CPB Netherlands Bureau for Economic Policy Analysis

CPB Discussion Paper | 387

The effect of reinsuring a deductible on pharmaceutical spending:

A Dutch case study on low-income people

Mariëlle Non
Richard van Kleef
Onno van der Galiën
Rudy Douven

The effect of reinsuring a deductible on pharmaceutical spending: A Dutch case study on low-income people

Mariëlle Non[a], Richard van Kleef[b], Onno van der Galiën[c] and Rudy Douven[a,b]

[a] CPB Netherlands Bureau for Economic Policy Analysis, [b] Erasmus School of Health Policy & Management, Erasmus University Rotterdam, [c] Achmea, Zeist, The Netherlands

Abstract

The basic health insurance in the Netherlands includes a mandatory deductible of currently 385 euros per adult per year. Several municipalities offer a group contract for low-income people in which the deductible is reinsured, meaning that out-of-pocket spending under the deductible is covered by supplementary insurance. This study examines to what extent such reinsurance leads to higher pharmaceutical spending.

We use a unique dataset from a Dutch health insurer with anonymized individual insurance claims for the period 2014-2017. We run a difference-in-difference regression to estimate the effect of reinsurance on pharmaceutical spending. The treatment group consists of enrollees from three municipalities that implemented reinsurance on January 1st 2017. The control group includes enrollees from three municipalities that didn't implement reinsurance.

We find that the introduction of reinsurance led to a statistically significant increase in pharmaceutical spending of 16% in the first quarter of 2017 and 7% in the second quarter. For the second half of 2017 the effect is small and not statistically significant. Conditional on people with low expected spending we find a statistically significant increase in pharmaceutical spending in all four quarters of 2017 varying from 22% to 30% per quarter.

Highlights

- Currently, the Dutch basic health insurance includes a mandatory deductible of 385 euro.
- Several municipalities introduced reinsurance of this deductible for low-income people.
- We find that the introduction of reinsurance increased pharmaceutical spending.
- The effect is statistically significant in the first two quarters after introduction.
- For low-risk people the effect is statistically significant in all four quarters.

JEL codes: I12, I13, C23, D12

Keywords: Health insurance, Deductible, Reinsurance of consumer cost sharing, Pharmaceutical spending, Low-income people

1. Introduction

In response to rising health care spending, many countries have increased the level of consumer cost sharing in their regulated health insurance schemes (Zare and Anderson, 2013). The Netherlands is no exception to this trend: the annual mandatory deductible in the basic health insurance for curative care has gradually increased from 150 euros per adult per year in 2008 to 385 euros in 2017. The current deductible level has led to concerns about the affordability of health care and the potential avoidance of necessary care, especially among people with low income.

We study the effect of the current deductible in the Netherlands on the use of care by analyzing a unique arrangement for low-income people. Dutch municipalities are responsible for (financial) support to persons at or below the social minimum income level.[1] As part of this task, most municipalities offer a group arrangement to low-income people through which they can purchase their basic health insurance with a premium discount. This arrangement – which we will refer to as a 'municipality contract' – comes with extensive supplementary coverage on top of the basic coverage. Many municipality contracts also include reinsurance of out-of-pocket spending due to the mandatory deductible. More specifically, this reinsurance option implies the mandatory deductible is waived in return for a higher monthly premium.

Municipalities mention three motives for such reinsurance. First, it mitigates financial uncertainty since low-income people will no longer face uncertainty about out-of-pocket spending during the year. Second, it might prevent liquidity problems and avoid (additional) debts associated with out-of-pocket spending (which might be up to 385 euros).[2] Third, reinsurance might avoid underuse of necessary care.

This study analyzes the effects of reinsuring the deductible on pharmaceutical spending, using a unique anonymized dataset from a Dutch insurance company with individual-level spending and characteristics for the period 2014-2017. The data includes three municipality contracts in which reinsurance was introduced (on January 1, 2017) and three municipality contracts in which reinsurance was not introduced. This data allows a clean difference-in-difference study to estimate the effects of reinsurance on health care spending.

A vast amount of literature shows that cost sharing reduces health care spending (see e.g. Gruber, 2006, Blais et al., 2003, Chandra et al., 2014). Two of the most prominent studies on the effect of cost sharing are the RAND health insurance experiment and the Oregon health insurance experiment. The RAND experiment found that people with a deductible spent less on health care compared to people with full insurance coverage (Newhouse et al., 1993). In the Oregon experiment the likelihood of having a hospital admission, outpatient care or taking prescription drugs increased for low-income people after obtaining insurance coverage (Finkelstein et al., 2013). A particularly interesting aspect of our study is that it concerns people who are used to having health insurance

[1] In 2018, the social minimum net of taxes is 992 euro per month for a single person and 1417 euro for a couple. Although the social minimum is defined at household level, the health insurance contract is on individual basis. For this reason, we refer to low-income individuals and not low-income households.
[2] Instead they will pay an additional premium which is evenly spread over twelve months. See also Marzilli Ericson and Sydnor (2018) on the value of insurance under liquidity constraints.

with a mandatory deductible and that the introduction of reinsurance de facto removes this cost sharing feature.

In line with the conclusions of previous studies, we find that with reinsurance people tend to have higher pharmaceutical spending than without reinsurance. The effect is most prominent in the first quarter following the introduction of reinsurance, and is no longer statistically significant in the third and fourth quarter. Our data also allows us to distinguish between persons with a relatively high probability of exceeding the deductible and those with a relatively low probability of exceeding the deductible. Theoretically, a rational consumer with a high probability of exceeding the deductible will hardly reduce spending, while people with a low probability of exceeding the deductible have a year-round incentive to use care sparingly. In line with this theory, we indeed find that for people with a low probability of exceeding the deductible the effect of reinsurance is statistically significant in all four quarters of 2017. However, for the complementary group the effect is still statistically significant in the first quarter of 2017, and not significant in the other quarters, suggesting that this group uses more care once they exceeded the deductible.

2. Institutional setting

The Dutch basic health insurance is based on regulated competition (Van Kleef et al., 2018). In this system consumers have a choice of health plan (leading to competition among insurers) and insurers have flexibility in provider contracting (resulting in competition among providers of care). The regulator has set certain rules to protect public objectives such as the affordability and accessibility of care. For example, insurance companies are obliged to accept every applicant and are not allowed to price discriminate between sick and healthy persons.[3] The benefits package is set by the government, and includes GP care, medication and hospital care, among other services. Consumers are obliged to purchase basic coverage. At the end of each year, they can switch health plans. On top of the basic insurance package, insurers offer supplementary insurance, e.g. covering dental care, physiotherapy and glasses. Contrary to the basic health insurance, no specific regulation applies to the market for supplementary insurance (apart from the standard insurance regulation, e.g. in terms of solvency requirements). This implies that insurance companies are completely free to decide which benefits to include. Moreover, consumers are not obliged to enroll in supplementary insurance.

The basic health insurance includes a mandatory deductible of 385 euros per adult per year (in 2017). This means that each year the first 385 euros of health care costs have to be paid out-of-pocket before insurance kicks in. Once the 385 euro threshold has been reached all costs are covered by the insurance (except for copayments for some specific treatments). The level of the mandatory deductible is set by the government.[4]

Within the Dutch health care system, group arrangements are allowed. In 2017, over 50,000 group arrangements exist and about two-thirds of the population opted for such an arrangement. People

[3] A risk equalization system compensates insurers for predictable spending variation among individuals.
[4] On top of the mandatory deductible, consumers can opt for a voluntary deductible (with a maximum of 500 euro per year) in return for a premium rebate. This option is not available in the group arrangements that we study.

joining a group arrangement usually get a premium discount (which by law is limited to 10% of the premium for non-group contracts). In addition, group arrangements also offer tailor-made supplementary health insurance that is relevant for the group (e.g. additional physiotherapy in a group contract for workers in a construction company).

Almost all of the 388 Dutch municipalities offer a special group arrangement for residents with low income, the municipality contracts.[5] These arrangements differ across municipalities, but generally include supplementary health insurance with extensive coverage. Almost all insurance companies offer a modest premium discount to people joining a municipality contract, and most municipalities give an additional premium subsidy. Though low-income people are not obliged to enroll in a municipality contract, the subsidy usually makes the contract more attractive than competing plans.

Approximately half of the municipality contracts include reinsurance of out-of-pocket spending due to the mandatory deductible.[6] More specifically, this means that insured pay an additional monthly fee, usually subsidized by the municipalities, and in return do not have to pay the deductible. In some municipality contracts insured are obliged to take up reinsurance while in other municipality contracts reinsurance is optional. Municipality contracts are the only type of group arrangements aimed at Dutch residents that sometimes include reinsurance. Although reinsurance of the deductible is not strictly forbidden[7], none of the health insurers offers it to the general public.

3. Data and method

We compare enrollees from three municipalities that introduced reinsurance of the deductible on January 1st 2017 (the treatment group) with enrollees from three municipalities that never offered such reinsurance (the control group). Before 2017, all six municipalities offered a group arrangement for low-income people with a regular deductible (i.e. without reinsurance). In 2017, the municipalities in the treatment group introduced a mandatory reinsurance and subsidized almost all premium costs of this reinsurance.[8] The municipalities decided on the reinsurance in the fall of 2016[9], leaving little to no scope for anticipation effects. All six municipality contracts have identical coverage.

