DEMAND SIDE COST-SHARING AND PRESCRIPTION DRUGS UTILIZATION: EVIDENCE FROM A QUASI-NATURAL EXPERIMENT

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Demand Side Cost-Sharing and Prescription Drugs Utilization: Evidence From a Quasi-Natural Experiment*

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April 2013

Abstract

In this paper we investigate the effects of introduction of lump sum copayments on the utilization of prescription drugs by elderly patients. We make use of an unique dataset and analyze the policy change that implemented patient cost-sharing in the Czech Republic starting in 2008. After the introduction of copayments the number of prescriptions filled decreased by 29%. At the same time, however, total expenditures on prescription drugs dropped only in the first quarter of the postintroduction period and then returned to previous levels. This was partially due to behavioral responses of patients and physicians: strategic shift of prescription purchases to the time right before the introduction of reform, prescription of more packages on one prescription and an upward shift in the price composition of prescribed drugs. Moreover, patients in general decided to forego those types of drugs that did not cause immediate worsening of health status.

Abstrakt

V našem článku zkoumáme efekt zavedení regulačních poplatků na spotřebu léků na předpis. Naše analýza se soustředí zejména na pacienty starší 64 let. K identifikaci využíváme změnu zákona, která zavedla povinnou spoluúčast pacientů v České republice v roku 2008. Naše výsledky ukazují, že po zavedení poplatků se počet vybraných receptů snížil o 20 procent. Naproti tomu, celková cena předepsaných léků se snížila jenom v následujícím kvartálu a pak se vrátila na stejnou rostoucí trajektorii. Bylo to spůsobeno třema druhy behaviorální odezvy pacientů a lékařů: posun nákupu léků do období těsně před zavedením poplatků, předpisovaní více balení na jeden recept (poplatek je placen za každý recept), a předepisování dražších léků. Mladší pacienti byli více ochotní omezit svou spotřebu než starší. Pacienti ale celkově omezili především spotřebu těch typů léků, jejichž neužívání nemá okamžité důsledky na zdravotní stav. Dlouhodobý vplyv na celkové zdraví obyvatelstva nelze nyní jěště spolehlivě odhadnout.

Keywords: health insurance, moral hazard, cost sharing, prescription drugs
JEL classification: I11, I19

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1 Introduction and Motivation

The rapid increase in health care utilization and the corresponding rise in health expenditures over the last decades concern policymakers in most developed countries (OECD 2009). In the European context, rising health expenditures have often led to adoption of additional cost-containment strategies, mostly implemented within the framework of reforms to existing systems of universal health coverage. While some of these measures have been oriented to regulation of providers, those that target the demand (patient) side are most publicly debated. By introducing higher rates of patient out-of-pocket payments policy makers aim to alter the attitudes of people towards their own health, to motivate them to take greater personal responsibility in health care utilization.

The ultimate success and efficiency of cost-sharing measures, however, crucially depends on two main factors. First, universally applied cost-containment measures disproportionately affect vulnerable groups within a population (e.g. youth, elderly, chronically ill), but it is difficult to design adjustment mechanisms for their protection. Second, cost-sharing measures often trigger ex-ante unanticipated behavioral responses. Patients tend to bypass the regulation, and thus develop new behavioral patterns which in turn might have negative consequences for different segments of the medical system. Policy makers should be aware of both pitfalls, understand their implications, and take these into consideration in the process of reform design.

In this paper we investigate the effects of the introduction of lump-sum copayments on the utilization of health care, specifically prescription drugs. We make use of the quasi-experiment of the recent nation-wide policy change that implemented patient cost-sharing in the Czech Republic starting in 2008[1]. Only one year after in-

[1]Motivation for the reform as well as details of its implementation are described in MHCR (2008).

troduction of copayments, regional elections led to political changes that resulted in at least partial reversal of the reform, as regional governments started to reimburse copayments at health care providers owned by regional governments (for details on policy change see Zděnek (2011)). Interestingly, different regions decided to implement different forms of reimbursement, ranging from on-the-spot reimbursement to ex-post payment by bank transfer. In addition, the timing of reimbursement differed. We employ this rich exogenous variation in our analysis. The design of the policy change enables us to not only identify and quantify changes in patient behavior after introduction of the copayment, but also to evaluate how persistent they are over time. Our paper focuses on elderly patients, aged 64 and older. This is often the most vulnerable subgroup of population due to worsened health status, higher prevalence of chronic illnesses and financial constraints due to limited working opportunities and relatively low state pensions[2]

Our results show that after the introduction of copayments the number of prescriptions filled decreased by 29%. At the same time, however, we find that the total price of purchased prescription drugs dropped only in the first quarter of the post-introduction period and then returned to previous levels with a growing trend. We explore determinants of this seeming inconsistency and identify three important behavioral responses to the cost-sharing. First, we find evidence of strategic timing behavior, estimating that people stocked-up on their medications in advance by almost 50% of the monthly pre-reform level of prescriptions. Second, since the copayment was paid on a per prescription basis, the average number of packages per prescription increased by 14%. Finally, the price composition of purchased drugs changed as physicians started to prescribe more expensive drugs. We show that while the segment of cheapest prescription drugs (less than 30 CZK per package)

[2]According to the OECD (2011) the ratio of average pension to average net wage is 64% (for men). This is an average percentage among OECD countries, with Greece and Hungary having the highest and Ireland and Mexico the lowest pensions relative to their respective average net wage.

plummeted by 60% (23% in total price) , the segment of high-cost drugs (more than 300 CZK per package) grew by more than 6%.

We also analyze the effects of policy reversal. We found no level response to the start of reimbursement, however, we found an increase in the linear trend. This implies that while a reaction to the introduction of copayments was an immediate drop in consumption, people reacted to their reimbursement by a gradual adjustment. The magnitude of this effect is lower compared to the introduction of reform also because only a small subset of pharmacies owned by regional governments was reimbursing the copayments.

