes.

[7] Prescription date, National Code (NC), anatomical, therapeutic and chemical code (ATC), drug price and number of pharmaceutical prescriptions.

[8] Despite high-income people having income intervals assigned, we dropped them from the analysis because there were very few observations (145 individuals).

Table 1: TSI 002.1, TSI 002.2, TSI 003 and TSI 0043) because for the study we needed to estimate an income variable:

1. Low-income WP (N_{LIWP} is 25,452; 40% co-payment): annual income less than EUR18,000, aged between 16 and 65 and their dependents (mainly minor children or minors in foster care, e.g., grandchildren)[9].

2. Low-income pensioners (N_{LIP} is 7,888; 10% co-payment; EUR 8 monthly ceiling): annual income less than EUR 18,000, aged over 65 (who have reached retirement age) or under 65 (who have taken early retirement) and their dependents.

3. The middle-income WP (N_{MIWP} is 6,942; 50% co-payment): annual income between EUR 18,000 and EUR 99,999, aged between 16 and 65 and their dependents[10].

4. Middle-income pensioners (N_{MIP} is1,680; 10% co-payment; EUR 18 monthly ceiling): annual income between EUR 18,000 and EUR 99,999, aged over 65 (who have reached retirement age) or under 65 (who have taken early retirement) and their dependents.

As the previous paragraphs show, the only information available in our data about income was the co-payment code of each individual (cf. Table 1). So, we just have two income intervals (less than EUR18,000; between EUR 18,000 and EUR 99,000). Given our aim to simulate alternative co-payment schemes with more income intervals, we needed to

[9] This group also includes children and pregnant women from countries without a collaboration agreement with Spain or immigrants; and working population from a different Autonomous Region without contribution codes indicated.

[10] This group also includes foreigners with European Health Insurance Cards and people from countries with collaboration agreements with Spain that do not prove their status as pensioners.

estimate a specific income for each individual. Thus, we used (and merged with our database) a database from the Spanish Tax Agency that provides income information by municipality for five income intervals (income less than EUR 6,010; between EUR 6,010 and EUR12,020; between EUR 12,020 and EUR 18,030; between EUR 18,030 and 21,035; over EUR 21,035)) [*Agencia Tributaria. Estadística de IRPF por municipios y tramos de BI*, 2013]. We develop this idea further in the following section. It would have been desirable to count on more income intervals (i.e., amongst those above over EUR 21,035) but this information was, unfortunately, not available due to the nature of both databases.

3.2. Methods

Concentration indices need two variables for them to be calculated: private spending (available in our database) and individual income (not available in our database). So, before explaining the calculations to obtain the concentration index, we show how we estimated the income variable:

First, we merged our database with one from the Spanish Tax Agency to apply Personal Income Tax (2013) [*Agencia Tributaria. Estadística de IRPF por municipios y tramos de BI*, 2013]. The information that the Spanish Tax Agency database provides is: (1) number of taxpayers within each income interval by municipality (income less than EUR 6,010; between EUR 6,010 and EUR12,020; between EUR 12,020 and EUR 18,030; between EUR 18,030 and 21,035; over EUR 21,035); and (2) per capita tax base within each income interval by municipality. Since both databases included the municipal district variable, we used it in order to merge them.

With the information above, we calculated the percentage of people who belonged to each income interval. We decided that individuals with incomes under EUR 18,000 must fall within one of the first three intervals, and those with incomes between EUR 18,000 and EUR 100,000 must fall within the last two intervals.

Then, to estimate an individual income variable, we ran 10,000 Monte Carlo simulations[12] with Stata software. We worked with a random uniform distribution that included the percentage of people who belonged to each income interval.

Stata allows to do both: simulations of simulations and simulations of bootstraps. Stata's bootstrap command works like a simulation, except that it feeds the user-written program a bootstrap sample (Monte Carlo Simulations, Stata, StataCorp LLC, College Station). We performed 10,000 simulations by randomly drawing a dataset:

First, we estimated the random sample median (using the percentage of people belonging to each income interval). Then, we used bootstrapping to obtain a dataset of medians calculated from bootstrap samples of the random sample. The standard deviation of these medians is the estimate of the standard error. The summary statistics are stored in the results of summarize (Monte Carlo Simulations, Stata, StataCorp LLC, College Station). Finally, after 10,000 times, we estimated the individual income variable.

Having clarified how we estimated the individual income variable, we will now explain the main methodology of this study:

[12] To create the Monte Carlo simulations, first, we set the seed of the random-number generator to make the results reproducible. After this, we built a memory place to store the results. And last, we ensured the process was repeated 10,000 times.

We used an adaption of concentration indices (CI onwards) to compare inequality in private pharmaceutical spending over a distribution of incomes before and after the 2012 reform (which we will call the “current” scheme).

Specifically, we used a Stata command (*conindex*) that provides point estimates and standard errors of a range of concentration indices. This command also plots concentration (Lorenz) curves that show the cumulative private pharmaceutical spending (ordinate axis in the graph) using income as ranking variable (from poorest to richest individuals) (abscissa axis in the graph) [O'Donnell et al. (2016)].

Standard CI definition is [O'Donnell et al. (2016)]:

$$CI(s|y) \; = \; \frac{2cov\,(s_i,R_i)}{\bar{s}} = \frac{1}{n}\sum_{i=1}^{n}\left[\frac{s_i}{\bar{s}}(2R_i-1)\right] \qquad \text{(Eq.1)}$$

where s_i is the health variable in which inequality is measured (i.e., private pharmaceutical spending) and the symbol – means average.

The standard CI moves from $\frac{1-n}{n}$, maximal pro-rich inequality (i.e., all private pharmaceutical spending is concentrated on the poorest individual) to $\frac{n-1}{n}$, maximal pro-poor inequality (i.e., all private pharmaceutical spending is concentrated on the richest individual)[11].

[11] According to [O'Donnell et al. (2016)] and after adapting it to our analysis, we assume that CI respects the principle of income-related private pharmaceutical spending transfers - social welfare falls when the private pharmaceutical spending of a lower income individual increases, and the private pharmaceutical spending of a higher income individual decreases by the same magnitude. Furthermore, we can interpret the concentration index as a weighted mean of (private pharmaceutical spending) shares with the weights depending on the fractional (income) rank (i.e., $(2R_i - 1)$).

Individual private pharmaceutical spending is an available variable in our dataset.

We also used *conindex* to simulate eleven more progressive scenarios than the current scheme (i.e., simulated scenarios S1 to S11). In these simulations, we imposed a restriction: the removal of co-payment differences between WP and pensioners with the same income category. We have done this for simplicity, but also considering that differentiation by any other characteristics would be inconsistent with the horizontal equity principal, and, therefore, would not justify any other categorisation of individuals apart from grouping them by income levels. This is in line with the recommendation of several experts [González López-Valcárcel et al. (2016a); Rodríguez Martínez and Puig-Junoy (2012); Vallejo Torres and Puig-Junoy (2019)] and also, in accordance with co-payment systems in the rest of European countries, where there is no such difference between employment status categories[13] [European Observatory on Health Systems and Policies website].

In the following section, we refer to two types of analysis: one that treats pensioner and WP together and one that treats them separately. We compared different scenarios by simulating private spending of individuals with different co-payment percentages (with and without monthly contribution ceilings) and then analysing them according to the degree of progressivity and the public and private spending generated.

Next, we present how the simulations were computed.

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[13] Portugal and Greece also have a different contribution treatment but only among vulnerable pensioners, that is to say, those with low-income.

Simulated Private Spending (SPS) per individual and prescription is specified as follows:

$$SPS_{ip} = \frac{Private\ Spending_i \times Simulated\ percentage\ copayment_i}{Actual\ percentage\ copayment_i} x(Q\ dem._{0i} + Q\ dem._{1ip},)$$

(Eq.2.1),

Note that (Eq.2.1) is composed of two elements:

The first one, which is $(\frac{Private\ Spending_i \times Simulated\ percentage\ copayment_i}{Actual\ percentage\ copayment_i})$, shows the effect on private spending of a co-payment percentage variation[14] and consists of private spending per individual; simulated percentage co-payment per individual; and actual percentage co-payment per individual.