The health insurer that offers the group arrangement in the six municipalities provided us with anonymized individual-level claims data for the period January 2014 to December 2017. The data include all enrollees (of the insurer) who were in the municipality contract at some point during

[5] The definition of low income differs between municipalities; the cutoff varies between 110% and 130% of the social minimum.
[6] Some of the municipalities without reinsurance offer a savings plan where insured pay a monthly instalment of one twelfth of the deductible, and are reimbursed at the end of the year if the use of care is below the deductible. Like reinsurance, this plan also reduces liquidity problems, but it does not remove the incentive to reduce the use of care. The municipalities in our research do not offer such a savings plan.
[7] The Dutch Healthcare Authority (NZa) notes that reinsurance in general is undesirable as cost sharing prevents the use of unnecessary care, but they also note that it might be a good solution for persons who have trouble paying the deductible right away (Nederlandse Zorgautoriteit, 2015). This includes low income people, but also people who live temporarily in The Netherlands (e.g. seasonal workers).
[8] The premium cost of reinsurance is roughly 27 euros per month, covering a deductible of 385 euros per year.
[9] One of the municipalities decided in the middle of September, the other two decided in November 2016.

those four years. In addition to the insurance claims, the data also includes information on the age and gender of the insured.

Our empirical analysis focusses on pharmaceutical spending per quarter as covered by the basic health insurance. Our motive for focusing on pharmaceutical spending is threefold. First, in our sample of low-income people with municipality contract pharmaceuticals form the major spending category under the deductible; approximately 55% of out-of-pocket spending under the deductible is on pharmaceuticals. Second, the variation in pharmaceutical spending is relatively small, compared to hospital spending for instance, which makes our estimations more robust. Third, when picking up medication, consumers often can make a reasonable guess of the price. For most types of care, including medication and hospital care, bills are usually sent to the insurer first who – in a second step – sends a bill for out-of-pocket spending to the consumer. For medication, this process usually takes about one to two months. Therefore, the consumer is quickly aware of the price and can take this into account when picking up repeat medication. Also, if asked, the pharmacist can immediately state the cost of medication. For hospital spending it usually takes several months more before the bill is sent to the consumer and moreover most specialists are not able to directly state the price of treatment. It can therefore be expected that insured behave more rational and price-sensitive with respect to pharmaceuticals than to hospital care.

From the data, we select individuals that are 18 years or older on January 1st 2014 and have been in the same municipality contract for all four years.[10] The resulting data is a balanced panel with 16 quarters of claims data for 5.868 individuals. Table 1, columns 2 and 3, provide some descriptive results for the treatment and control group respectively. The groups are fairly similar. The sample includes more women than men, possibly because 20% of the receivers of income support in the Netherlands are single parent, which are mostly women.[11] Because municipality contracts include extensive supplementary coverage the population has high health spending and is relatively old.

Table 1: Descriptive statistics

	Total population		Never exceeded deductible in 2014-2016		Exceeded deductible in at least one of the years 2014-2016	
	Treatment	Control	Treatment	Control	Treatment	Control
n	2,219	3,649	356	543	1,863	3,106
% female	71.5%	68.8%	60.1%	59.3%	73.6%	70.4%
Mean age on 31-12-2014	56.0	58.7	49.5	51.5	57.2	60.0
Mean quarterly spending on pharmaceuticals (s.e.)	€ 187 (802)	€ 205 (786)	€ 14 (29)	€ 13 (28)	€ 221 (871)	€ 239 (848)

[10] We also removed five persons who received long term care, as the compulsory Dutch long term care insurance covers the pharmaceuticals used by those persons. Including those persons in the data did not affect our results.

[11] Statistics Netherlands, table of social assistance by household composition, accessible at https://opendata.cbs.nl/#/CBS/nl/dataset/82015NED/table?ts=1527771112894

In the next section, we estimate the following fixed effects difference-in-difference equation.

$$Y_{it} = \alpha_i + \gamma_t + \sum_{t=2017,1}^{2017,4} \beta_t \, I_{treatment,t} + \varepsilon_{it}$$

Here Y_{it} denotes the (log) pharmaceutical spending of person i in year-quarter t, α_i and γ_t denote individual and year-quarter fixed effects and $I_{treatment,t}$ is a dummy denoting persons in the treatment group in quarter t. β_t are our difference-in-difference estimates of the effect that reinsurance has on the (log) pharmaceutical spending.

Note that the effect estimates are a measurement of how much the (log) spending in the treatment group differs from the (log) spending in the control group in 2017, given pre-existing differences between the populations (the α_i) and given the quarterly development in the control group (the γ_t). The quarterly development includes any changes over time in e.g. medical developments and the level of the deductible. In the four years considered for this study the change in the deductible has been moderate and roughly in line with general inflation; in 2014, the deductible was 360 euros, in 2015 it was 375 euros and in 2016 and 2017 it was 385 euros. Moreover, there have been no major changes in the pharmaceuticals covered by the basic health insurance.

There are two selection issues that can potentially bias the difference-in-difference estimates. First, the introduction of reinsurance might attract new and relatively unhealthy persons to the municipality contract.[12] To avoid this potential selection bias, we select only those persons who are in the same contract for all four years and hence leave out any persons who might be newly attracted to the contract because of the reinsurance feature. Second, as reinsurance is less attractive for healthy persons, the introduction of reinsurance might lead to selection in the persons who leave the contract and therefore are not in our data. However, we note that the subsidy provided by municipalities covers almost all premium costs of reinsurance, making reinsurance financially attractive even for persons with low expected medical costs. Moreover, we find that the dropout rate at the end of 2016 is 7% for the treatment group and 8% for the control group, and that the average medical costs in 2016 of both groups of dropouts are comparable. Therefore, we expect that the second selection issue does not lead to bias in our analysis.

The effect of reinsurance might be different for people with a low probability of exceeding the deductible than for those with a high probability of exceeding the deductible. To test this hypothesis we repeat our difference-in-difference analysis separately for two subgroups. One subgroup consists of persons whose medical spending (including hospital care etc.) in 2014 until 2016 never exceeded the yearly deductible. The complementary group – i.e. those who in at least one of the years 2014-2016 exceeded the deductible - forms the other subgroup. For the first group the probability of exceeding the deductible in 2017 indeed is substantially lower than for the latter: 20% versus 76%. Table 1 presents some descriptive results conditional on these groups.

[12] Indeed, in 2017 the number of adults insured in the treated municipality contracts grew by 57%, compared to 13% in the non-treated municipality contracts.

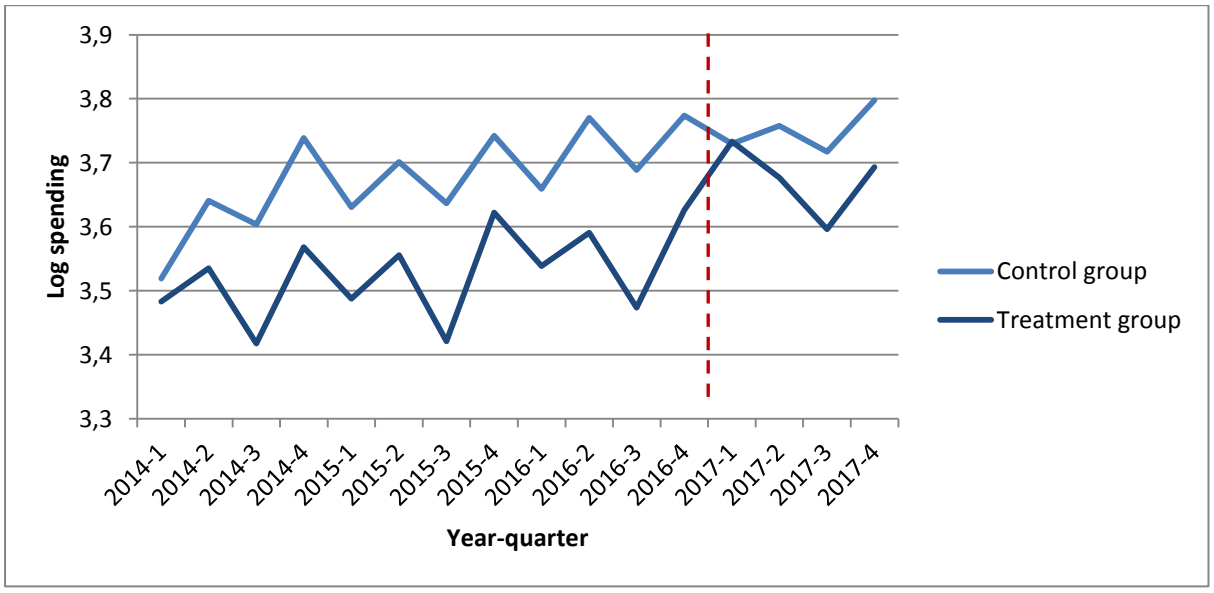
4. Results

Figure 1 displays the average log quarterly spending on pharmaceuticals for both the treatment and the control group. The spending is somewhat lower in the treatment group than in the control group, which corresponds with the lower average age in the treatment group. In the model we correct for individual level differences with the individual fixed effects α_i.

Over the four-year period, there is a slight upward trend in spending. Since we follow the same group of persons over time, this upward trend can be the effect of ageing. In addition, there might be small fluctuations in prices of medication, also contributing to the upward trend. In both the treatment and control group there is a prominent seasonal pattern. In quarters 1 and 3 spending is relatively low, in quarter 2 spending is somewhat higher, and in quarter 4 spending peaks. A possible explanation for the peak in quarter 4 and the dip in quarter 1 might be that some people who have already exceeded their deductible in a year pick up larger amounts of pharmaceuticals at the end of that year to avoid out-of-pocket spending in the (first quarter of the) new year. The dip in quarter 3 might be caused by the summer holidays. The parameter γ_t in the model corrects for the general upward trend in the data and the seasonal effects.