To analyse the effect further, we looked into the separate reactions of different age groups. The reaction of different age groups to the reform, however, has been strikingly similar. The only difference can be traced in their further development - while younger cohorts were gradually increasing utilisation, older patients remained at the post-reform levels. Patients decided to forego those types of drugs that did not cause immediate worsening of health status (e.g. drugs for high cholesterol or diuretics, and life style maintenance drugs like immunostimulants, products against joint / muscle pain or analgesics). While this decision can be considered a rational outcome of individual cost-benefit analysis, long-term health effects (mainly due to decreased demand in the category of chronic treatment drugs) are yet to be determined. In general, our study confirms that even patients from the highly sensitive subpopulation are willing to change their behavior in response to external stimuli, and that these changes have predictable patterns.

2 Literature Review

The seminal base for the evaluation of the effects of the patient cost-sharing on both medical care utilization and health outcomes are the results of the RAND Health Insurance Experiment (summarized in Manning et al. (1987) and Newhouse

(1993)). In the late 1970's the US government funded a large scale social experiment where participating families were randomly assigned to plans with different levels of copayments and deductibles. The main findings that are important for our study are that (1) cost-sharing matters and (2) the price sensitivity of drug utilization to prescription drug copayments is fairly strong.

With expansion of health maintenance organizations (HMO's) in the US and adoption of similar cost-containment measures in the health care systems of other countries, the literature evaluating these measures has expanded. Recently, much attention has been given to prescription drugs.[3] Goldman et al. (2004) and Landsman et al. (2005) both look at the outcomes of natural experiments in the prescription drug coverage and confirm a significant elasticity with respect to price. They find that the price elasticity differs with different type of drugs - from low elasticity of utilization of drugs treating chronic conditions (- 8% for antidepressants and - 10% for antihypersensitives) to higher elasticity of utilization of treatments for acute diseases (-45% for anti-inflammatory drugs and -44% for antihistamines). Both of these studies, however, were done on samples of non-elderly patients.

Rice and Matsuoka (2004) review studies that focus on the elderly. Most of these studies used cross-sectional data to identify the effect of cost-sharing either directly on health outcomes (Kennedy and Erb 2002; Pilote et al. 2002) or on the degree of "appropriateness" of medical services utilization (Tamblyn et al. 2001). The research designs of existing studies, cross section or simple before and after comparison, did not allow the researchers to control for underlying trends in drug utilization. As the one exception, Johnson et al. (1997) use the quasi-experimental design of comparing the health status indicators of HMO enrollees who experienced an increase in drug copayments with enrollees of different HMO who did not. They do not find any significant effect. Most recently, Chandra, Gruber, and McKnight

[3]Mainly in the context of information used for design of Medicare Prescription Drug Coverage (part D) within the US system of insurance for elderly - Medicare.

(2010) used a natural experiment of changes in elderly patients' cost-sharing with both variation over time and across plans . They not only estimated the elasticities of prescription drug demand, but also provide the first sound evidence on the existence of offset effects (specifically higher hospitalization rates), mainly for the sickest population with chronic diseases.

The first academic study that quantified the effects of the health care 2008 reform in the Czech Republic was conducted by Zápal (2010). He exploits variation created by the legislative waiver that in April 2009 abolished copayments for children aged 0-18 years to measure the effect on health care utilization. He uses data on drug sales from a pharmacy as a proxy for the number of doctor's visits, finding no effect of the reform. He also points out a strong strategic timing effect, with the suggestive evidence of postponing of physician visits after the start of waiver. However, his dataset consists of data from only one Prague pharmacy and the length of the dataset is very limited. The same natural experiment has been utilized by Votapkova and Zilova (2012), who used data from EU-SILC survey and looked at the change in the number of of doctor visits in the year after copayments for children were abolished.

One year after introduction of the copayments in 2008, the Ministry of Health of the Czech Republic prepared a non-technical evaluation document summarized at the March 2009 press release (MHCR 2009). They conclude that regulatory copayments brought yearly savings of 10 billion CZK which were further used to finance the high-cost-treatment of severely ill patients. They also report a 30% drop in the number of (filled) prescribed items and a 21% drop in the number of purchased drug packages.

3 Institutional background

Prior to the reform, the Czech public health insurance system provided complete coverage. The level of cost-sharing by patient was very low (around 10%) and consisted solely of the supplementary payments for prescription drugs (i.e. no copayments).[4] Expenditures on prescription drugs and medical aids together accounted for approximately 60 billion CZK paid from the public health insurance system per annum.[5] The estimated value of unused and expired drugs was between 4-10 billion CZK annually, i.e. 6 - 16 % of the total expenditures on health care (MHCR 2008). Moreover, the Czech Republic had the highest number of physician visits per person in the EU, at 13 visits per year (MHCR 2008). According to anecdotal evidence some of the physician visits were undertaken solely to get a prescription. Ministry of Health claimed that the system of drug prescription and reimbursement was inefficient and that without a reform its financing would be unsustainable in the long term.

On August 21, 2007, the Czech Parliament approved reform of the health care system as part of its comprehensive reform of public finance. The main goal was to establish appropriate incentives on both demand and supply sides of the health care market, thereby controlling costs and enhancing the efficiency of the system as a whole. To achieve this goal, on January 1, 2008, the Ministry of Health of the Czech Republic introduced mandatory cost sharing in the form of lump-sum copayments for several types of health care services including physician office visits (30 CZK), each prescription for drugs (30 CZK), emergency room visits (90 CZK) and each day of hospitalization / institutional care (60 CZK). The patient was obliged to pay 30 CZK for each drug prescribed, regardless of the number

[4]Within the Czech health insurance system, part of the price for a prescription drug is paid by an insurance company (reimbursement), and part by a patient (supplementary payments). The ratio varies with the price of the drug, with more expensive drugs being more generously reimbursed.

[5]The exchange rate was 24.942 CZK/EUR in 2008 and 26.445 CZK/EUR in 2009.

of packages purchased. For the prescription drugs fully paid by the patient (e.g. contraception) the copayment was naturally not applicable.