The second one, which is, $(Q\ dem._{0ip} \pm Q\ dem._{1ip})$, shows the effect on consumption of a co-payment percentage variation and consists of the quantity demanded before the simulation and quantity demanded after the simulation per each individual prescription. The value of the quantity demanded before the simulation (i.e. $Q\ dem._{0ip} = 1$) is always fixed and equal to one because our database has one observation for each individual prescription. Therefore, the second element of Eq.2 provides the resulting quantity demanded due to the co-payment percentage variation $(1 \pm Q\ dem._{1ip})$ where,

$$Q\ dem._{1ip} = \frac{copayment\ percentage\ variation_i}{Actual\ copayment\ percentage_i} \times Elasticity_{ip}$$

(Eq.2.2)

[14] We use a simple rule of three to show the effect on private spending of a co-payment percentage variation.

Eq. 2.2 consists of the co-payment percentage variation per individual and the actual co-payment percentage per individual. We obtained *the* $Q\ dem._{1ip}$ from *the elasticity formula of Elasticity, which is* composed of quantity demanded variation per individual and prescription and co-payment percentage variation per individual:

$$Elasticity_{ip} = \frac{Q\ dem.variation_{ip}}{Copayment\ percentage\ variation_{i}} =$$

$$= \frac{\frac{Q\ dem._{1ip} - Q\ dem._{0ip}}{Q\ dem._{0ip}}}{\frac{Copayment\ percentage_{1i} - Copayment\ percentage_{0i}}{Copayment\ percentage_{0i}}}$$

$$= \frac{\frac{Q\ dem._{1ip} - 1}{1}}{\frac{Copayment\ percentage_{1i} - Copayment\ percentage_{0i}}{Copayment\ percentage_{0i}}}$$

(Eq.3)

We could not calculate the elasticity value because of the limitations of the database, given that the variability of the co-payment change was low (i.e., between 0% and 10% percent or between 40% and 50%). Although many studies assume a common price-elasticity for drugs (-0.2) [Jiménez Martín and Viola (2016); Robert et al. (2006); Puig-Junoy et al. (2014)], chronic disease drugs are more inelastic (-0.08) [Puig-Junoy et al. (2014)]. Our analysis applied the results published in [Puig-Junoy et al. (2011)], where the authors calculated the price-elasticity for 15 therapeutic groups (price-elasticity varies from -0.03 to -0.26) (cf. Table 6 in Appendix).

Table 2 presents the eleven scenarios (cf. Table 2).

The establishment of monthly contribution ceilings also has an impact on pharmaceutical consumption. Currently, only pensioners benefit from monthly contribution ceilings (i.e., EUR 8 ceiling when pensioners' incomes are lower than EUR 18,000; EUR 18 when pensioners' incomes are between EUR 18,000 and EUR 100,000). Therefore, using as reference, pensioners spending, we calculated the difference between WP and pensioners' spending derived from the ceilings. To obtain this, we first simulated a scenario in which the low-income WP have the same co-payment percentage as low-income pensioners before (cf. Eq.4) and after (cf. Eq.5) the reform (i.e., 0% before;10% after).

$$SPS_{\ 0ipWP} = \frac{Private\ Spending_{\ i} \times 0\%}{40\%} \times \left(Q\ dem._{\ 0ip} = 1 + \left(\frac{40}{40} \times E_{ip}\right)\right) \quad \text{(Eq.4)}$$

$$SPS_{\ 1ipWP} = \frac{Private\ Spending_{\ i} \times 10\%}{40\%} \times \left(Q\ dem._{\ 0ip} = 1 + \left(\frac{30}{40} \times E_{ip}\right)\right) \quad \text{(Eq.5)}$$

Then, we obtained the difference in the private spending derived from the existence of monthly contribution ceilings among pensioners. Therefore, we developed a linear regression model using quasi-experimental difference-in-difference design. Our control group was low-income WP, while our intervention groups were low-income pensioners and middle-income WP (cf. Eq.6).

$$Y_{igt} = \beta_0 + \delta I_{gt} + \gamma I_{gt} D_{t\geq 1} + \mu C_{igt} + \varepsilon_{igt} \qquad \text{(Eq.6)}$$

where i (individual), g (group), and t (time). Y_{igt} is monthly pharmaceutical expenditure, measured as amount of monthly private spending per individual of the sample. I_{gt} is a measure of intervention, it is a triple categorical variable for one control (low-income WP) and two intervention groups (low-income pensioners and middle-income

WP). $D_{t\geq 1}$ (policy break indicator) is a two-level categorical variable: before the reform's implementation (0) and after the reform's implementation (1). C_{igt} is a vector of individual-specific covariates (age, sex, municipality; simulated income). ε_{igt} (random error).

Overall, the monthly contribution ceilings increased the monthly private spending per individual by EUR 3.91 (low-income pensioners) and EUR 4.51 (middle-income WP) (cf. Table 7 in Appendix).

The nature of the database only allowed us to obtain the effect on pharmaceutical consumption of the actual monthly contribution ceilings. Accordingly, we could not simulate five different monthly contribution ceilings (i.e., one per income rage).

4. Results

4.1. Descriptive statistics

The second range (between EUR 6,010 and EUR 12,020) is the largest in the sample. Also, the majority of people who belonged to the middle-income WP were those who recorded most changes in their contribution codes after the reform, changing to low-income WP. By contrast, the fourth range (between EUR 18,030 and EUR 21,034) is the smallest in the sample (cf. Table 3). Regarding the age of WP individuals, it is noteworthy that as the income range increases, their average age is higher (cf. Table 3). Concerning the number of individuals that changed their contribution code after the reform, the majority of them moved from middle-income WP to low-income WP (cf. Table 3).

4.2. Concentration index results

As before the reform, pensioners were not subject to co-payment, we can only compare the WP CI. Accordingly, the current scheme is more progressive than the previous (i.e., CI increases from 0.03 to 0.07 for the WP). This co-payment system increased EUR 5.02 and EUR 3.4 the annual private and public spending per individual (private and public spending onwards), respectively (cf. Table 4).

The average annual pharmaceutical spending per individual is EUR 199.42 and the different co-payment scenarios show how this spending is distributed between individuals (private spending) and SNHS (public spending) (cf. Table 4).

We have sorted the scenarios from lowest to highest progressivity, though all of them are more progressive than the current scheme (cf. Table 4, Fig. 1 and, in Appendix, cf. Figs. 3, 4 and 5). Once the differences between WP and pensioners'[15] contributions are removed, all simulations are more progressive for the WP than for pensioners (cf. Table 4).

In the general analysis, scenario S11 provides the most progressive co-payment system (CI is 0.20, private spending is EUR 39.26, publicspending is EUR 160.17) and redistributes EUR 5.44 from public to private spending (cf. Fig. 2). In the separate analysis of WP and then pensioners, scenario S11 is the most progressive scheme for the WP (CI is 0.33, private spending is EUR 17.53, public spending is EUR 50.15) and for pensioners (CI is 0.16, private spending is EUR 113.13, public spending is EUR 534.21) (cf. Table 4; Figs. 1 and 2).

[15] Currently, working population has higher cost-sharing than pensioners in the same income category.

In the general analysis, scenario S9 results in the lowest private spending (CI is 0.14, private spending is EUR 30.31, public spending is EUR 169.11) and redistributes EUR 3.51 from private to public spending. In the separate analysis, scenario S9 (CI is 0.23, private spending is EUR 12.04, public spending is EUR 55.64) provides the least private spending for WP and pensioners, respectively (cf. Table 4; Fig. 1).

Again, in the general analysis, scenario S1 generates the greatest public savings (CI is 0.05, private spending is EUR 44.87, public spending is EUR 154.55) and redistributes EUR 11.05 from public to private spending. In the separate analysis, scenario S1 (CI is 0.13, private spending is EUR 31.77, public spending is EUR 35.91) and scenario S11 (CI is 0.16, private spending is EUR 113.13, public spending is EUR 534.21) generate the least public spending for WP and pensioners, respectively (cf. Table 4; Fig. 1).