Starting on January 1st 2017, the deductible is reinsured in the treatment group. In the first quarter following the policy change there is a striking increase in spending in the treatment group, compared to a decrease in spending in the control group. However, in the following quarters the spending seems to return to normal or slightly above normal values.

Figure 1: Average log quarterly spending of treatment and control group (total population)

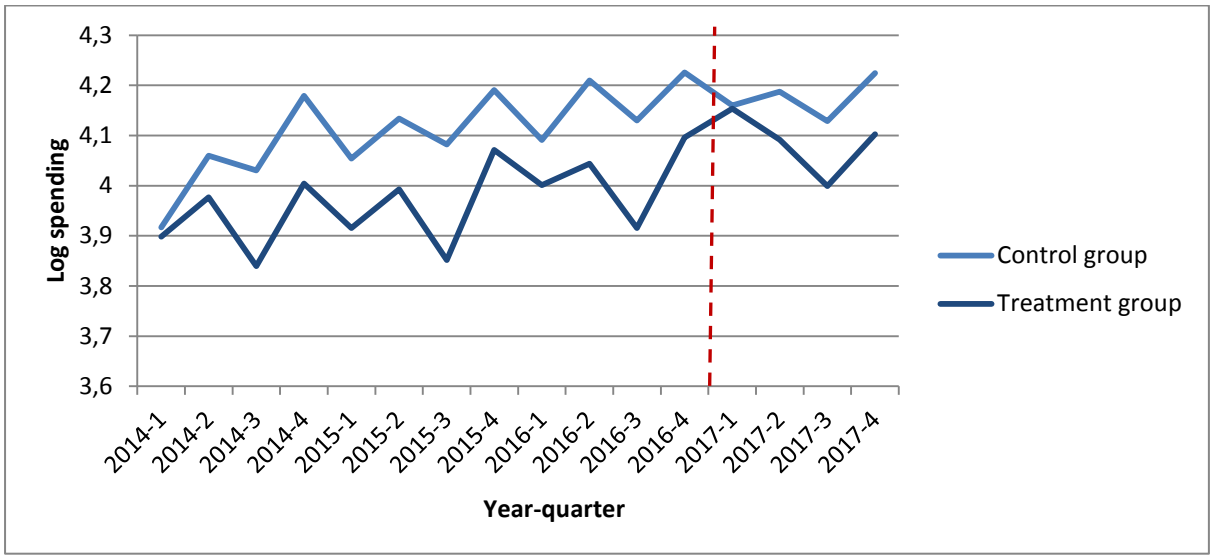


The regression results in Table 2 (column 2) confirm those observations. There is a statistically significant positive effect of reinsuring the deductible on pharmaceutical spending in the first quarter after introduction, and a smaller but still statistically significant effect in quarter 2. In later quarters, the effect is no longer statistically significant. The estimates for the first and second

quarter imply a 16% and 7% increase in spending respectively.[13] Given an average spending of € 187 (Table 1) this gives an increase of roughly 30 euros in the first quarter and 13 euros in the second quarter. In Appendix A we present several additional statistics and show that the results are robust to a range of alternative specifications.

Figures 2 and 3 show the average quarterly spending for two groups: people who exceeded the deductible in at least one of three prior years (Figure 2) and those who didn't exceed the deductible in each of three prior years (Figure 3). Note that Figure 3 gives spending in euros[14], as the quarterly spending is relatively low, while Figure 2 gives the logarithm of spending. The pattern for the group that exceeded the deductible in at least one of three prior years is quite similar to that of the total sample. The pattern for the complementary group is markedly different. First, the spending for both the treatment and control group increases linearly in 2017. The persons in the subsample in Figure 3 are chosen based on the fact that their spending is low in 2014-2016. Someone who e.g. is in good health in 2014 and 2015, but falls ill in 2016 (resulting in spending above the deductible) is excluded from this subsample. This results in almost constant average spending in 2014-2016 in Figure 3. However, persons in good health in 2014-2016 with a health shock in 2017 are included in this subsample, leading to the increase in average spending. In Appendix B we show that the group of people who never exceeded the deductible in 2014 and 2015, but might have a health shock in 2016, has a similar increase in average spending in 2016. Second, until 2017 the spending in the treatment and control group is very similar, but in all quarters of 2017 the treatment group spends approximately four euros more than the control group.

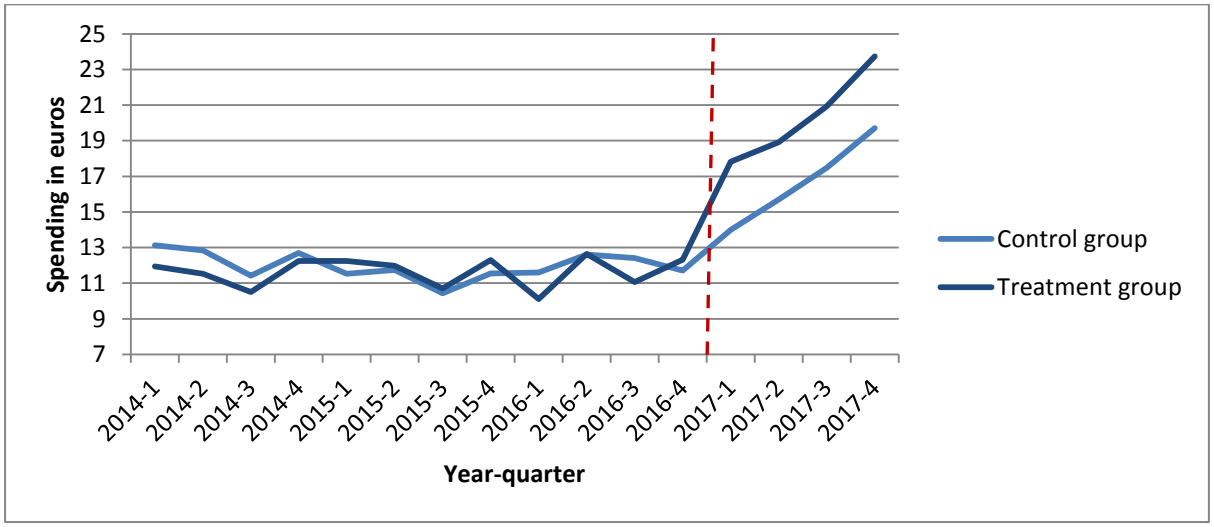
Figure 2: Average log quarterly spending of treatment and control group (people who exceeded the deductible in at least one of the years 2014-2016)



[13] As we use the log(spending) as dependent variable, we compute the percentage increase in spending as $100(e^{\beta}-1)$.

[14] Appendix B gives the results on log(spending).

Figure 3: Average quarterly spending of treatment and control group (people who never exceeded the deductible in 2014-2016)



The regression results in Table 2 (columns 3 and 4) again confirm those observations. In the group that didn't exceed the deductible in each of three prior years the introduction of reinsurance leads to an increase of approximately 4 euros in quarterly pharmaceutical spending, and this effect is statistically significant in all quarters. Taking the spending in 2017 of the control group as the reference point, the spending in the treatment group increases with 30% in quarter 1 and 22% to 23% in the remaining quarters. In the group that exceeded the deductible in at least one of three prior years there only is a statistically significant increase in the first quarter (+14%, roughly 26 euros). We did split this group further in persons who exceeded their deductible in only one or two years, and persons who exceeded the deductible three years in a row. The results of those groups did not significantly differ from each other. We also investigated a subgroup of persons who three years in a row exceeded their deductible in the first quarter of the year. The results on this group again do not differ from the group in the main analysis.

Appendices B and C provide additional statistics and show that the results are robust to alternative specifications.

Table 2: Difference-in-differences estimates of changes in quarterly spending in 2017

	Total population	Exceeded deductible in at least one of the years 2014-2016	Never exceeded deductible in 2014-2016
	Log(spending)	Log(spending)	Spending in euros
$\beta_{2017,1}$	0.150*** (0.032)	0.135*** (0.035)	4.173** (1.661)
$\beta_{2017,2}$	0.065** (0.032)	0.046 (0.035)	3.561** (1.661)
$\beta_{2017,3}$	0.026 (0.032)	0.012 (0.035)	3.787** (1.661)
$\beta_{2017,4}$	0.042 (0.032)	0.019 (0.035)	4.372*** (1.661)

Models include individual level fixed effects and year-quarter dummies

***p<0.01, **p<0.05, *p<0.1

5. Discussion

We find that the introduction of reinsurance for out-of-pocket spending under the mandatory deductible in the Dutch basic health insurance increased pharmaceutical spending. The effect of reinsurance differs between the groups with a low respectively high probability of exceeding the deductible. For the subgroup of people who did not exceed their deductible in each of three prior years we find a statistically significant and fairly equal increase in spending in all four quarters following the introduction of reinsurance. For the complementary group of people who exceeded their deductible in at least one of three prior years we find a statistically significant effect only in the first quarter. One possible explanation for this result might be that insured in the control group start spending more on healthcare once they exceeded their deductible. They could be more willing to pick up (possibly non-urgent) medication, but they might also stock up on necessary medication to avoid out-of-pocket spending in the first quarter of the next year. We note that in the group who exceeded the deductible in at least one of three prior years a considerable share of the control group has exceeded the deductible by quarter two[15]; these insured might behave in quarter three and four as if they do not have a deductible, and hence the spending differences between the treatment and control group will diminish in later quarters. In the group that did not exceed the deductible in each of three prior years, the large majority of people in the control group will remain below the deductible throughout the entire year 2017. Consequently, spending in the control group remains to be lower in all four quarters of 2017.