The main function of the copayments was intended to be regulatory and behavioral. In the case of prescription copayment, the declared intention of policymaker was to lower the total number of prescriptions, with particular focus on low-priced drugs that were also available for the over-the-counter purchase.[6] The additional resources in the system, coming either from savings or from the copayments themselves, were supposed to be used to improve treatment of high-severity illnesses and to finance high cost life-saving medications.

It is important to note that several other changes were made in the system of reimbursement of drugs from the universal health insurance. Value added tax (VAT) on drugs increased from 5% to 9%, effective from January 1, 2008. The reimbursement amounts from the insurance companies have not changed, however, and there was a change in the regulation of profit margins of pharmacies on the prescribed drugs. These steps have prevented the VAT increase being directly reflected in the final price of the drug, i.e., VAT increase was mostly absorbed in the profit margins of pharmacies.

The introduction of patient cost-sharing became one of the main topics of the 2008 election for regional councils, which took place in 13 out of 14 regions of the country (excluding Prague). Newly established regional governments pledged to mitigate the effects of health reform on citizens by reimbursing the copayments for treatment in regional government-owned health centers/hospitals from their own regional budgets.[7] Stredocesky kraj started to reimburse copayments on January

[6] Contrary to common practice in the US, some drugs can be both prescribed and sold over the counter in the Czech Republic.

[7] Different regions decided to implement different types of reimbursement, for example in Stredocesky kraj the patient had to agree (verbally) with the reimbursement of copayment by the region, in Jihocesky kraj the patient had to sign an agreement that he obtained a gift from the regional government, while in Plzensky kraj the patient had to pay the copayment himself and then claim a reimbursement by post.

1, 2009, followed by the other 12 regions from February 2, 2009. The capital city of Prague (the largest region) has never started to reimburse copayments. Some regions only reimbursed selected types of copayments - for example Zlinsky kraj reimbursed ambulance copayments, but did not reimburse ER copayments, or copayments for prescription drugs. This has resulted in great variation in the ratio of reimbursed copayments among the regions (for details on the reimbursement policies of individual regions see Table 1 in the Appendix).

With respect to copayments on prescription drugs, 12 regions (excluding Zlinsky kraj and Prague) have decided to reimburse copayments in pharmacies affiliated with the hospitals and medical centers owned by regional governments (in total 53 pharmacies out of approximately 2400 in the country). Several private pharmacies, including the biggest private chain of pharmacies (with an estimated 120 affiliated pharmacies), have reacted by introducing compensation of copayments in various forms, such as deductions from the price of purchase or gift certificates. They heavily advertised this measure, arguing that if they had not taken it, they would be pushed out of the market. The magnitude of the reimbursement, however, generally corresponded to the reimbursement policy of each particular region.

The institutional set-up of the reform and their reversal created sufficient variation to identify the causal effect of copayments on the utilization of prescription drugs. In particular, it allows us to shed light on the behavioral responses of patients (and physicians) to the introduction of copayments, and the effect of these responses on the efficiency of the new policies.

4 Data and Methodology

4.1 Data and sample construction

We use unique individual level panel data obtained from the major Czech public health insurance company, which currently covers approximately 64% of the population of the Czech Republic. The data spans the period 2006-2009, i.e. two years before the introduction of copayments, one year of their existence and one year after they began to be reimbursed in the regional government-owned medical facilities.

Our sample consists of a balanced panel[8] of 332,724 enrollees older than 64 years, which represents 5% of all enrollees of the health insurance company and 29% of its enrollees older than 64 years of age. The insurance company that provided us with the data is for historical reasons serving more than 77% of the whole elderly population in the Czech Republic. The sample was randomly selected from all elderly enrollees. This allows us to claim that our results give a representative picture of the drugs utilization patterns among the elderly in all regions of the Czech Republic.

Our data provide information about all prescribed drugs, materials and medical aids that enrollees utilized throughout the period of coverage, including both drugs provided at hospitals and physician offices, and drugs purchased by prescription at pharmacies. For our analysis in this paper we focus on prescription drugs collected at pharmacies, because only these were affected by the introduction of copayments, and we disregard the drugs provided in hospitals and during other inpatient admissions.[9] Information in our dataset includes identification of general type of drug

[8] Our dataset consist only of enrollees who were continuously insured at given health insurance company during the entire 4 years. In our analysis we thus do not consider people who changed insurers in the given time period, or have deceased. Even though this might bias results, we argue this would be a downward bias and thus our results provide a lower bound for the estimates.

[9] One could thus argue that part of the estimated effect was offset by an increase in the drugs provided in physician offices and hospitals. Nevetheless, this form of provision accounts for

(the first three digits of ATC nomenclature[10]), number of packages, date of purchase, identification of the physician who prescribed the drug, identification of the pharmacy and the final price of the drug.

We construct four utilisation measures: (1) number of prescriptions filled at pharmacies, (2) total price of purchased prescription drugs[11], (3) total number of packages of prescription drugs purchased, and (4) average number of packages per prescription. We then compute the total of each utilization measure for each cohort in each region, year and month, separately for males and females, which yields 46,977 observations in our final dataset.

4.2 Empirical approach

To quantify the magnitude of the causal effect of the introduction of copayments, we estimate the specification of the form:

$$\begin{aligned}
\text{util}_{\text{crmy}} &= \alpha + \beta_1 \,\text{reform}_{\text{my}} + \beta_2 \,\text{reversal}_{\text{rmy}} + \\
&+ \gamma_1 \,\text{trend}_{\text{my}} + \gamma_2 \,\text{trend_after}_{\text{my}} + \gamma_3 \,\text{trend_reverse}_{\text{my}} \\
&+ \delta_1 \,\text{M}(-3)_{\text{my}} + \delta_2 \,\text{M}(-2)_{\text{my}} + \delta_3 \,\text{M}(-1)_{\text{my}} + \delta_4 \,\text{M}(1)_{\text{my}} + \delta_5 \,\text{M}(2)_{\text{my}} + \delta_6 \,\text{M}(3)_{\text{my}} \\
&+ \rho \,\text{male}_{\text{rmy}} + \omega_1 \text{cohort} + \omega_2 \text{cohort}^2 + \theta_r + \phi_m + \epsilon_{\text{crmy}} \qquad (1)
\end{aligned}$$

where util_{rmy} is selected utilization measure (in logs) for cohort c in region r, month m and year y, and $\text{reform}_{\text{my}}$ is a dummy variable indicating time after introduction of copayments (i.e. Jan08 - Dec09). Variable $\text{reversal}_{\text{rmy}}$ is zero for

only around 9% of all drugs, the rest being prescriptions. Moreover, while the raw number of prescriptions dropped by 29% between 2007 and 2008, the amount of drugs provided by physicians grew by only 4%, which is less than the growth in the previous year (7%).