5. Discussion and conclusions

The establishment of co-payments according to the income range of individuals (i.e. the 2012 co-payment reform) increased the progressivity of the Spanish co-payment system for the WP. However, potentially because of the economic crisis, we also observed that the majority of people who changed their contribution code after the reform moved from middle-income to low-income ranges (cf. Table 3). In fact, there is evidence of access barriers to medicines caused by economic factors after the 2012 reform, which coincided with the economic crisis (i.e., between 2008-2014) [González López-Valcárcel et al. (2016a); MSSI. *Barómetro Sanitario. La opinión de los ciudadanos*, 2013]. We can also observe a similar situation in Italy [Terraneo et al. (2014)]. Thus, the evidence highlights the sensitivity to co-payments of vulnerable groups (e.g., low-income individuals), who have a greater propensity to lower their adherence to medication, with the corresponding negative health effects [González López-Valcárcel et al. (2016a); Chernew and Newhouse (2008); Chernew et al. (2008); Skipper (2013); Terraneo et al. (2014); González López-Valcárcel et al., (2016b)].

Our results highlight that the breadth of income intervals limits the extent of the vertical equity principle. We have largely confirmed this hypothesis undertaking eleven simulations (using five -instead of three- income ranges for co-payment percentages). With the exception of simulated scenario S1 for pensioners (for the separate analysis), all simulated schemes turn out to be more progressive than the current co-payment system. These findings are in line with previous evidence [González López-Valcárcel et al. (2016a), MSSI. *Barómetro Sanitario. La opinión de los ciudadanos*, 2013]. However, our simulations also highlight that if we consider it desirable to increase progressivity and reduce public expenditure (to contribute to long-term sustainability), we can do this using different simulations. There is an exception in the separate analysis for pensioners (where scenario S11 is the best for both dimensions), when there is a trade-off between both objectives. This can be seen in the general analysis, where the more progressive schemes are related to higher public expenditure and those with lower progressivity are related to less public expenditure. Scenario S11 seems to be the most favourable scheme as it is the most progressive scheme but still at tolerable levels of public expenditure (6^{th} in the ranking). Something similar happens with the WP (separate) analysis, where less (more) progressive schemes are related to higher (lower) levels of public expenditure, with simulated scenario S4 being the most suitable.

Generally speaking, the more progressive simulated scenarios establish low co-payments percentages for the poorest population (e.g., between 10% and 20%) increasing them progressively, as income grows. For pensioners, all the simulations contributed to a long-term sustainable public pharmaceutical spending through an increase in co-payment contributions. The establishment of co-payments for pensioners would be positive because, according to the evidence, small co-payments are quite effective at reducing drug utilization when individuals were previously used to having free full coverage [Sen et al. (2012)]. Pensioners are more likely to over-consume medicines because they had free full coverage until the reform and currently, they still benefit from a low contribution with monthly contribution ceilings (cf. Table 1). However, this encourages moral hazard problems [Rodríguez Martínez and Puig-Junoy (2012); Vallejo Torres and Puig-Junoy (2019); Puig-Junoy and López Casasnovas (1999)]. Notwithstanding the above, pensioners (mostly elderly) also have a natural tendency to suffer more illnesses that increases their pharmaceutical consumption. For the WP, all the simulations would provide more progressive models than the current scheme because the WP (especially, low-income) is the least protected group (cf. Table 1). This scenario, apart from presenting horizontal inequities (i.e., pensioners with the same ability to pay have better conditions), could result in negative health effects among low-income WP [González López-Valcárcel et al. (2016a); Chernew and Newhouse (2008); Chernew et al. (2008); Skipper (2013); Terraneo et al. (2014); González López-Valcárcel et al. (2016b)]. In this regard, inequity problems to access medication are related to income and this factor does not seem to depend on the pensioner or WP condition. Indeed, expert recommendations are directed towards eliminating the differences between WP and pensioners because the only relevant aspect to apply co-payments should be -apart from individuals' health needs- their ability to pay [González López-Valcárcel et al. (2016a); Rodríguez Martínez and Puig-Junoy (2012); Vallejo Torres and Puig-Junoy (2019)]. In fact, Spain is the only European country that maintains these differences [European Observatory on Health Systems and Policies website].

Regarding the study's limitations, we can only obtain the effect on pharmaceutical consumption of existing monthly contribution ceilings due to the nature of the database. Predictably, if we had established five monthly contribution ceilings, the most progressive simulated scenario, would have been scenario S11 (cf. Table 4; Fig. 2) with five monthly contribution ceilings according to each income range (e.g., EUR 10, EUR 20, EUR 30, EUR 40 and EUR 50). Furthermore, if health care needs are concentrated among lower income groups, as previous evidence seems to show [Kawachi and Kennedy (1999); Marmot (2002)], then our results would be underestimating the redistributive effect. In addition, this underestimation of the concentration index would apply both for the separate analysis and for the simulations where we do not distinguish between pensioners and WP. In so far as this problem remains constant in the "before-and-after" comparisons, our conclusions regarding such comparisons would not be affected. Another limitation may arise because of the time span of the analysis (i.e., one year before/after the reform), particularly if it is true what some studies show arguing that the reduction of pharmaceutical consumption that followed the 2012 co-payment reform seemed to be temporary (Sánchez et al. (2014); IMS. *Evolución del mercado farmacéutico desde la implantación del copago*; Puig-Junoy et al. (2016)].

To conclude, for the WP, the current co-payment scheme, which resulted from the 2012 reform, is more progressive, but also slightly more expensive than the previous (both in terms of public and private expenditure). Although the use of income ranges has been effective in increasing progressivity, if the Government increased the number of income intervals, this would further enhance progressivity of the scheme. We have shown this by simulating the application of five income ranges used by the Spanish Tax Agency to apply Personal Income Tax (although more income ranges above EUR 21,035 would give even better results in terms of progressivity). Despite free full coverage for low-income individuals being the most progressive scenario, it does not seem suitable in terms of cost if the aim is to achieve a long-term sustainable co-payment model. Therefore, we provide alternative co-payment schemes that would maintain or, even, reduce public pharmaceutical spending, as well as offering improvements in terms of vertical equity.

References

Agencia Tributaria. Estadística de IRPF por municipios y tramos de BI (2013), Servicio de Estudios Tributarios y Estadísticas. [online database] Available in: https://www.agenciatributaria.es/AEAT.internet/datosabiertos/catalogo/hacienda/Estadistica_de_los_declarantes_del_IRPF_por_municipios.shtml

Álvarez García S. (2004), "La ética en el diseño y aplicación de los sistemas tributarios". Herrera Molina PM, editor. Madrid: Madrid: Instituto de Estudios Fiscales.

Antoñanzas Villar F., Rodríguez-Ibeas R., Juárez-Castelló C.A.and Lorente Antoñanzas M.R. (2014), "Impact of the Royal Decree-Law 16/2012 on the number of prescriptions and pharmaceutical expenditures", Revista Española de Salud Pública.; 88(2): 233-249. doi: 10.4321/S1135-57272014000200006.

Chernew M., Gibson T., Yu-Isenberg K., Sokol M., Rosen A.and Fendrick A. (2008), "Effects of Increased Patient Cost Sharing on Socioeconomic Disparities in Health Care", Journal of General Internal Medicine; 23(8): 1131-1136. doi: 10.1007/s11606-008-0614-0.

Chernew M.E.and Newhouse J.P. (2008), What does the RAND Health Insurance Experiment tell us about the impact of patient cost sharing on health outcomes?, The American Journal of Managed Care; 14(7): 412-414.

Decreto 3157/1966, de 23 de diciembre, por el que se regula la dispensación de especialidades farmacéuticas en el Régimen General de la Seguridad Social. Available in: http://www.boe.es/boe/dias/1966/12/30/pdfs/A16476-16476.pdf

European Observatory on Health Systems and Policies website. The Health Systems and Policy Monitor. Available in: http://www.hspm.org/mainpage.aspx

Gallo P. and Gené-Badia J. (2013), “Cuts drive health system reforms in Spain”. Health Policy, 113(1-2): 1-7. doi: 10.1016/j.healthpol.2013.06.016.

González López-Valcárcel B., Puig-Junoy J. and Rodríguez Feijoó S. (2016a), “Copagos sanitarios. Revisión de experiencias internacionales y propuestas de diseño”. FEDEA Policy Papers 2016-04.