A rational consumer would take into account the probability of exceeding the deductible during the contract period. For example, a diabetic with annual treatment costs of 2,000 euros has a probability of nearly 1.0 to pay the full deductible. For this person it hardly makes sense to reduce spending since he or she will exceed the deductible anyway. In other words, rational people would respond to the expected 'end-of-year' price, instead of the 'spot' price. For those with a probability of nearly 1.0 to exceed the deductible, the end-of-year price will be close to zero. Following this theory, it is remarkable that we still find a significant effect of reinsurance for the group with a high probability of exceeding the deductible. Apparently, not all insured behave completely rational. This is in line with the finding of Brot-Goldberg et al. (2016) that insured tend to respond to the spot price even though arguably the expected end-of-year price is zero. In our context, a possible explanation for the response to spot prices might be the fact that our population has a low income and is likely to face liquidity constraints. This could make insured hesitant to use care under the deductible.

For municipalities, reinsurance of the deductible comes with both advantages and disadvantages. An advantage of reinsurance is that it might mitigate financial uncertainty and prevent liquidity problems, especially for a low-income population. A disadvantage is that reinsurance is unattractive for low-income people with low expected use of care. This results in a selection problem where mainly unhealthy people will choose for a municipality contract with reinsurance, raising the premium of reinsurance. To keep the municipality contract attractive the municipality may have to substantially subsidize the higher premiums. Another advantage of reinsurance arises if the increase in pharmaceutical spending concerns high-value care. The RAND experiment (Newhouse et al., 1993)

[15] Analysis of the spending in 2016 shows that 48% of our population reaches the maximum copayment in the first quarter. In quarters 2, 3 and 4 an additional 19%, 8% and 5% respectively exceed the copayment limit.

shows that especially low-income people have worse health outcomes under co-payment, suggesting that cost sharing leads them to cut back on needed care. However, reinsurance might (also) increase the use of low-value care, making reinsurance less desirable. We were not able to determine whether the increase in pharmaceutical spending found in this study concerns low-value or high-value care. This remains a question for further research.

A further limitation of our research is that the data only included one year after the introduction of reinsurance. Adding more years would allow us to research whether the observed pattern is persistent over time. However, although data on the use of care in 2018 is not yet available, we did observe that as of January 2018 a significant number of insured switched to a new municipal insurance plan, of another insurer. This severely limits the options for future research.

Acknowledgements

We thank Achmea for providing us access to the Achmea Health Database. The views presented here are those of the authors and not necessarily those of Achmea or the CPB.

References

Blais, L., J. Couture, E. Rahme, and J. LeLorier (2003), Impact of a cost sharing drug insurance plan on drug utilization among individuals receiving social assistance. *Health Policy* 64(2), pp. 163–72.

Brot-Goldberg, Z.C., A. Chandra, B. Handel, and J.T. Kolstad (2016), What does a deductible do? The impact of cost-sharing on health care prices, quantities, and spending dynamics. *The Quarterly Journal of Economics* 132(3), pp. 1261-1318.

Chandra, A., J. Gruber, and R. McKnight (2014), The impact of patient cost-sharing on low-income populations: evidence from Massachusetts. *Journal of Health Economics* 33, pp. 57-66.

Finkelstein, A., S. Taubman, B. Wright, M. Bernstein, J. Gruber, J.P. Newhouse, H. Allen, K. Baicker, and the Oregon Health Study Group (2012), The Oregon Health Insurance Experiment: evidence from the first year, *The Quarterly Journal of Economics* 127(3), pp. 1057-1106.

Gruber, J. (2006), *The role of consumer copayments for healthcare: lessons from the RAND Health Insurance Experiment and beyond*. Menlo Park, CA: Heny J. Kaiser Family Foundation.

Marzilli Ericson, K., and J.R. Sydnor (2018), Liquidity constraints and the value of insurance, *National Bureau of Economic Research, working paper 24993*

Nederlandse Zorgautoriteit (2015), *Marktscan zorgverzekeringsmarkt 2015*. Accessible at https://puc.overheid.nl/nza/doc/PUC_3341_22/1/ (in Dutch).

Newhouse J.P., and the Insurance Experiment Group (1993), *Free for all?: Lessons from the Rand Health Insurance Experiment*. Harvard University Press.

Van Kleef R.C., F. Eijkenaar, R.C.J.A. van Vliet, and W. van de Ven (2018), Health plan payment in the Netherlands. In T.G. McGuire and R.C. van Kleef (eds), *Risk adjustment, risk sharing and premium regulation in health insurance markets*, Elsevier Publishing.

Zare, H. and G. Anderson (2013), Trends in cost sharing among selected high income countries – 2000-2010. *Health Policy* 112(1-2), pp. 35-44.

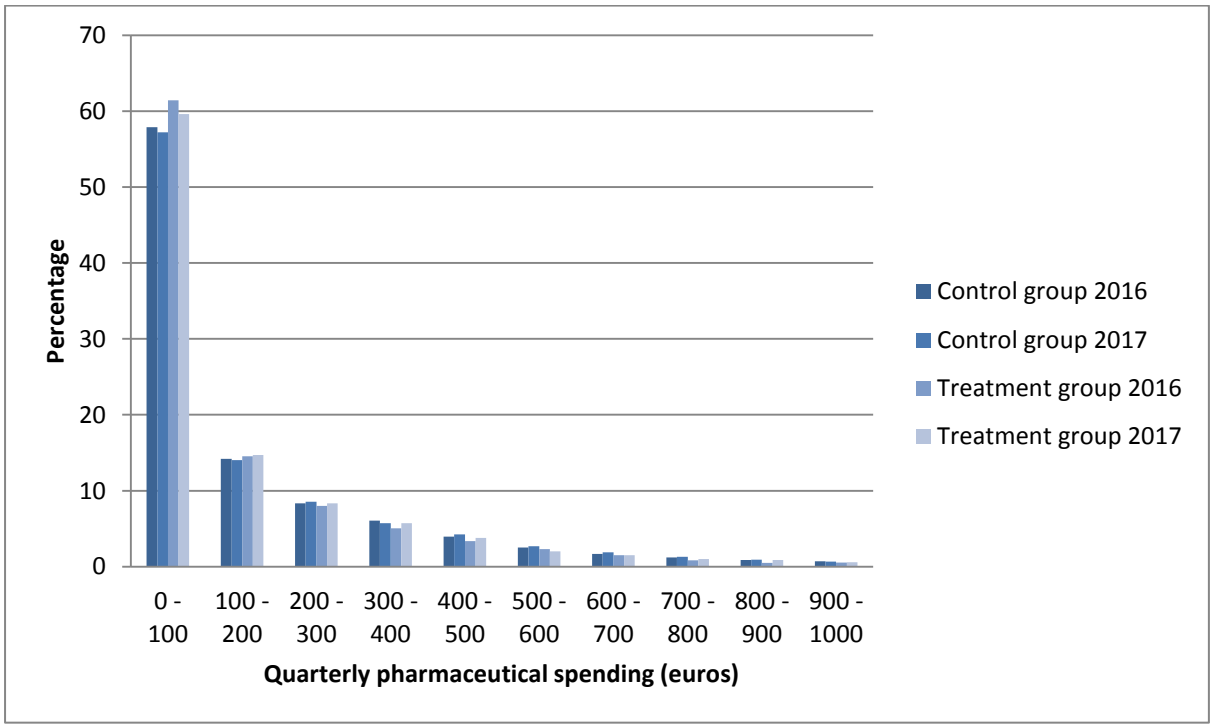
Appendix A: Additional statistics and analyses for the total dataset

Figure A1 contains a histogram of the quarterly spending on pharmaceuticals for the treatment and the control group, for 2016 and 2017. The histogram is cut off at 1,000 euros. For each group and year 2 to 3 percent of the observations is above 1,000 euros and approximately 10 observations per group and year are above 10,000 euros. The maximum quarterly spending fluctuates between 41,000 euro for the control group in 2017 and 49,000 euro for the treatment group in 2016.

In our analysis, we control for the long tail of the spending distribution by analyzing the log of spending. The high spending levels are mostly concentrated at specific persons, hence the individual level constant in the model also helps to correct for the long tail in the distribution. As the number and level of outliers does not differ much between years and groups, there is no need to remove observations. To be sure, we did estimate the main model on a dataset without outliers, using several definitions of outlier, but this indeed did not notably change the results.

When comparing the control and treatment group in Figure A1, the control group has a somewhat lower percentage of observations below 100 euros. The control group also has a slightly higher percentage of observations above 200 euros. This corresponds with Figure 1 in the main text, which shows that the average log spending is higher for the control group than for the treatment group.