[10]The Anatomical Therapeutic Chemical (ATC) Classification System is used for the classification of drugs. It is controlled by the WHO Collaborating Centre for Drug Statistics Methodology (WHOCC).

[11]Regarding the total expenditure on purchased drugs, it is important to distinguish expenditures on the price of drugs and expenditures on copayments. In our analysis, we decided to omit the latter, as they are a simple multiplication of the number of prescriptions times 30, and their inclusion would distort information on the change in price composition of the purchased drugs.

the period before the start of reimbursement, while afterwards it takes on the values of the share of copayments that were actually reimbursed in the given region (Jan/Feb09 - Dec09, reimbursement shares available in Table 1). Therefore, we interpret β_1 as the level percentage change in selected utilization measure after the introduction of copayments, and β_2 as additional percentage change after copayments started to be reimbursed by regional governments. We control for linear trend in utilisation corresponding e.g. to ageing and increasing health care needs of our cohorts, as well as for possible changes in trends both after introduction and reversal of the policy.

We also account for the possible strategic timing of drug purchases (stockpilling of drugs just before the launch of reform) by introducing the dummy variables M(-3) - M(3) indicating separately three months before and after copayment introduction.[12] We thus capture a persistent (robust) change in the utilization patterns, rather than one-time shift in the timing of prescription collection. We also estimate an alternative specification without these controls, to demonstrate the importance of this phenomena and its effects on the evaluation of the reform.

Other control variables included are a quadratic polynomial of cohort (age as of 2006), region and month fixed effects ω_c, θ_r and ϕ_m and a gender dummy. We cluster by regions, to allow both for autocorrelation and heteroskedasticity in residuals.[13]

We first estimate both standard and alternative specification without stockpilling dummies on the full sample. Then we use the standard specification to separately estimate effects for six price categories (based on price per one package): drugs priced 0 - 30 CZK (the most affected group of drugs, as the copayment is higher than their price), 30 - 60 CZK, 60 - 100 CZK, 100 - 300 CZK, 300 -1300

[12] The three months period was chosen based on the visual inspection of data.

[13] We considered using GLS to account for autocorrelation and heteroskedasticity, however, estimated standard-errors were similar to the OLS estimation with clustering. Bertrand, Duflo, and Mullainathan (2004) explain the problems stemming from autocorrelation and heteroskedasticity in difference-in-difference estimates.

CZK and more than 1300 CZK[14]. By tracking changes in the price composition of drugs, we can detect whether the prescription behavior of physicians has changed (e.g. they might prescribe fewer low-cost drugs and more high-cost drugs).[15]

Next, we estimate the regression separately for different age groups of patients, to describe how the patterns of utilisation change with rising age. We divided patients into 5 age groups: younger than 70 years, 70-74 years, 75-79 years, 80-84 years and 85+. Finally, we want to assess whether the copayments affected consumption of different drug categories differently, in particular whether there was a different reaction with respect to acute treatment vs. chronic treatment drugs. Therefore, we estimate the regression separately for each of 82 available ATC groups (2nd level).[16]

5 Results

5.1 Estimation on aggregate data

A basic description of the sample as well as of trends in the utilisation of prescription drugs in the analyzed period can be found in the Figure 1 and Table 2. Table 2 provides additional information about the age, gender and regional composition of the sample and summary statistics of both important utilisation measures: the number of prescriptions as well price as the of drugs purchased. Observed trends are in line with general intuition. There has been an increasing share of women in older cohorts, consistent with higher life-expectancy of women and thus higher probability of remaining in a balanced sample. The share of co-

[14]Drugs with price higher than 1300 CZK are the top percentile in the price distribution of drugs in the year 2006. In this category, therefore, we capture the trends in prescription of high-cost drugs.

[15]In the system in which more expensive drugs are usually fully reimbursed, physicians may opt for more expensive drugs, effectively lowering the total amount of payments that patient has to make (supplementary payment for drug plus lump sum copayment).

[16]We have excluded groups with fewer than 50 prescriptions, effectively omitting 12 categories.

hort categories on the total sample population remains constant over the years, indicating a fairly similar response of utilisation to reform. We observe substantial variation in utilisation across regions, Prague being the outlier with the lowest number of prescriptions yet the highest price of drugs purchased per person. Nevertheless, on all levels of categorisation we can observe a drop in the number of prescriptions as well as number of packages after introduction of copayments.

Figure 1 depicts the evolution of different utilisation measures over time, and illustrates the direction and magnitude of change after the implementation of copayments. We observe a peak in the total number of filled prescription items one quarter before introduction, while immediately after these numbers dropped and remained at the lower levels for the next two years. On the other hand, the total price of purchased prescription drugs decreased only temporarily, and resumed growing at increasing rates afterwards. There is a discontinuous jump in the average number of packages per prescription, indicating that prescription of additional packages was a common behavioral response to the reform. Finally, we find that fewer visits to pharmacies have been made by people to fill prescriptions. [17]

These observations were confirmed by the results of our estimation, summarized in Table 3. In panel A we show a robust 29 % level decrease in the **number of prescriptions** filled in the post-introduction period.[18] After the start of reimbursement we observe an increasing trend in the number of prescriptions filled, corresponding to a gradual return of patients to their pre-reform utilisation patterns.