González López-Valcárcel B., Librero J., Peña-Logobardo L., Bauer S., García-Sempere A., Puig-Junoy J., et al. (2016b), “Effect of Drug Cost-Sharing Change on Non-Adherence to Essential Medications for Acute Coronary Syndrome: A Population Based Natural Experiment”, Value in Health.; 19(7): A659- A659. doi: 10.1016/j.jval.2016.09.1800.

IMS. Evolución del mercado farmacéutico desde la implantación del copago. IMS Report [Recurso electrónico]: noviembre de 2012. Available at: http://www.farmaindustria.es/ Farma Public/Noticias/Medios/FARMA 119186?idDoc=FARMA 119186.

Jiménez Martín S. and Viola A.A. (2016), “Consumo de medicamentos y copago farmacéutico”, Studies on the Spanish Economy FEDEA, 2016-06.

Kawachi I. and Kennedy B.P. (1999), “Income inequality and health: pathways and mechanisms”, Health Services Research; 34(1 Pt 2): 215.

Lynch J.W., Smith G.D., Kaplan G.A. and House J.S. (2000), “Income inequality and mortality: importance to health of individual income, psychosocial environment, or material conditions”, BMJ; 320(7243): 1200-1204.

Marmot M. (2002), “The influence of income on health: views of an epidemiologist”, Health Affairs (Project Hope); 21(2): 31-46. doi: 10.1377/hlthaff.21.2.31.

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MSSI. Barómetro Sanitario. La opinión de los ciudadanos, 2013. (Consultado en septiembre de 2018) Disponible en: http://www.msssi.gob.es/estadEstudios/estadisticas/sisInfSanSNS/informeAnual2012.htm

O'Donnell O., O'Neill S., Van Ourti T. and Walsh B. (2016), "Conindex: Estimation of concentration indices", The Stata Journal; 16(1): 112-138.

Plan presupuestario 2019 y remisión trimestral de información (2018), [Recurso electrónico]: Presupuestos Generales del Estado, proyecto de 15 de octubre de 2018. Madrid..

Puig-Junoy J., García-Gómez P. and Casado-Marín D. (2011), "Free Medicines thanks to Retirement: Moral Hazard and Hospitalization Offsets in an NHS", Tinbergen Institute Discussion Paper, No. 11-108/3: Tinbergen Institute. Amsterdam and Rotterdam.

Puig-Junoy J., García-Gómez P. and Casado-Marín D. (2016), "Free Medicines Thanks to Retirement: Impact of Coinsurance Exemption on Pharmaceutical Expenditures and Hospitalization Offsets in a national health service", Health Economics; 25(6): 750-767. doi: 10.1002/hec.3182

Puig-Junoy J. and López-Casasnovas G. (1999), La aplicación de precios de referencia a los medicamentos. Cuadernos de Información Económica,143: 77-89.

Puig-Junoy J., Rodríguez-Feijoó S. and González Lopez-Valcárcel B. (2014), "Paying for Formerly Free Medicines in Spain After 1 Year of Co-Payment: Changes in the Number of Dispensed Prescriptions", Applied Health Economics and Health Policy, 12(3): 279-287. doi:

10.1007/s40258-014-0097-6.

Puig-Junoy J., Rodríguez-Feijóo S., González López-Valcárcel B. and Gómez-Navarro V. (2016), “Impacto de la reforma del copago farmacéutico sobre la utilización de medicamentos antidiabéticos, antitrombóticos y para la obstrucción crónica del flujo aéreo”, Revista Española de Salud Pública; 90: e1-e15.

Puig-Junoy J., Tur-Prats A. and Vera Hernández M. (2014), “Estimation of Price-Elasticities of Pharmaceutical Consumption for the Elderly”, University College London. Available in: http://www.homepages.ucl.ac.uk/~uctpamv/papers/TurPrats_etal2012.pdf

Real Decreto 945/1978, de 14 de abril, por el que se da nueva regulación a la aportación del beneficiario de la Seguridad Social en la dispensación de las especialidades farmacéuticas (1978), [Recurso electrónico]: Boletín Oficial del Estado, núm. 108, de 6 de mayo de 1978. Madrid: Madrid: BOE.

Real Decreto-Ley 1030/2006, de 16 de septiembre, por el que se establece la cartera de servicios comunes del Sistema Nacional de Salud y el procedimiento para su actualización (2006), [Recurso electrónico]: Boletín Oficial del Estado, núm. 222 de 16 de septiembre de 2006. Madrid: Madrid: BOE.

Real Decreto Ley 16/2012, de 20 de abril, de medidas urgentes para garantizar la sostenibilidad del Sistema Nacional de Salud y mejorar la calidad y seguridad de sus prestaciones (2012), [Recurso electrónico]: Boletín Oficial del Estado, núm.98 de 24 de abril de 2012. Madrid: Madrid: BOE.

Real Decreto Ley 7/2018, de 27 de julio, sobre el acceso universal al Sistema Nacional de Salud (2018), [Recurso electrónico]: Boletín Oficial del Estado, núm. 1 183, de 30 de julio de 2018. Madrid: Madrid: BOE.

Robert B.H., Keeler E.B., Lohr K.N., Newhouse J.P., Ware J.E. and Rogers W.H. (2006), The Health Insurance Experiment: A Classic RAND Study Speaks to the Current Health Care Reform Debate", RAND Corporation.

Rodríguez-Feijoo S. and Rodríguez-Caro A. (2021), "El copago farmacéutico en España tras la reforma del año 2012 desde la perspectiva del usuario. ¿Evidencias de inequidad?", Gaceta Sanitaria, 35(2): 138-144.

Rodríguez Martínez M. and Puig-Junoy J. (2012), "Por qué no hay que temer al copago". Gaceta Sanitaria; 26(1): 78-9. doi: 10.1016/j.gaceta.2011.09.026.

Sánchez D.P., Guillén J.J., Torres A.M., Arense J.J., López Á. and Sánchez F.I. (2014), "La recuperación del consumo farmacéutico tras la modificación del copago: evidencia de un servicio regional de salud", Atención Primaria.; 47(7): 411-418. doi: 10.1016/j.aprim.2014.10.005.

Sen B., Blackburn J., Morrisey M.A., Kilgore M.L., Becker D.J., Caldwell C., et al. (2012), "Did Copayment Changes Reduce Health Service Utilization among CHIP Enrollees? Evidence from Alabama", Health Services Research; 47(4): 1603-1620. doi: 10.1111/j.1475-6773.2012.01384.x.

Simó Miñana J. (2015), "Co-payment on prescription drugs in the Spanish public health system: Certainty, risk and selection of risks". Atención Primaria; 47(10): 669-673. doi: 10.1016/j.aprim.2015.06.010.

Skipper N. (2013), "On the demand for prescription drugs: heterogeneity in price responses", Health Economics; 22(7): 857-869. doi: 10.1002/hec.2864.

Terraneo M., Sarti S. and Bordogna M.T. (2014), "Social Inequalities and Pharmaceutical Cost Sharing in Italian Regions", International Journal of Health Services; 44(4): 761-785. doi: 10.2190/HS.44.4.e.

Vallejo Torres L. and Puig-Junoy J. (2019), "Copago farmacéutico,- ¿debemos volver a una situación similar a la anterior al RDL 16/2012?" Gaceta Sanitaria. January. Available in: http://sespas.elsevier.es/copago-farmaceutico-debemos-volver-a-una-situacion-similar-a-la-anterior-al-rdl-16-2012/

Tables and Figures

Table 1 Coinsurance change

		Before July 2012		After July 2012	
Contribution codes created by SNHS	Income intervals	Coinsurance (%)	Monthly contribution ceiling	Coinsurance (%)	Monthly contribution ceiling
		Pensioners			
TSI 001 (a)	-	0	-	0	-
TSI 002.1	< €18,000	0	-	10	€ 8
TSI 002.2	€18,000 - €99,999	0	-	10	€ 18
TSI 005	≥ €100,000	0	-	60	€ 60
		Working population (WP)			
TSI 001 (b)	-	40		40/0	-
TSI 003	< €18,000	40	-	40	-
TSI 004	€18,000 - €99,999	40	-	50	-
TSI 005	≥ €100,000	40	-	60	-

NOTE (1): Table 1 shows the coinsurance change of individuals in our sample classified according to the following groups:

TSI 001 (a): Corresponds to non-contributory pensioners, toxic syndrome or disability.