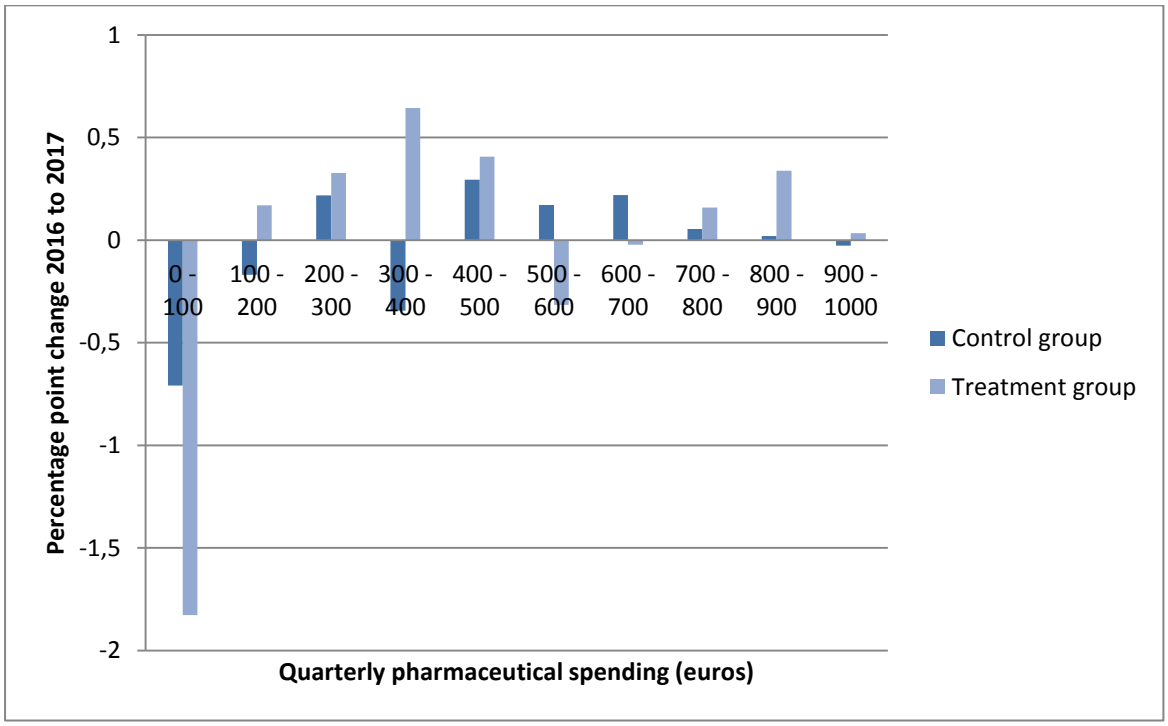
Figure A1 Histogram of quarterly pharmaceutical spending



The effect of the introduction of reinsurance of the deductible in 2017 is not well visible in Figure A1. For both the treatment and control group the percentage of observations in the 0-100 euro range decreases somewhat in 2017. Figure A2 gives the percentage point change from 2016 to 2017 for

each bin. For the treatment group, the percentage of observations in the smallest bin (0-100 euros) decreases more than for the control group, suggesting that the introduction of reinsurance leads persons to move to higher bins, but the difference with the control group is limited.

Figure A2 Percentage point change in observations per bin, 2017 compared to 2016



To obtain more insight in the changes in spending from 2016 to 2017, Table A1 indicates the percentage of persons who had higher spending in 2017 compared to 2016. We calculated this statistic for each quarter (e.g. comparing quarter 1 in 2016 with quarter 1 in 2017) and for the total yearly spending. As a robustness check, the last row gives the percentage of persons who had higher total spending in 2016 than in 2015. As in both of those years both the treatment and control group had a regular deductible, we do not expect to find a significant difference between the groups.

The last column of Table A1 gives the p-value of a chi-square test on the equivalence of the treatment and control group. In quarter 1 the difference between the groups is statistically significant at 1% level, and in quarter 2 at 5% level. In both quarters the treatment group has a higher percentage of persons increasing their spending. In quarters 3 and 4 the difference between the groups is not statistically significant. The total (yearly) spending is again statistically significant at 1% level. When considering the percentage of persons who increase their spending in 2016 compared to 2015, the treatment group has a *lower* percentage than the control group, although this difference is not statistically significant.

Table A1 Percentage of persons with higher spending in 2017 compared to 2016

	Control group	Treatment group	p-value chi-square test
Spending quarter 1	45.4%	49.8%	0,0009
Spending quarter 2	43.6%	46.4%	0,0336
Spending quarter 3	43.4%	44.4%	0,4756
Spending quarter 4	44.4%	45.4%	0,4538
Yearly spending	47.4%	52.7%	0,0001
Yearly spending 2015 to 2016	49.8%	47.6%	0,1040

Our findings on the percentage of persons increasing their spending is in line with our results in the main text, and shows that these main findings do not hinge on a single outlier with major increase in spending.

As a further check, we estimated a modified version of the difference-in-difference equation, with a dummy for pharmaceutical spending (0 for no spending, 1 for positive spending) instead of the log spending as dependent variable. We estimated this equation both with linear regression techniques and with a logit specification. Figure A3 shows the fraction of persons with strictly positive quarterly spending for the treatment and the control group. In the first quarter of 2017, this fraction seems to peak for the treatment group. The model estimates in column 2 and 3 of Table A2 indeed give a positive and statistically significant estimate for the first quarter of 2017. However, the fraction with strictly positive spending is quite volatile, also in 2014 till 2016. Therefore our findings on 2017 must be interpreted with caution and can only serve as supplementary evidence. It might be possible that the increase in spending in 2017 for the treatment group is only partially caused by healthy persons who start using medication in 2017, and is mainly driven by people who already used some medication before.

Figure A3 Fraction of persons with strictly positive spending on pharmaceuticals

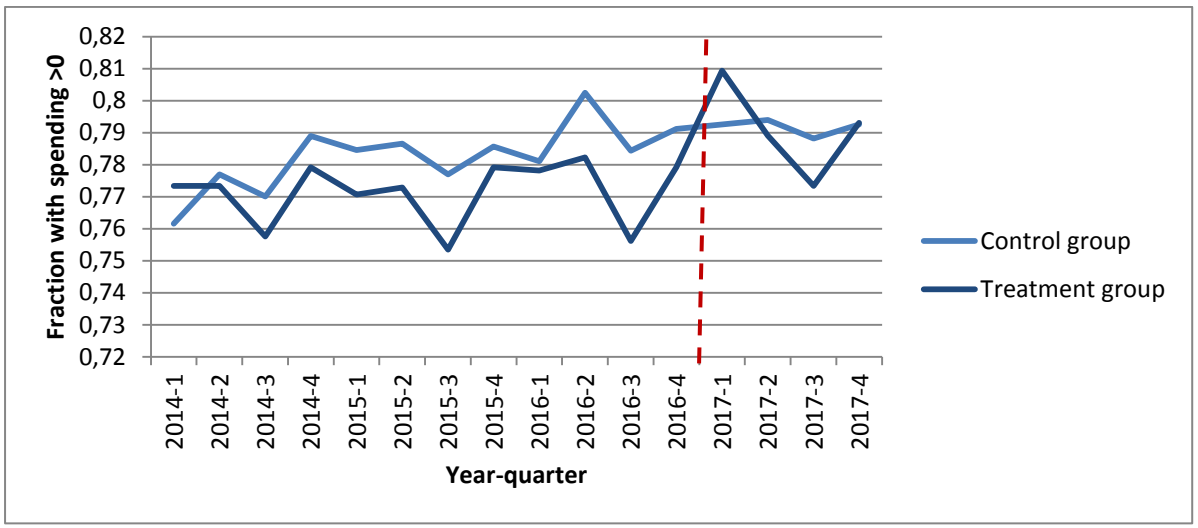


Table A2 Estimation results of robustness analyses

Dependent variable	Dummy yes/no spending	Dummy yes/no spending	Log(spending)	Log(spending)	Log(spending)
Model	Linear	Logit	Linear	Linear	Time trend
$\beta_{2016,1}$				0.016 (0.033)	
$\beta_{2016,2}$				-0.043 (0.033)	
$\beta_{2016,3}$				-0.078** (0.033)	
$\beta_{2016,4}$				-0.011 (0.033)	
$\beta_{2017,1}$	0.028***(0.008)	0.339***(0.103)		0.141*** (0.033)	0.174*** (0.034)
$\beta_{2017,2}$	0.006 (0.008)	0.060 (0.102)		0.056* (0.033)	0.060* (0.034)
$\beta_{2017,3}$	-0.004 (0.008)	-0.054 (0.101)		0.016 (0.033)	0.103*** (0.034)
$\beta_{2017,4}$	0.011 (0.008)	0.131 (0.102)		0.032 (0.033)	0.031 (0.034)
β_{2017}			0.071*** (0.018)		
δ					0.007*** (0.002)
γ_2					0.050** (0.021)
γ_3					-0.081*** (0.021)
γ_4					0.081*** (0.022)

All models include individual level fixed effects, the linear and logit models also include year-quarter dummies
***p<0.01, **p<0.05, *p<0.1

The main analysis focused on the effects at quarterly level. We estimated a slightly modified model that replaces the four difference-in-difference dummies with one dummy for 2017. That is, instead of allowing four different effects in the four quarters, we now restrict the model to estimating a single parameter, which can be interpreted as the average increase in quarterly spending in 2017 for the treatment group, compared to the control group. Table A2, column 4 shows the estimate. The average increase in spending is 7%, which is highly significant.

A standard robustness check of a difference-in-difference model is to include lagged values of the treatment group. In our model, this means including dummies for the treatment group in 2016. The treatment and control group should not significantly differ from each other in 2016, and hence the estimates should be non-significant. This is indeed the case for the first, second and fourth quarter of 2016 (Table A2, column 5). The estimate on quarter 3 is statistically significant at the 5% level. When inspecting Figure 1 in the main text, it can be noted that all dips in spending in quarter 3 are stronger for the treatment group than for the control group. The dummy for quarter 3 in 2016 picks up this effect. The statistically significant negative effect suggests that possibly the estimate for quarter 3 in 2017 is an underestimate of the true effect.