We would like to stress, however, the extent of the **stockpiling effect** and its

[17] Wile there is an evident effect of the introduction of copayments, the question of how individual copayments interacted to cause this effect remains. An analysis of this issue is provided in Appendix 1.

[18] We performed a robust check on our results using the subsample of prescriptions purchased by citizens with residence in different regions, to account for cross-region travelling after the introduction of reimbursement. Nevertheless, results for this subsample were similar to the aggregate results and we have not estimated significant change in the proportion of out-of-region clients after the reform, or its reversal. For detailed results, please contact authors.

implications for policy evaluation. Patients were well-informed about the timing of reform and were able to use the opportunity to save money by asking their physicians to prescribe more drugs before its onset. According to our estimates, during the three months before introduction of reform people stocked up (cumulatively) almost 50% of the pre-reform monthly level of prescriptions, which almost perfectly corresponds to the relative drop in the first quarter after introduction. Comparing the results of two specifications in the Table 3 panel A, we see that without accounting for the strategic timing we would overestimate the overall effect by 12.5%, i.e., by more than a third of its actual value.

While quantity of prescriptions conveys information about patients' visits to physician and its change vis-a-vis the reform, the **number of packages** is more indicative of their actual drug utilization. In Table 3 panel C we report a post-introduction drop in the number of packages purchased by 13% accompanied by significant decrease in growth (-0.3% a month). Response to reimbursement can again be traced to the increase in the growth rate. We detect an even higher stockpiling effect than by prescriptions, cumulatively at 55% of pre-reform values.

Stockpiling behavior motivated us to look at the evolution of the **number of packages per prescription**. We inferred that as the number of prescribed packages is not effectively limited, the rational response would be to increase it to the maximum extent possible given the expiration date. Indeed, we find a significant increase in the number of packages per prescription estimated at 16% (Table 3, panel D). After the start of reimbursement we observe a trend reversal (-0.2% per month), which leads us to infer that this behavioral response is fairly persistent over time. Estimates of the stockpiling effect confirm our assumption that patients have both stocked up on prescriptions before the reform, and have also obtained prescriptions for more packages.

Finally, we look at the **total price** of prescribed drugs. Estimates endorse

visual observation from the Figure 1, where after accounting for the stock pilling effect and consequent offset in utilisation, neither reform nor reversal had significant level effect on thhe total price of prescribed drugs. Comparing columns (1) and (2) in panel B of Table 3 we see that accounting for stockpiling changed the sign of the estimated effect from a decrease (which was communicated by Ministry in media) to an actual increase. On the other hand, we see that after introduction of copayments the trend became significantly steeper (+0.5% per month).

5.2 Price composition of purchased drugs

Growing expenditures on a decreasing number of drug packages (and even lower number of prescriptions) present an interesting paradox, which leads to speculation that the price composition of the drugs prescribed changed. Therefore, we have categorized drugs with respect to their unit price (per package) and estimated the effect of copayments on each group separately. Figure 2 depicts the evolution of the number of prescriptions as well as total price of these drugs over time separately for each price group, together with the representation of the shares that each category represents. To simplify comparison, we present variables in the logs, normalized by the log level in January 2006, i.e., as percentage differences from the initial value. Results of estimation are summarized in Table 4, panels A-D.

The copayments should primarily affect the prescription of cheaper drugs. Those drugs with a price is lower than the copayment of 30 CZK should be particularly sensitive, and, therefore, the patient is better off by directly purchasing the drug over-the counter. Although some lower priced drugs that are available only by prescription (e.g. antidepressants) exist, if they are fully paid by the patient the copayment does not apply. Indeed, our data confirm that the number of packages as well as total price of this group of drugs has decreased discontinuously since the introduction of copayments. In Table 4, panel A we show that the number of

prescriptions dropped by 61%. The start of reimbursement then seems to reverse the decreasing utilisation trend. [19]

Contrary to aggregate results, in this group the total price has persistently dropped by almost 23% percent. It is smaller than a dro in the number of filled prescriptions, which can be explained by 24% increase in the number of packages per prescription. We thus can conclude that for the category of drugs with a unit price under 30 CZK, the reform had the intended effect of decreasing both utilization and expenditures on drugs from the perspective of public insurance. Nevertheless, we cannot infer anything about the amount of drugs purchased over the counter and related expenditures.[20] Moreover, even though drugs under 30 CZK represent around 20% of all packages sold, they constitute only 2-3% of the total price of prescription drugs purchased.

Within the category of cheaper drugs (under 300 CZK), we originally singled out drugs with unit price 30-60 CZK as in this category the price of drug corresponds to the copayment for prescription plus copayment for the physician visit. Yet, the results are very similar to categories 60-100 CZK and 100-300, thus we will comment on them together. We found a persistent drop in both the number of prescriptions filled (30, 26% and 19%, respectively) and a smaller drop in the total price (12, 12, and 0%). This is, however, a much weaker response than in the category of the cheapest drugs. Reimbursement that began in 2009 primarily effected long-term trends, indicating that patients return to their pre-reform utilisation. In summary, in the broader category of drugs cheaper than 300 CZK, we confirm a discontinuous drop in utilization, consistent with the intentions of the reform. This broader category represents more than 90 % of total purchased packages, however,

[19] One could argue, however, that a deeper drop was expected, as prescription of this group of drugs is irrational.We therefore performed a robust check of this estimation using as dependent variable the total price for the prescription (because the prescription could be still rational if more than one package was prescribed). Results confirmed our intuition, with an estimated 88% drop.

[20] These purchases are not recorded by insurance company and thus does not appear in our data

only 50 % of total price.[21] Yet, the results are striking, because as numerous pharmecists have commented by in media, the reform did not effectively change the total purchase price for the patient, as the 30 CZK copayment was absorbed by the lower supplementary payment of the patient.