TSI 002.1: Corresponds to low-income pensioners

TSI 002.2: Corresponds to middle-income pensioners

TSI 005: Corresponds to high-income WP and pensioners

TSI 001 (b): Corresponds to toxic syndrome; disability; recipients of income from social integration; unemployed who have exhausted the unemployment benefit as long as their situation persists; work accident and occupational disease.

TSI 003: Corresponds to low-income WP

TSI 004: Corresponds to middle-income WP

NOTE (2): Monthly contribution ceiling reflects that currently, only pensioners benefit from monthly contribution ceilings.

Table 2 Simulated scenarios

	Pensioners		Working population (WP)	
Income intervals (€)	Coinsurance (%)	Monthly contribution ceiling (€)	Coinsurance (%)	Monthly contribution ceiling (€)
		First simulation (S1)		
<6,010	40	8	40	8
6,010 -12,019	50	8	50	8
12, 020 -18, 029	60	8	60	8
18, 030-21,034	70	18	70	18
> 21,035	80	18	80	18
		Second simulation (S2)		
<6,010	40	8	40	8
6,010 -12,019	40	8	40	8
12, 020 -18, 09	40	8	40	8
18, 030-21,034	50	18	50	18
> 21,035	50	18	50	18
		Third simulation (S3)		
<6,010	40	8	40	8
6,010 -12,019	45	8	45	8
12, 020 -18, 029	50	8	50	8
18, 030-21,034	55	18	55	18
> 21,035	60	18	60	18
		Fourth simulation (S4)		
<6,010	30	8	30	8
6,010 -12,019	40	8	40	8
12, 020 -18, 029	50	8	50	8
18, 030-21,034	60	18	60	18
> 21,035	70	18	70	18
		Fifth simulation (S5)		
<6,010	30	8	30	8
6,010 -12,019	35	8	35	8
12, 020 -18, 029	40	8	40	8
18, 030-21,034	45	18	45	18
> 21,035	50	18	50	18

Sixth simulation (S6)				
<6,010	20	8	20	8
6,010 -12,019	25	8	25	8
12, 020 -18, 029	30	8	30	8
18, 030-21,034	35	18	35	18
> 21,035	40	18	40	18
Seventh simulation (S7)				
<6,010	20	8	20	8
6,010 -12,019	30	8	30	8
12, 020 -18, 029	40	8	40	8
18, 030-21,034	50	18	50	18
> 21,035	60	18	60	18
Eight simulation (S8)				
<6,010	10	8	10	8
6,010 -12,019	15	8	15	8
12, 020 -18, 029	20	8	20	8
18, 030-21,034	25	18	25	18
> 21,035	30	18	30	18
Ninth simulation (S9)				
<6,010	10	-	10	-
6,010 -12,019	15	-	15	-
12, 020 -18, 029	20	-	20	-
18, 030-21,034	25	-	25	-
> 21,035	30	-	30	-
Tenth simulation (S10)				
<6,010	10	8	10	8
6,010 -12,019	20	8	20	8
12, 020 -18, 029	30	8	30	8
18, 030-21,034	40	18	40	18
> 21,035	50	18	50	18
Eleventh simulation (S11)				
<6,010	10	-	10	-
6,010 -12,019	20	-	20	-
12, 020 -18, 029	30	-	30	-
18, 030-21,034	40	-	40	-
> 21,035	50	-	50	-

NOTE (1): Table 2 presents the eleven simulated scenarios by individuals in our sample classified according to the Spanish Tax Agency income intervals without distinction between WP and pensioners.

NOTE (2): The simulations consist of establishing different co-payment percentages (with and without monthly contribution ceilings).

Table 3 Demographic key outcome variables

	< €6,010		**€6,010-€12,019**		**€12,020-€18,029**		**€18,030-€21,034**		**≥ €21.035**	
% Of individuals										
W.P.	26.15 (8,470)		28.14 (9,117)		24.28 (7,865)		4.39 (1,422)		17.04 (5,520)	
P	27.48 (2,629)		29.53 (2,825)		25.44 (2,434)		3.38 (323)		14.18 (1,357)	
Average Age of individuals within each group										
W.P.	32		32		32		34		34	
P	64		64		63		62		64	
% Of individuals within each group by sex (Women 'W', Men 'M')										
	W	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**
W.P.	52.92 (4,482)	47.08 (3,988)	52.24 (4,763)	47.76 (4,354)	52.82 (4,154)	47.18 (3,711)	50.07 (712)	49.93 (710)	48.7 (2,688)	51.3 (2,832)
P	57.66 (1,516)	42.34 (1,113)	58.51 (1,653)	41.49 (1,172)	59.2 (1,441)	40.8 (993)	53.25 (172)	46.75 (151)	51.29 (696)	48.71 (661)
Average income of individuals within each group										
W.P.	2,991		9,017		15,062		19,533		60,482	
P	3,005		9,054		15,051		19,439		60,320	
% Of individuals per island										
Working population (WP)										
FT	22.66 (406)		27.51 (493)		29.97 (537)		4.24 (76)		15.63 (280)	

GC	24.11 (2,785)	26.98 (3,116)	25.83 (2,984)	4.58 (529)	18.50 (2,137)
LG	30.22 (149)	30.63 (151)	17.65 (87)	5.27 (26)	16.23 (80)
EH	24.68 (58)	27.66 (65)	25.53 (60)	5.11 (12)	17.02 (40)
LZ	24.26 (872)	27.74 (997)	27.94 (1,004)	4.56 (164)	15.50 (557)
LP	30.42 (592)	29.65 (577)	18.04 (351)	4.32 (84)	17.57 (342)
TF	27.85 (3,608)	28.68 (3,716)	21.90 (2,837)	4.10 (531)	17.47 (2,263)
Pensioners					
FT	28.03 (74)	26.52 (70)	27.27 (72)	3.41 (9)	14.77 (39)
GC	26.98 (1,099)	30.07 (1,225)	27.27 (1,111)	2.72 (111)	12.96 (528)
LG	33.75 (54)	33.13 (53)	19.38 (31)	3.13 (5)	10.63 (17)
EH	32.47 (25)	29.87 (23)	28.57 (22)	3.90 (3)	5.19 (4)
LZ	22.59 (155)	30.61 (210)	24.64 (169)	4.23 (29)	17.93 (123)
LP	31.30 (215)	32.17 (221)	21.98 (151)	1.75 (12)	12.81 (88)
TF	27.73 (1,007)	28.14 (1,022)	24.17 (878)	4.24 (154)	15.72 (571)

Number of individuals that changed their contribution code after the reform

	To:	Low-income pensioners (TSI 002)	Low-income working population (TSI 003)	Middle-income working population (TSI 004)
From:	Low-income pensioners (TSI 002)	-	(350)	(9)
	Low-income working population (TSI 003)	(383)	-	(938)
	Middle-income working population (TSI 004)	(136)	(1,070)	-

NOTE (1): Table 3 reflects demographic key outcome variables for individuals in our sample classified according to the Spanish Tax Agency income intervals and discerning between working population (WP) and pensioners.

NOTE (2):
(a) The number of individuals is shown in parentheses.
(b) W.P. (Working population); P (Pensioners).
(c) FT (Fuerteventura); GC (Gran Canaria); LG (La Gomera); EH (El Hierro); LZ (Lanzarote); LP (La Palma); TF (Tenerife).