To explore this possibility, we estimated a model with time trend of the form

$$Y_{it} = \alpha_i + \delta T + \gamma_q + \sum_{t=2017,1}^{2017,4} \beta_t I_{treatment,t} + \varepsilon_{it}$$

Here T denotes a linear time trend (i.e. $T = 1$ for the first quarter of 2014 and $T = 16$ for the last quarter of 2017) and γ_q is a quarter dummy. With this specification we allow for a linear upward trend in the costs and for seasonal deviations in this trend.

Because we expect the quarter 3 dummy to be stronger for the treatment group than the control group, we estimate the model on only the treatment group. Note that the identification of the effect of reinsurance now comes from the deviation of the time trend in 2014-2016. This contrasts with the difference-in-difference model, which identifies the effect by the deviation from the trend in the control group.

The estimation results are in the last column of Table A2. As expected, there is a general upward trend in the log spending. Quarter 1 is the reference point; compared to quarter 1 the log spending increases significantly in quarters 2 and 4, and decreases significantly in quarter 3. Given this time trend, the introduction of reinsurance of the deductible leads to higher log spending in quarters 1 and 2 of 2017. The estimates are again comparable to the estimates in the main analysis. In quarter 3, the effect now also is positive and highly significant, indeed suggesting that the difference-in-difference analysis provides an underestimate for quarter 3. As before, the effect for quarter 4 is small and not statistically significant.

As final robustness check, we also estimated a version of this model including dummies for 2016 (not reported here). In this model, none of the 2016 dummies is statistically significant, suggesting that the assumption of a linear time trend with seasonal effects is a good fit to the data and the effects in 2017 are indeed driven by the introduction of reinsurance of the deductible.

Appendix B: additional statistics and analyses for the persons who never exceeded the deductible in 2014-2016

Figure 3 in the main text shows a remarkable increase in spending in 2017, compared to 2014-2016. This increase occurs because we use a subsample of persons who never exceeded the deductible in 2014-2016. By construction, the spending in 2014-2016 is low, as total yearly spending should be below the deductible. At the same time, the persons in the subsample decide to stay in the municipality contract in 2017, even though this insurance comes with an extensive coverage. Hence, it is likely that at least some of the persons expect that they might need this coverage in 2017.

To further substantiate the explanation proposed above, we constructed a sample of persons who did not exceed the deductible in 2014 and 2015, and follow those persons over time. Note that this sample includes the persons who never exceeded the deductible in 2014-2016, but also includes persons who exceeded the deductible in 2016. Figure B1 gives the average quarterly spending (in euros) of this sample. The spending now increases from the first quarter of 2016 onwards and is (in 2016) equal for the treatment and control group. In 2017 there is a substantial difference between the treatment and control group. Closer inspection of the data reveals that this difference is caused by a small number of persons with very high costs. Figure B2 gives the costs where outliers above 1,000 euros are removed. Without these outliers, there is no substantial difference between the groups anymore.

Figure B1 Average quarterly spending of treatment and control group (people who never exceeded the deductible in 2014-2015)

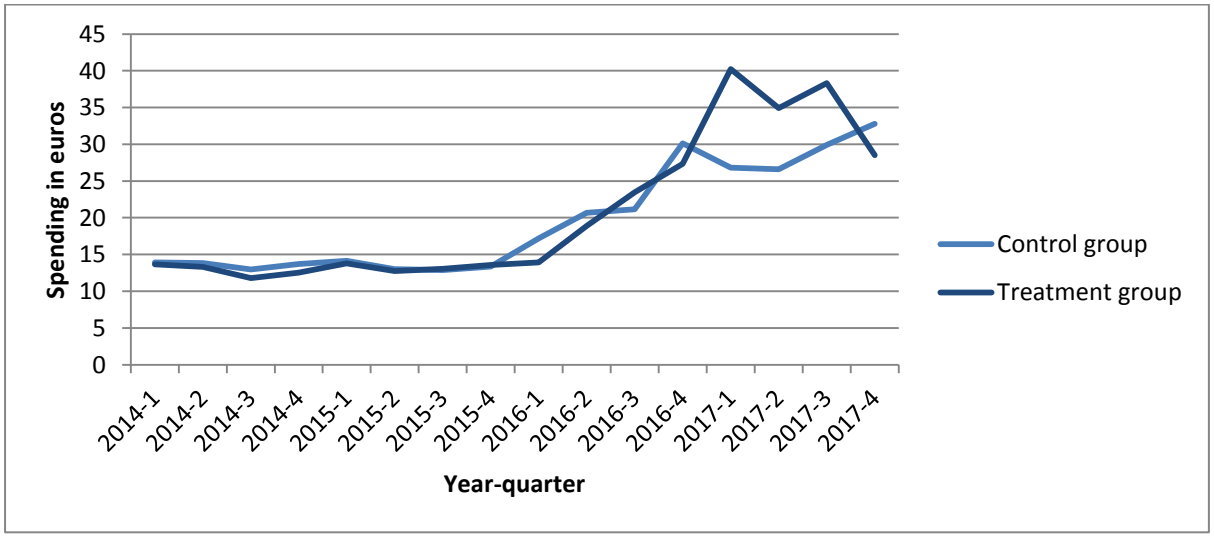
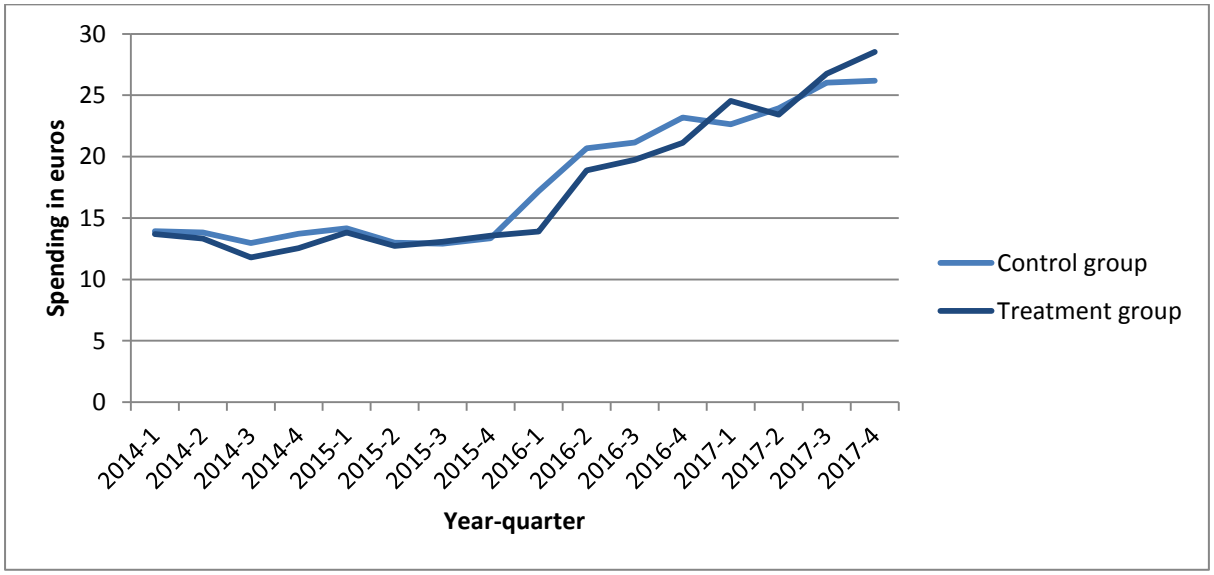


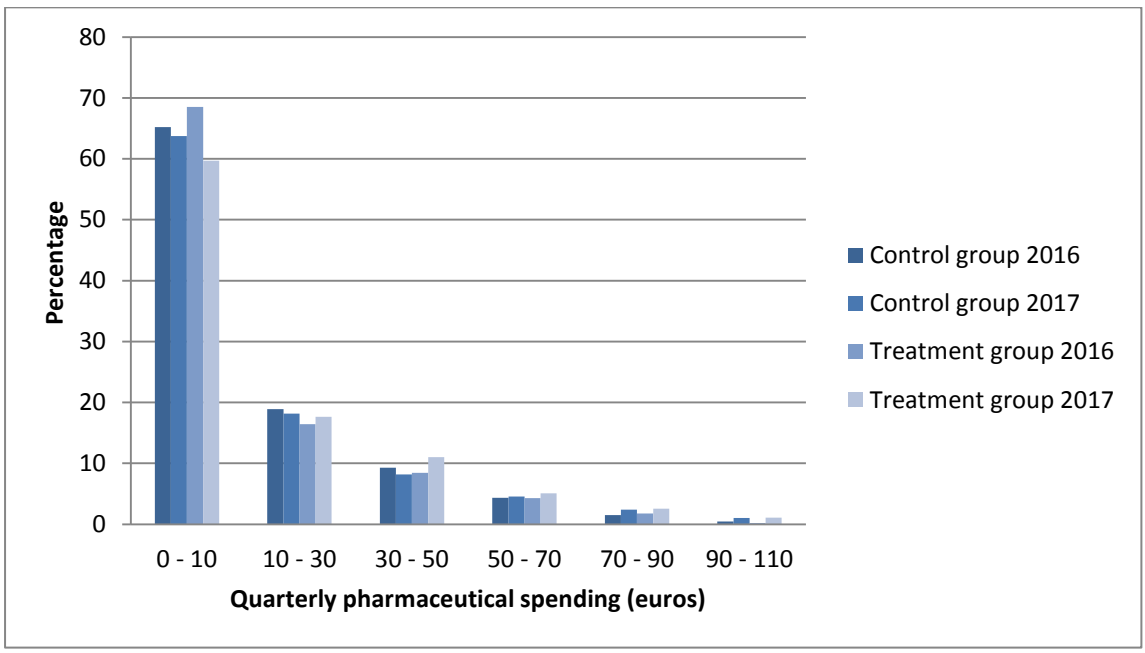
Figure B2 Average quarterly spending of treatment and control group (people who never exceeded the deductible in 2014-2015, excluding outliers)



We now return to a further analysis of the subsample in the main text, consisting of persons who never exceed the deductible in 2014-2016.