On the other hand, drugs with unit price higher than 300 CZK represent 50-60 % of total total price of prescription drugs, and the total number of packages in this group did not show any permanent decrease after the reform. Quite the opposite, for the drugs priced 300-1300 CZK, we estimate a 6% increase in the number of prescriptions in the period after reform accompanied by a significant increase in the trend. This translates into evolution of expenditures by 6% increase in total price after the start of reform and an additional 10% after reversal (again with increasing trend). We do not find evidence of a bundling effect in this category.

The increasing trend is even more pronounced in the category of drugs which represented the top 1% of expenditures in 2006, i.e. more expensive than 1300 CZK. Here we find an 18% increase in number of prescriptions accompanied by almost 1.5 percentage points / month increase in linear trend. The number of packages and total price of drugs follow very similar patterns. Again, a bundling effect is not present.

5.3 Changes in the utilisation of prescription drugs by age category

Our analysis of utilisation by age categories is motivated by the different health needs of individual age subgroups. Indeed, in Table 2 we see that patients older than 85 years file almost 50% more prescriptions per person than patients younger than 70 years. Interestingly, however, total price of their drugs only amounts to 90% of the bill of younger patients. Consequently, we ask whether these differences

[21] After reform the ratios changed to a little above 80 % and 40%, respectively.

also imply different willingness and ability to cut down on utilisation.

General trends are illustrated in the Figure 3[22] and estimation results are summarized in Table 5. In general, the magnitude of discontinuous jump in utilisation measures after the introduction of copayments is very similar for all age groups and thus correspond to overall values – 29% decrease in number of prescriptions and approx. 14% decrease in number of packages (with 14-18% increase in packages per prescription), with no significant change in the total price of purchased drugs. The largest difference can be noted for the category of people older than 85 years - as they do not have a long-term trend of increasing utilisation (approx 0.3% per month) and after reimbursement they do not tend to converge to the pre-reform levels, but rather stay at lower post-reform levels.

We were interested in identifying the main driver of the differences between age-categories. First, we compared the price composition of the average "drug consumption basket" of different categories. However, we did not find significant differences. Therefore, we looked further into the utilisation of drugs from different treatment categories.

5.4 Effect of the reform on the utilisation of selected drug categories

In the classification of drugs, we follow the Anatomical Therapeutic Chemical (ATC) classification system which has 14 main groups (1st level) with different pharmacological and therapeutic subgroups (2nd level). While in the dataset we observe 94 categories, for estimation we omitted 12 as having too few observations. For the illustration of general pattern, we have chosen categories that had one of the ten greatest shares in total utilisation of at least one age group in at least one year. In Table 6 we report the share of the given category on the total number of

[22]Again, we simplify comparison by expressing the variables of interest in logs and normalizing them by their value in January 2006

prescriptions for all age groups, and their estimated change after the reform.

The biggest share of all utilised prescription drugs in most age categories was for drugs for the cardiovascular system (group C). in terms of age structure, while for patients under 80 years after reform utilisation of these drugs dropped (ranging from -21% for lipid modifiers to -41% for vasoprotectives), for older patients the magnitude of the drop has been about half of those numbers. We explain this by differences in the need of utilisation. These are maintenance drugs for treatment of chronic health conditions.

Our results indicate that at younger age, where severe symptoms are unlikely to be observed, patients may choose to forego their medication. This becomes less and less sustainable at older ages, when symptoms are more likely to manifest. By way of contrast, a good example of a chronic treatment drug where cutting down on utilisation is not an option are drugs used for to treat diabetes (A10). Indeed, in this category (see Table 6) we see only a modest drop in utilisation in any age category.

On the other hand, in Table 7 we report the top 10 drug categories with the greatest utilisation drops after reform.[23] In line with common intuition, these are mostly so called "life-style maintenance" drugs, where the decision to utilize the drugs lies primarily at the discretion of patients. Indeed, after introduction of copayments all age groups decided to forego use of psycholeptics, vaccines, immunostimulants, medicines treating cough and cold, products against joint and muscular pain, and dermatological preparates.

[23]These categories were selected based on the drop estimated for the age category of people younger than 70 years.

6 Concluding Remarks

In this paper we analyze the natural experiment of introducing small lump-sum copayments for health services in the Czech Republic. Our findings have several generalizable implications for any policy makers considering similar measures. First, we find that people approach reforms with reasonable foresight and adjust their behavior to mitigate the impact of reforms. In our example, patients not only prepare in advance by "stocking-up" on prescriptions few months before the introduction of reforms, but also exploit the weakness of the reform design where the fee is paid per prescription, not per package. This implies that policy makers should: 1) carefully construct the incentive structure of reform in the process of its design (e.g. limit number of packages per prescription), and, 2) in the evaluation stage, be aware of strategic timing issues that can bias initial estimates of the effects.

We have also looked at whether the reform disproportionately affected the most vulnerable subgroups of the population, where we proxy vulnerability by age category. In younger cohorts patients were willing to cut down on their utilisation and lowered their demand for so called "life-maintenance" as well as chronic treatment drugs. On the other hand, in older cohorts the post-reform drop was more limited, indicating that these age-groups cannot forego treatment without severe health implications. One could therefore argue, that the reform did not have an immediate negative effect on the health of elderly, as they have carefully considered which drugs they can and cannot afford to forego. There are, however, also possible negative implications. First, the elderly face a higher financial burden of copayments, which in their case represent a non-negligible share of monthly expenditures (approx 4.5% based on Household Budget Survey statistics). Second, long term health outcomes may be negatively affected by under-utilisation of chronic treatment drugs, consideration that can be confirmed only after passage of time.

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Appendix

Appendix A

Even after analyzing the effect of the reform in total, one important policy question remains: Was the drop in the number of prescriptions filled the result of a copayment for the prescription drugs, or of an introduction of copayments in general and subsequent cutting down on physician visits? How do these different types of copayments interact?