Table 4 Co-payment scenarios before and after the reform, government reform and simulated co-payment scenarios

Income ranges (€)	Co-payment (%)	Monthly contribution ceiling (€)	Concentration index (CI)	Annual private spending per individual (€)	Annual public spending per individual (€)
Previous co-payment system			0.041***(0.01)	18.33	-
Pensioners					
-	0	-	-	0	-
WP					
-	40	-	0.03***(0.01)	23.7	35.56
Current co-payment system			0.04***(0,00)	33.82	165.6
Pensioners					
<18,000	10	8	0.01 (0.01)	51.15	596.18
18,000-100,000	10	18			
WP					
<18,000	40	-	0.07***(0.01)	28.72	38.96
18,000-100,000	50	-			
18,000-100,000	50	-			
First simulation (S1)			0.05***(0.00)	44.87	154.55
Pensioners					
<6,010	40	8	-0.02***(0.01)	89,43	557.91
6,010-12,020	50	8			
12,021-18,030	60	8			
18,031-21,035	70	18			
>21,035	80	18			
WP					
<6,010	40	8	0.13***(0.00)	31.77	35.91
6,010-12,020	50	8			

12,021-18,030	60	8			
18,031-21,035	70	18			
>21,035	80	18			
Second simulation (S2)			0.06***(0.00)	44.4	155.02
Pensioners					
<6,010	40	8	0.04***(0.01)	94.5	552.83
6,010-12,020	40	8			
12,021-18,030	40	8			
18,031-21,035	50	18			
>21,035	50	18			
WP					
<6,010	40	8	0.10***(0.00)	29.67	38.01
6,010-12,020	40	8			
12,021-18,030	40	8			
18,031-21,035	50	18			
>21,035	50	18			
Third simulation (S3)			0.06***(0.00)	44.7	154.73
Pensioners					
<6,010	40	8	0.03***(0.01)	95.29	552.05
6,010-12,020	45	8			
12,021-18,030	50	8			
18,031-21,035	55	18			
>21,035	60	18			
WP					
<6,010	40	8	0.10***(0.00)	29.82	37.86
6,010-12,020	45	8			
12,021-18,030	50	8			
18,031-21,035	55	18			
>21,035	60	18			
Fourth simulation (S4)			0.08***(0.00)	43.36	156.07
Pensioners					
<6,010	30	8	0.04***(0.01)	90.5	556.84
6,010-12,020	40	8			
12,021-18,030	50	8			
18,031-21,035	60	18			
>21,035	70	18			
WP					
<6,010	30	8	0.14***(0.00)	29.49	38.19
6,010-12,020	40	8			
12,021-18,030	50	8			
18,031-21,035	60	18			
>21,035	70	18			
Fifth simulation (S5)			0.08***(0.00)	42.13	157.3
Pensioners					
<6,010	30	8	0.06***(0.00)	91.18	556.15
6,010-12,020	35	8			
12,021-18,030	40	8			
18,031-21,035	45	18			
>21,035	50	18			
WP					
<6,010	30	8	0.13***(0.00)	27.7	39.98
6,010-12,020	35	8			
12,021-18,030	40	8			
18,031-21,035	45	18			
>21,035	50	18			
Sixth simulation (S6)			0.09***(0.00)	37	162.43
Pensioners					
<6,010	20	8	0.08***(0.00)	81.54	565.79
6,010-12,020	25	8			
12,021-18,030	30	8			
18,031-21,035	35	18			

>21,035	40	18			
WP					
<6,010	20	8			
6,010-12,020	25	8			
12,021-18,030	30	8	0.12***(0.00)	26.91	43.79
18,031-21,035	35	18			
>21,035	40	18			
Seventh simulation (S7)			0.12***(0.00)	40.22	159.21
Pensioners					
<6,010	20	8			
6,010-12,020	30	8			
12,021-18,030	40	8	0.09***(0.01)	85.46	561.87
18,031-21,035	50	18			
>21,035	60	18			
WP					
<6,010	20	8			
6,010-12,020	30	8			
12,021-18,030	40	8	0.17***(0.00)	26.91	40.77
18,031-21,035	50	18			
>21,035	60	18			
Eighth simulation (S8)			0.12***(0.00)	30.66	168.77
Pensioners					
<6,010	10	8			
6,010-12,020	15	8			
12,021-18,030	20	8	0.13***(0.01)	66.14	581.19
18,031-21,035	25	18			
>21,035	30	18			
WP					
<6,010	10	8			
6,010-12,020	15	8			
12,021-18,030	20	8	0.14***(0.00)	20.22	47.46
18,031-21,035	25	18			
>21,035	30	18			
Ninth simulation (S9)			0.14***(0.01)	30.31	169.11
Pensioners					
<6,010	10	-			
6,010-12,020	15	-			
12,021-18,030	20	-	0.12***(0.01)	92.45	554.88
18,031-21,035	25	-			
>21,035	30	-			
WP					
<6,010	10	-			
6,010-12,020	15	-			
12,021-18,030	20	-	0.23***(0.01)	12.04	55.64
18,031-21,035	25	-			
>21,035	30	-			
Tenth simulation (S10)			0.17***(0.00)	35.32	164.11
Pensioners					
<6,010	10	8			
6,010-12,020	20	8			
12,021-18,030	30	8	0.15***(0.01)	74.88	572.45
18,031-21,035	40	18			
>21,035	50	18			
WP					
<6,010	10	8			
6,010-12,020	20	8			
12,021-18,030	30	8	0.20***(0.00)	23.68	44
18,031-21,035	40	18			
>21,035	50	18			
Eleventh simulation (S11)			0.20***(0.01)	39.26	160.17
Pensioners					

<6,010	10	-	0.16***(0.01)	113.13	534.21
6,010-12,020	20	-			
12,021-18,030	30	-			
18,031-21,035	40	-			
>21,035	50	-			
WP					
<6,010	10	-	0.33***(0.01)	17.53	50.15
6,010-12,020	20	-			
12,021-18,030	30	-			
18,031-21,035	40	-			
>21,035	50	-			

NOTE (1): Table 4 provides information on: (1) co-payment scenarios before and after the reform, (2) government reform and (3) simulated co-payment scenarios. In the 3 cases, the analysis is by individuals in our sample classified according to the Spanish Tax Agency income intervals. We included both, a general analysis (with working population (WP) and pensioners) and a separated analysis discerning between WP and pensioners.

NOTE (2): Table 4 includes the results about:

(1) concentration index (to compare inequality in private pharmaceutical spending over the distribution of incomes before and after the 2012 reform). Specifically, we used a Stata command (conindex) that provides point estimates and standard errors of a range of concentration indices [O'Donnell et al. 2016].

(2) Annual private spending per individual.

(3) Annual public spending per individual.

Fig. 1 Current scheme and simulated scenarios ranked by progressivity, by private spending and by public spending

General analysis (WP and pensioners)

Based on progressivity	Based on private spending	Based on public spending
Ranked from – to +progressivity	*Ranked from + to – spending*	*Ranked from + to – spending*
current	S1	S9
S1	S3	S8
S2	S2	Current
S3	S4	S10
S4	S5	S6
S5	S7	S11
S6	S11	S7
S7	S6	S5
S8	S10	S4
S9	current	S2
S10	S8	S3
S11	S9	S1

Separate analysis (pensioners)

Based on progressivity	Based on private spending	Based on public spending
Ranked from – to +progressivity	*Ranked from + to – spending*	*Ranked from + to – spending*
S1	S11	Current
current	S3	S8
S3	S2	S10
S2	S9	S6
S4	S5	S7
S5	S4	S1
S6	S1	S4
S7	S7	S5
S9	S6	S9
S8	S10	S2
S10	S8	S3
S11	current	S11

Separated analysis (WP)