Figure B3 contains a histogram of the quarterly spending on pharmaceuticals for the treatment and the control group, for 2016 and 2017. The histogram is cut off at 110 euros. In 2016 about 0,3% percent of the observations is above 110 euros and in 2017 2 to 3 percent is above 110 euros. In 2017, in total 5 observations are above 400 euros, with a maximum of 1,000 euros. Removing those observations did not affect our results.

Figure B3 Histogram of quarterly pharmaceutical spending



When comparing the control and treatment group in Figure B3, in 2016 the control group has a somewhat lower percentage of observations below 10 euros. In 2017 this flips around; after the introduction of reinsurance the treatment group has a markedly lower percentage of observations below 10 euros. Figure B4 zooms in on the percentage point difference between 2016 and 2017. In the treatment group, the percentage of observations below 10 euros decreases with 8.8 percentage points, compared with a 1.5 decrease in the control group. Again, this shows that our results do not hinge on a few outliers in the data.

Figure B4 Percentage point change in observations per bin, 2017 compared to 2016

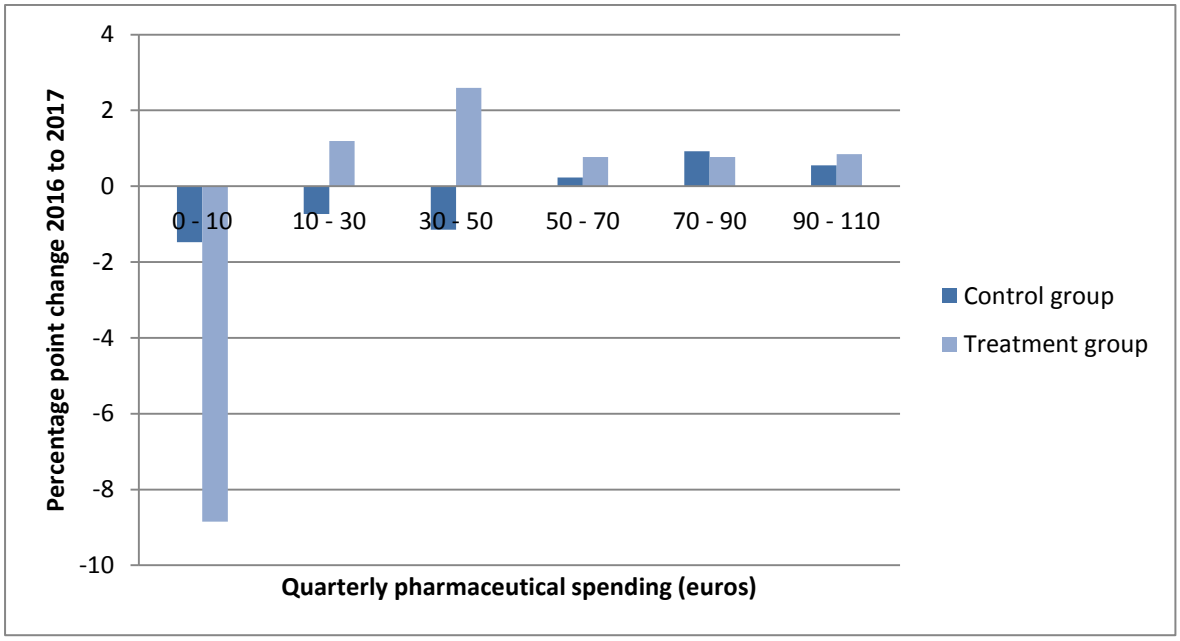


Table B1 indicates the percentage of persons who had higher spending in 2017 compared to 2016. We calculated this statistic for each quarter (e.g. comparing quarter 1 in 2016 with quarter 1 in 2017) and for the total yearly spending. In all quarters and in the whole year, the treatment group shows a larger percentage of persons with higher spending than the control group. As a robustness check, the last row gives the percentage of persons who had higher total spending in 2016 than in 2015. Here, the treatment group shows a lower increase in spending than the treatment group.

The last column of Table B1 gives the p-value of a chi-square test on the equivalence of the treatment and control group. To interpret the p-value, it is important to note that the subsample consists of a relatively small number of persons. This will affect the significance. Still, at yearly level as well as in quarters 1 and 4 the difference between the groups is statistically significant at 5% or 10% level.

Table B1 Percentage of persons with higher spending in 2017 compared to 2016

	Control group	Treatment group	p-value chi-square test
Spending quarter 1	29.8%	36.0%	0,0549
Spending quarter 2	28.0%	32.6%	0,1410
Spending quarter 3	29.1%	32.0%	0,3505
Spending quarter 4	29.3%	35.7%	0,0442
Yearly spending	40.9%	48.9%	0,0182
Yearly spending 2015 to 2016	38.3%	34.6%	0,2536

Finally, Table B2 gives the results of several alternative model specifications. The second and third columns show the estimates of a difference-in-differences model with a dummy for pharmaceutical spending (zero or strictly positive spending) as dependent variable. The second column gives the results of a linear specification, the third column gives the results of a logit specification. The results are equivalent: in the first quarter there is a statistically significant increase in the probability of spending, in the other quarters there is no statistically significant effect. These results suggest that the increase in spending in euros that we observed in the main text is mainly caused by persons who already used a small amount of medication.

Table B2 Estimation results of robustness analyses

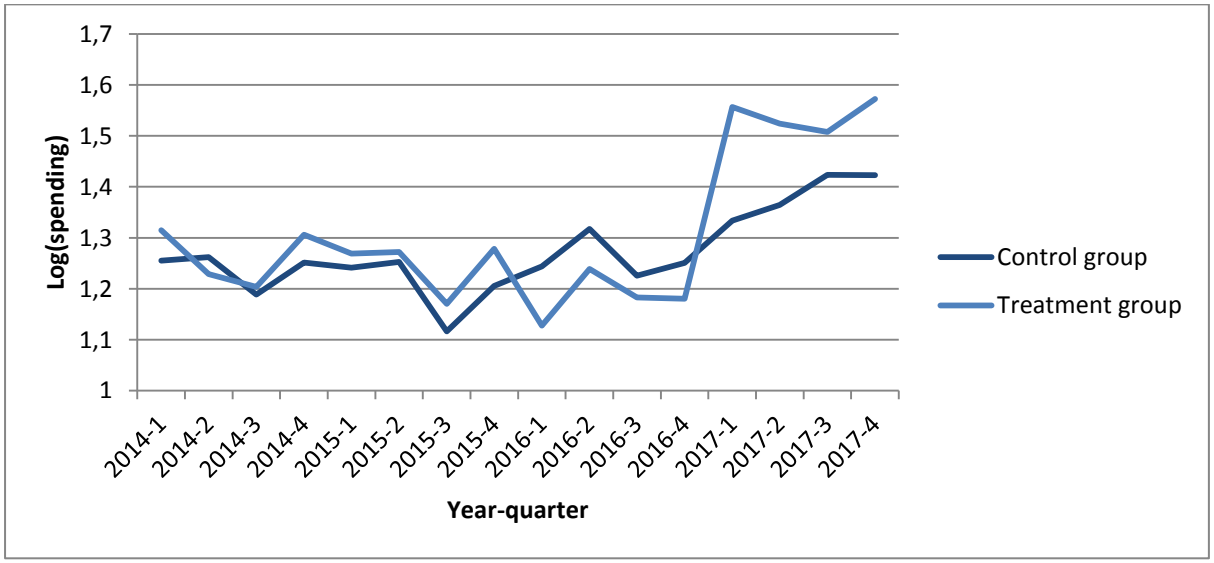
Dependent variable	Dummy yes/no spending	Dummy yes/no spending	Log(spending)	Spending in euros	Spending in euros
Model	Linear	Logit	Linear	Linear	Linear
$\beta_{2016,1}$					-1.266 (1.693)
$\beta_{2016,2}$					0.275 (1.693)
$\beta_{2016,3}$					-1.115 (1.693)
$\beta_{2016,4}$					0.840 (1.693)
$\beta_{2017,1}$	0.050**(0.025)	0.351*(0.196)	0.226***(0.083)		4.067** (1.693)
$\beta_{2017,2}$	0.035 (0.025)	0.236 (0.197)	0.162*(0.083)		3.456** (1.693)
$\beta_{2017,3}$	-0.001 (0.025)	-0.043 (0.197)	0.087 (0.083)		3.682** (1.693)
$\beta_{2017,4}$	0.024 (0.025)	0.150 (0.197)	0.153*(0.083)		4.267** (1.693)
β_{2017}				3.973*** (0.921)	

Models include individual level fixed effects and year-quarter dummies

***p<0.01, **p<0.05, *p<0.1

The fourth column in Table B2 gives the results of the difference-in-differences model when the log of spending is used as dependent variable, instead of the spending in euros. Figure B5 shows the average quarterly log spending for the treatment and control group. As expected, in 2017 the treatment group has higher spending than the control group, but the statistical significance is lower than in the model on spending in euros. This might be related to our findings on the probability of spending. If the results on spending in euros are mainly caused by persons who already used some medication, the increase in spending will be less visible if the log of spending is taken, as the log transformation compresses higher numbers more. E.g. an increase from 0 to 10 euros will be more visible than an increase from 10 to 20 euros.