We have attempted to partially answer this question by matching data on prescriptions filled at pharmacies and visits to physicians. We identified the visits to physicians with associated prescriptions by personal ID, physician ID and date of visit in relation to the date of prescription filling (we have chosen max 15 days gap between the two, as this is the deadline provided in the law). 3 types of episodes have been identified:

1. Visits to a physician with associated prescription

2. Prescription without associated visit to a physician: most likely these represent long-term prescriptions, as most of them are prescribed by the same provider and they are filled at fairly regular intervals

3. Visits at physicians without associated prescription

For type 1 and 2 episodes we look separately at how many people visited a physician's office or pharmacy, respectively, in a given period and how many visits per person they made (both attributable primarily to the copayment for the visits) and how many prescriptions were written or filled per visit (impact of a copayment for prescription) both before and after introduction of copayments. For type 3 episodes we look at how the frequency of visits changed over time.

In the Figure 4 we present results for the visits with associated prescriptions. We can see that post-reform drop in the number of prescriptions (around 30%) which can be ascribed to all three levels in the prescription process. Fewer patients make this type of visit in general (-10%), and they make slightly fewer visits per person (-5%). Finally, fewer prescriptions are written at each visit (approx - 5-10%). The magnitude of change varies significantly for different age groups, with the oldest category of having the greatest drop.

Results for episodes where prescriptions were filled without a previous visit to a physician (Figure 5) have a similar pattern, yet much greater magnitude (total drop around 40%, primarily driven by a lower number of patientsmaking at least some visit to a doctor). Again, the differentiation between age groups is only significant at last level - i.e. number of prescriptions filled per one pharmacy visit.

Interestingly, introduction of copayments did not change the patterns of the probability of at least one visit to a GP (Figure 6) or specialist (Figure 7) without an associated prescription being written (while with GPs the pattern is an increasing trend, in specialist visits we see seasonal fluctuations around the constant). Conditional on at least one visit, the non-prescription visits to a GP decreased consistently by 10% (without a hint of reversal), while specialist visits remained roughly the same.

Table 1: Overview of regional reimbursement policies.

Region	Start of reimbursement	Reimbursement of copay for drugs	Type of agreement	% of reimbursed copays	Number of reimbursing pharmacies
Praha	never	NO	NA	NA	NA
Stredocesky	1.1.2009	Yes	oral	95 %	5
Jihocesky	1.2.2009	Yes	written	70 %	7
Plzensky	1.2.2009	Yes	ex-post	25 %	3
Karlovarsky	1.2.2009	Yes	oral/written	63 %	1
Ustecky	1.2.2009	Yes	written	40 %	4
Liberecky	1.2.2009	Yes	written	51 %	2
Kralovehradecky	1.2.2009	Yes	oral/written	65 %	3
Pardubicky	1.2.2009	Yes	written	46 %	5
Vysocina	1.2.2009	Yes	written	60 %	5
Jihomoravsky	1.2.2009	Yes	written	65 %	4
Olomoucky	1.2.2009	Yes	written	65 %	3
Zlinsky	1.2.2009	NO	written	25 %	4
Moravskoslezsky	1.2.2009	Yes	written	45 %	8