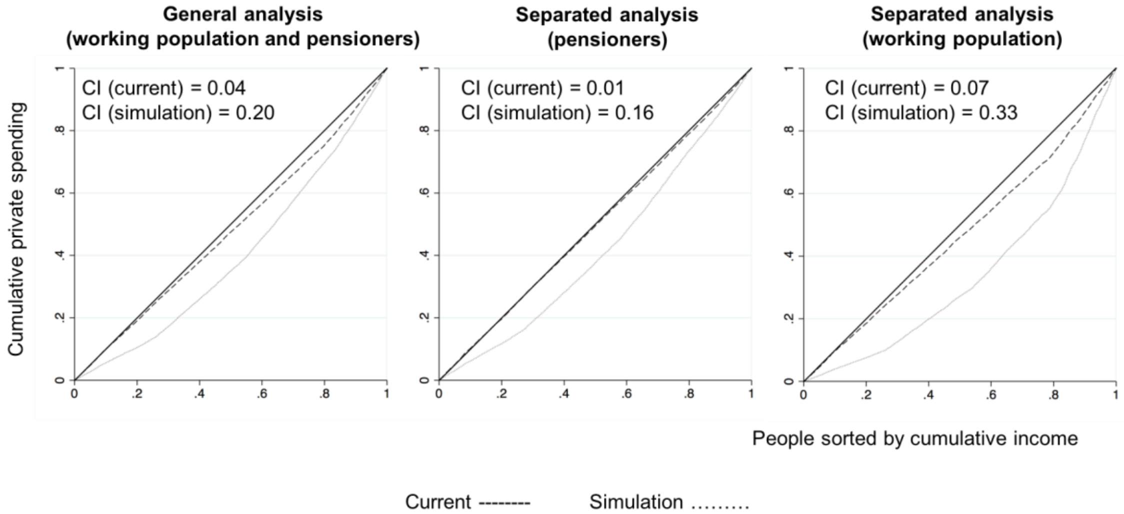
Based on progressivity	Based on private spending	Based on public spending
Ranked from – to +progressivity	*Ranked from + to –*	*Ranked from + to –*
current	S1	S9
S2	S3	S11
S3	S2	S8
S6	S4	S10
S1	current	S6
S5	S5	S7
S8	S7	S5
S4	S6	current
S7	S10	S4

	S10		S8		S2
	S9		S11		S3
	S11		S9		S1

NOTE (1): Fig. 1 provides information on the current scheme and simulated scenarios ranked from: (1) progressivity, (2) private spending and (3) public spending. The analysis is by individuals in our sample classified according to the Spanish Tax Agency income intervals. We included both, a general analysis (with working population (WP) and pensioners) and a separated analysis discerning between WP and pensioners.):

NOTE (2): Fig. 2 includes the results about concentration index (to compare inequality in private pharmaceutical spending over the distribution of incomes before and after the 2012 reform). Specifically, we used a Stata command (conindex) that provides point estimates and standard errors of a range of concentration indices [O'Donnell et al. 2016].

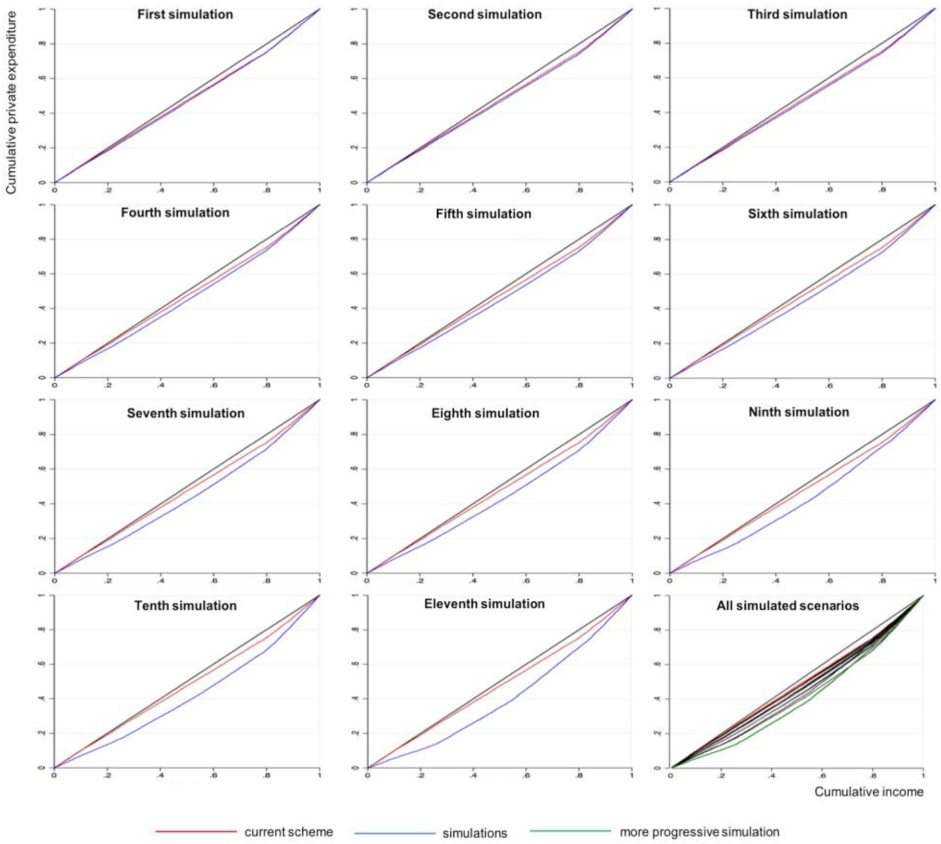
Fig. 2 Concentration curve comparison of current cost sharing schemes and the most progressive simulation



NOTE (1): Fig. 2, shows the concentration curve comparison of current cost sharing scheme and the most progressive simulation. The analysis is by individuals in our sample classified according to the Spanish Tax Agency income intervals. We included both, a general analysis (with working population (WP) and pensioners) and a separated analysis discerning between WP and pensioners. Specifically, we used a Stata command (conindex) that provides point estimates and standard errors of a range of concentration indices. This command also plots concentration (Lorenz) curves that allows us to show the cumulative private pharmaceutical spending (ordinate axis in the graph) using income as ranking variable (from poorest to richest individuals) (abscissa axis in the graph) [O'Donnell O, O'Neill S, et al., 2016].