Figure B5 Average log quarterly spending of treatment and control group (people who never exceeded the deductible in 2014-2016)



The fifth column in Table B2 estimates the average quarterly effect of reinsurance on pharmaceutical spending in euros. As expected, this effect is about 4 euros and is statistically significant at the 1% level. The final column in Table B2 adds the four quarters of 2016 to the model, to test the common trend assumption. As none of the added variables is statistically significant, in 2016 the treatment and control group show a similar development.

Appendix C: additional statistics and analyses for the persons who exceeded the deductible at least once in 2014-2016

Figure C1 gives a histogram of the quarterly pharmaceutical spending for the treatment and control group in 2016 and 2017. The histogram is quite similar to the histogram in Figure A1 for the total sample, except that now there are fewer people in the smallest bin and more in the higher bins. Also the percentage point change from 2016 to 2017 (Figure C2) is quite similar to the change in the total sample. As the group of persons who exceeded the deductible at least once in 2014-2016 is about 85% of the total, and is the group with expected higher use of care, those finding are as expected.

Figure C1 Histogram of quarterly pharmaceutical spending

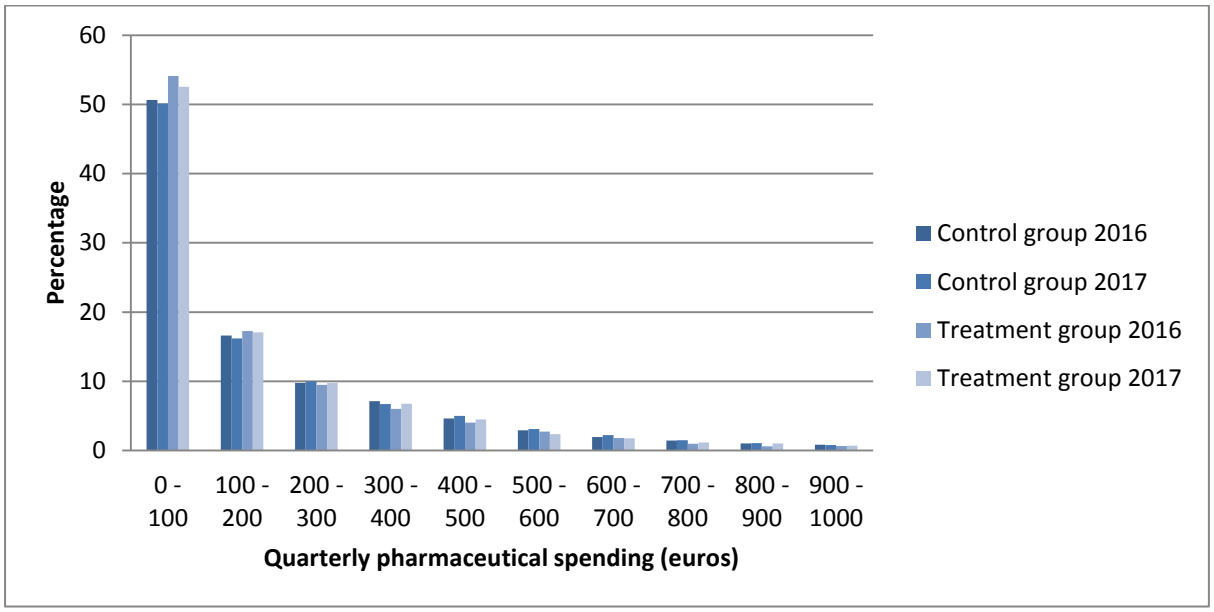
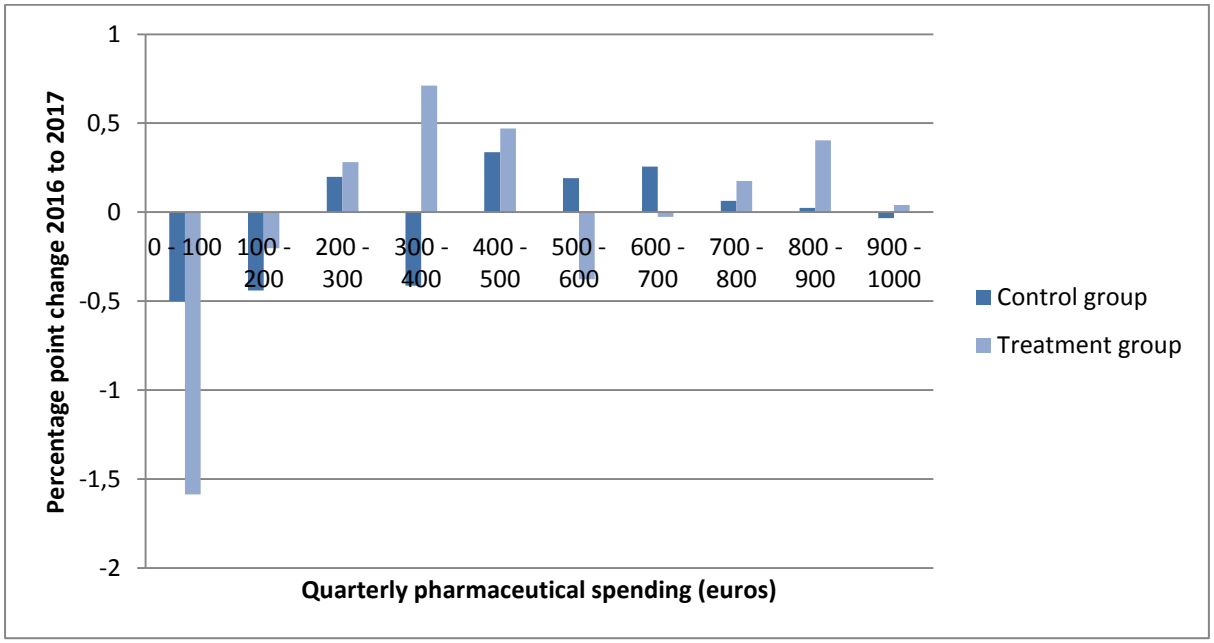


Figure C2 Percentage point change in observations per bin, 2017 compared to 2016



To get more insight in the changes in spending from 2016 to 2017, we again calculate the percentage of persons who had higher spending in 2017 compared to 2016 (Table C1). In quarter 1 the difference between the groups is statistically significant at 1% level, and in quarter 2 at 10% level. In both quarters the treatment group has a higher percentage of persons increasing their spending. In quarters 3 and 4 the difference between the groups is not statistically significant. The total (yearly) spending is again statistically significant at 1% level. When considering the percentage of persons who increase their spending in 2016 compared to 2015, the treatment group has a *lower* percentage than the control group, although this difference is not statistically significant.

As before, our findings on the percentage of persons increasing their spending is in line with our results in the main text, and shows that these main findings do not hinge on a single outlier with major increase in spending.

Table C1 Percentage of persons with higher spending in 2017 compared to 2016

	Control group	Treatment group	p-value chi-square test
Spending quarter 1	48.1%	52.5%	0,0027
Spending quarter 2	46.3%	49.1%	0,0590
Spending quarter 3	45.9%	46.8%	0,5797
Spending quarter 4	47.1%	47.3%	0,8809
Yearly spending	48.5%	53.4%	0,0008
Yearly spending 2015 to 2016	51.8%	50.1%	0,2455

Table C2 Estimation results of robustness analyses

Dependent variable	Log(spending)	Log(spending)	Log(spending)
Model	Linear	Linear	Time trend
$\beta_{2016,1}$		0.047 (0.036)	
$\beta_{2016,2}$		-0.029 (0.036)	
$\beta_{2016,3}$		-0.078** (0.036)	
$\beta_{2016,4}$		0.008 (0.036)	
$\beta_{2017,1}$		0.131*** (0.036)	0.131*** (0.037)
$\beta_{2017,2}$		0.042 (0.036)	0.003 (0.037)
$\beta_{2017,3}$		0.007 (0.036)	0.046 (0.037)
$\beta_{2017,4}$		0.015 (0.036)	-0.0392 (0.037)
β_{2017}	0.053*** (0.020)		
δ			0.011*** (0.002)
γ_2			0.056** (0.023)
γ_3			-0.090*** (0.023)
γ_4			0.087*** (0.024)

All models include individual level fixed effects, the linear and logit models also include year-quarter dummies
***p<0.01, **p<0.05, *p<0.1

Table C2 gives the results for three regressions. In contrast with Appendices A and B, we did not estimate models on the dummy indicating whether someone had zero or strictly positive spending. Almost all persons who have exceeded their deductible at least once in 2014-2016 have strictly positive spending on pharmaceuticals, and hence this model is redundant.

The estimated average increase in quarterly spending in 2017 for the treatment group, compared to the control group, is 0.053 and is statistically significant at 1% level. This parameter implies a 5% increase in spending. Adding dummies for 2016 again gives a statistically significant effect for quarter 3, implying that the effect for quarter 3 in 2017 might be underestimated. However, although the estimate for quarter 3 of 2017 in the model with a linear time trend and quarter dummies is much higher than in the difference-in-differences model in the main text, it is not statistically significant.

Publisher:

CPB Netherlands Bureau for Economic Policy Analysis
P.O. Box 80510 | 2508 GM The Hague
T (088) 984 60 00

November 2018