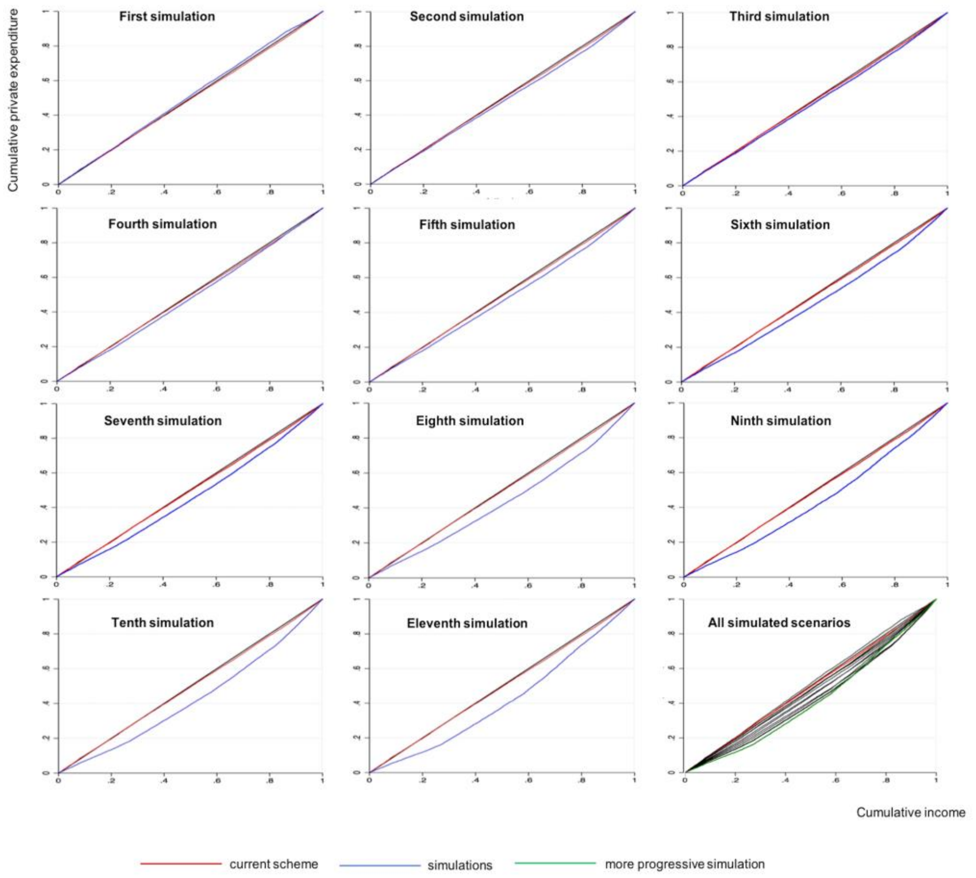
Appendix

Fig. 3 General concentration curves



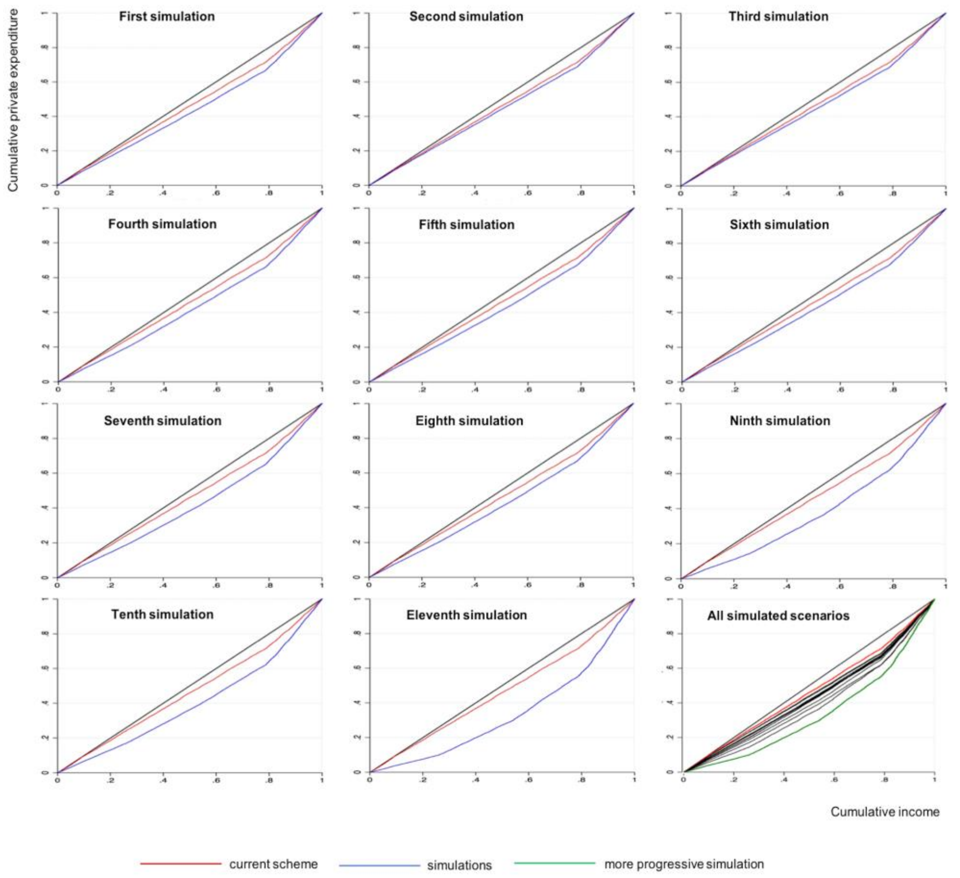
NOTE (1): Fig. 3, shows the concentration curve of the eleven simulations. The analysis is by individuals in our sample classified according to the Spanish Tax Agency income intervals. We included the general analysis (with working population (WP) and pensioners). Specifically, we used a Stata command (conindex) that provides point estimates and standard errors of a range of concentration indices. This command also plots concentration (Lorenz) curves that allows us to show the cumulative private pharmaceutical spending (ordinate axis in the graph) using income as ranking variable (from poorest to richest individuals) (abscissa axis in the graph) [O'Donnell O, O'Neill S, et al., 2016].

Fig. 4 Pensioners concentration curves



NOTE (1): Fig. 4, shows the concentration curve of the eleven simulations. The analysis is by individuals in our sample classified according to the Spanish Tax Agency income intervals. We included the separated analysis for pensioners. Specifically, we used a Stata command (conindex) that provides point estimates and standard errors of a range of concentration indices. This command also plots concentration (Lorenz) curves that allows us to show the cumulative private pharmaceutical spending (ordinate axis in the graph) using income as ranking variable (from poorest to richest individuals) (abscissa axis in the graph) [O'Donnell O, O'Neill S, et al., 2016].

Fig. 5 Working population concentration curves



NOTE (1): Fig. 5, shows the concentration curve of the eleven simulations. The analysis is by individuals in our sample classified according to the Spanish Tax Agency income intervals. We included the separated analysis for working population. Specifically, we used a Stata command (conindex) that provides point estimates and standard errors of a range of concentration indices. This command also plots concentration (Lorenz) curves that allows us to show the cumulative private pharmaceutical spending (ordinate axis in the graph) using income as ranking variable (from poorest to richest individuals) (abscissa axis in the graph) [O'Donnell O, O'Neill S, et al., 2016].

Table 5 Average amount of private (i.e., assumed by users) and public (i.e., assumed by the SNHS) pharmaceutical spending per patient before and after the reform

	10 months before (August 1st, 2011-June 30th, 2012)		11 months after (July 1st, 2012-June 1st, 2013)	
	Private	**Public**	**Private**	**Public**
< €6,010				
WP	6.22	9.33	6.59	9.89
Pensioners	0	-	7.09	97.96
€6,010-€12,019				
WP	6.15	9.22	6.36	9.55
Pensioners	0	-	6.86	92.01
€12,020-€18,029				
WP	6.07	9.1	6.32	9.48
Pensioners	0	-	6.89	94.18
€18,030-€21,034				
WP	7.14	10.71	8.71	8.71
Pensioners	0	-	8.04	81.65
≥ €21.035				
WP	7.89	11.83	9.75	9.75
Pensioners	0	-	8.55	86.81

NOTE (1): Table 5, provides information on average amount of private (i.e., assumed by users) and public (i.e., assumed by the SNHS) pharmaceutical spending per patient before and after the reform. The analysis is by individuals in our sample classified according to the Spanish Tax Agency income intervals. We included the separated analysis for working population (WP) and pensioners.

NOTE (2):

(a) As pensioners benefited from free full coverage before the reform, we could not obtain their public spending.

(b) We compare 10 months before (August 1st, 2011-June 30th, 2012) with 11 months after (July 1st, 2012-June 1st, 2013) the reform, because the number of observations in July 2011, it was not representative.

(c) The average amount of monthly private spending increased (i.e., less than €1, for the three first income ranges and more than €1, for the last two income ranges) among the working population. Accordingly, the average amount of monthly public spending increased less than €1, for the first three income intervals and it decreased around €2, for the last two income ranges. For pensioners, private spending increased considerably (i.e., less than €7, for the three first income ranges and between €8-€8.55, for the last two income ranges). However, it highlights the gap in the public spending of working population and pensioners (i.e., between €8.71-€9.89, for working population; and between €81.65-€97.96, for pensioners).

Table 6 Price-elasticity associated with each of the 15 following therapeutic groups from J. Puig Junoy et al. (2016)

Cardiovascular agents	0.030
Anti-hyperlipidemics	0.038
Endocrine/metabolic agents	0.080
Central nervous system agents	0.081
Biologicals	0.101
Diabetes drugs	0.121
Dermatologicals	0.129
Gastrointestinal drugs	0.132
Analgesics/anti-inflammatories	0.143
Eye/ear/nose/throat preparations	0.158
Anti-infectives	0.161
Immunological agents	0.167
Upper respiratory agents	0.194
Genitourinary agents	0.217
Pulmonary drugs	0.256

NOTE (1): Table 6, shows the price-elasticity associated to each one of the 15 following therapeutic groups from J. Puig Junoy et al. (2016).

NOTE (2): The table is sorted from lowest to highest price-elasticity of demand.

Table 7 Effect of monthly contribution ceilings on pharmaceutical expenditure

	Low-income pensioners vs low-income working population	Middle-income working population vs low-income working population
After-before the announcement	**3.91***** (0.04)	0.60***(0.00) **4.51** (b)

NOTE (1): (a) Table 7 contains Difference in Difference estimates from linear regression models with robust standard errors. All regressions include age and age2, and time dummies. Standard errors are in parentheses. Within each cell, we first report the estimated coefficients; we then report in parentheses robust standard errors. The dummy period variable that we have used is: (0) Before the announcement of the reform; (1) After the implementation of the reform.

NOTE (2): (b) As the only group that benefits from monthly contribution ceilings is pensioners and our control group is low income working population, the difference in the amount of monthly pharmaceutical spending between middle-income working population and low-income pensioners is calculated as follows: 3.91 + 0.60=4.11