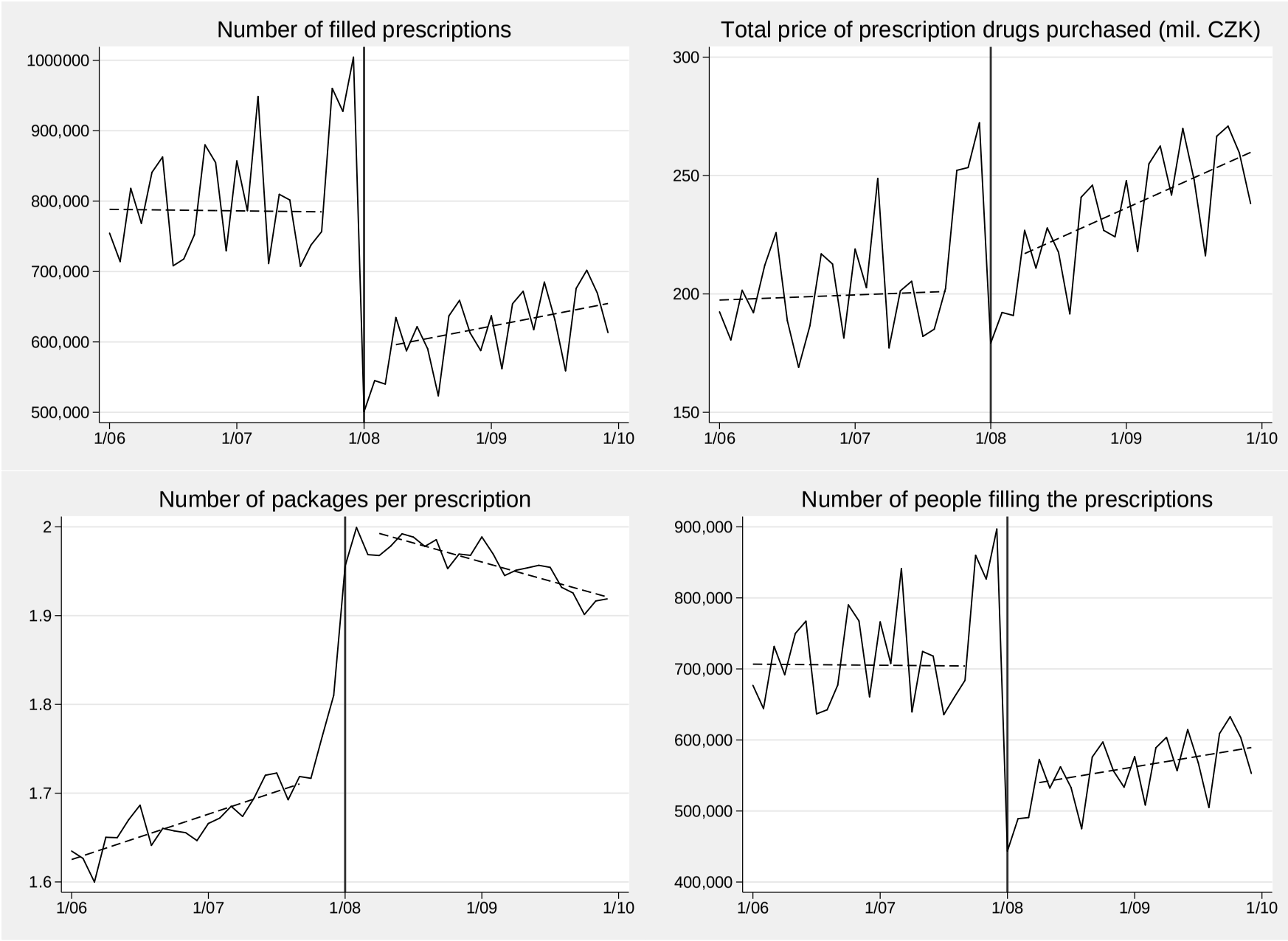

Figure 1: Overview of aggregate utilisation measures, including linear fit before and after reform (1.1.2008)

Table 2: Summary statistics of the sample of patients purchasing prescriptions drugs over 2006-2009, by age category and NUTS.

Age group	% share of group on total	female (%)	**Prescriptions (per person)** 2006	2007	2008	2009	**Expenditures (per person)** 2006	2007	2008	2009
<70	40	57	24.6	26.3	19.1	21.1	7,140	7,840	7,990	9,330
70-74	23	61	30.3	32.4	23.0	25.1	7,980	8,810	8,820	10,240
75-79	20	65	34.1	36.0	25.2	27.0	7,930	8,720	8,560	9,860
80-84	12	71	36.1	37.5	26.2	27.4	7,330	8,950	7,790	8,620
85+	5	75	36.3	37.0	25.5	26.0	6,310	6,550	6,240	6830

Region	**pharmacies**	**patients**	**Prescription (per person)** 2006	2007	2008	2009	**Price of purchased drugs (per person)** 2006	2007	2008	2009
Praha	472	64,755	23.2	24.2	18.0	19.3	7,230	7,750	8,030	9,170
Stredocesky	269	50,015	24.1	25.1	18.3	19.7	5,330	5,800	5,840	6,800
Jihocesky	191	31,224	26.3	28.1	20.4	21.9	6,090	6,710	6,840	7,850
Plzensky	132	23,069	26.1	27.5	20.0	21.3	7,020	7,610	7,670	8,710
Karlovarsky	102	12,401	27.3	28.7	21.0	22.7	6,540	7,110	7,160	8,470
Ustecky	204	32,676	25.9	27.1	20.1	21.7	6,150	6,630	6,900	7,920
Liberecky	118	20,431	25.6	26.8	18.8	20.3	5,870	6,310	6,380	7,310
Kralovehradecky	149	25,915	26.5	27.9	20.4	21.9	6,860	7,250	7,520	8,560
Pardubicky	154	25,616	26.0	27.6	20.3	22.1	6,390	7,110	7,180	8,420
Vysocina	122	22,806	25.8	27.3	20,0	21.4	6,030	6,660	6,810	7,920
Jihomoravsky	361	46,834	28.7	30.1	21.3	22.7	7,400	8,150	8,330	9,300
Olomoucky	157	24,957	27.4	28.8	20.5	22.0	6,900	7,450	7,510	8,530
Zlinsky	160	26,228	28.1	29.8	21.1	22.6	6,490	7,160	7,280	8,290
Moravskoslezsky	302	34,918	28.8	30.5	21.7	23.7	7,030	7,760	7,840	9,200

Table 3: Effect of introduction and consequent reimbursement of copayments on the utilization of prescription drugs.

	A. Number of prescriptions		**B. Price of drugs**		**C. Number of packages**		**D. Packages/prescription**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Reform	-0.411***	-0.285***	-0.144***	0.014	-0.268***	-0.125***	0.143***	0.160***
	(0.017)	(0.021)	(0.018)	(0.023)	(0.016)	(0.020)	(0.005)	(0.006)
Reversal	0.030	-0.008	0.070**	0.019	0.039	-0.005	0.009	0.003
	(0.028)	(0.031)	(0.027)	(0.030)	(0.029)	(0.029)	(0.010)	(0.010)
Trend	0.003***	0.000	0.005***	0.001*	0.006***	0.002***	0.003***	0.002***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Trend_after	0.002	0.000	0.007***	0.005**	-0.002	-0.003**	-0.004***	-0.004***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Trend_reverse	-0.002	0.007**	-0.007**	0.003	-0.003	0.006**	-0.002**	-0.001
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.001)	(0.001)
M(-3)		0.090***		0.130***		0.100***		0.010**
		(0.006)		(0.016)		(0.009)		(0.005)
M(-2)		0.100***		0.158***		0.133***		0.033***
		(0.018)		(0.018)		(0.018)		(0.004)
M(-1)		0.267***		0.330***		0.325***		0.058***
		(0.014)		(0.017)		(0.014)		(0.003)
M(+1)		-0.201***		-0.228***		-0.233***		-0.032***
		(0.023)		(0.030)		(0.023)		(0.006)
M(+2)		-0.017		-0.042*		-0.018		-0.001
		(0.017)		(0.022)		(0.017)		(0.004)
M(+3)		-0.200***		-0.229***		-0.200***		0.000
		(0.013)		(0.019)		(0.014)		(0.005)
R^2	0.941	0.942	0.937	0.938	0.938	0.939	0.350	0.353
N	46,977	46,977	46,977	46,977	46,977	46,977	46,977	46,977

Note: Each panel shows results of regressions of different dependent variables (in logs) under two specifications: (1) baseline regression controlling for level and trend effect of introduction of copayments and reversal; (2) regression with controlling for the timing effect 3 months before and 3 months after introduction of copayments. All regressions control for region, month and fixed effects, gender, as well as cohort effects (quadratic specification) ; SE are clustered on the level of regions. ***,** and * denote significance at 1%, 5% and 10% level; standard deviations are in the brackets

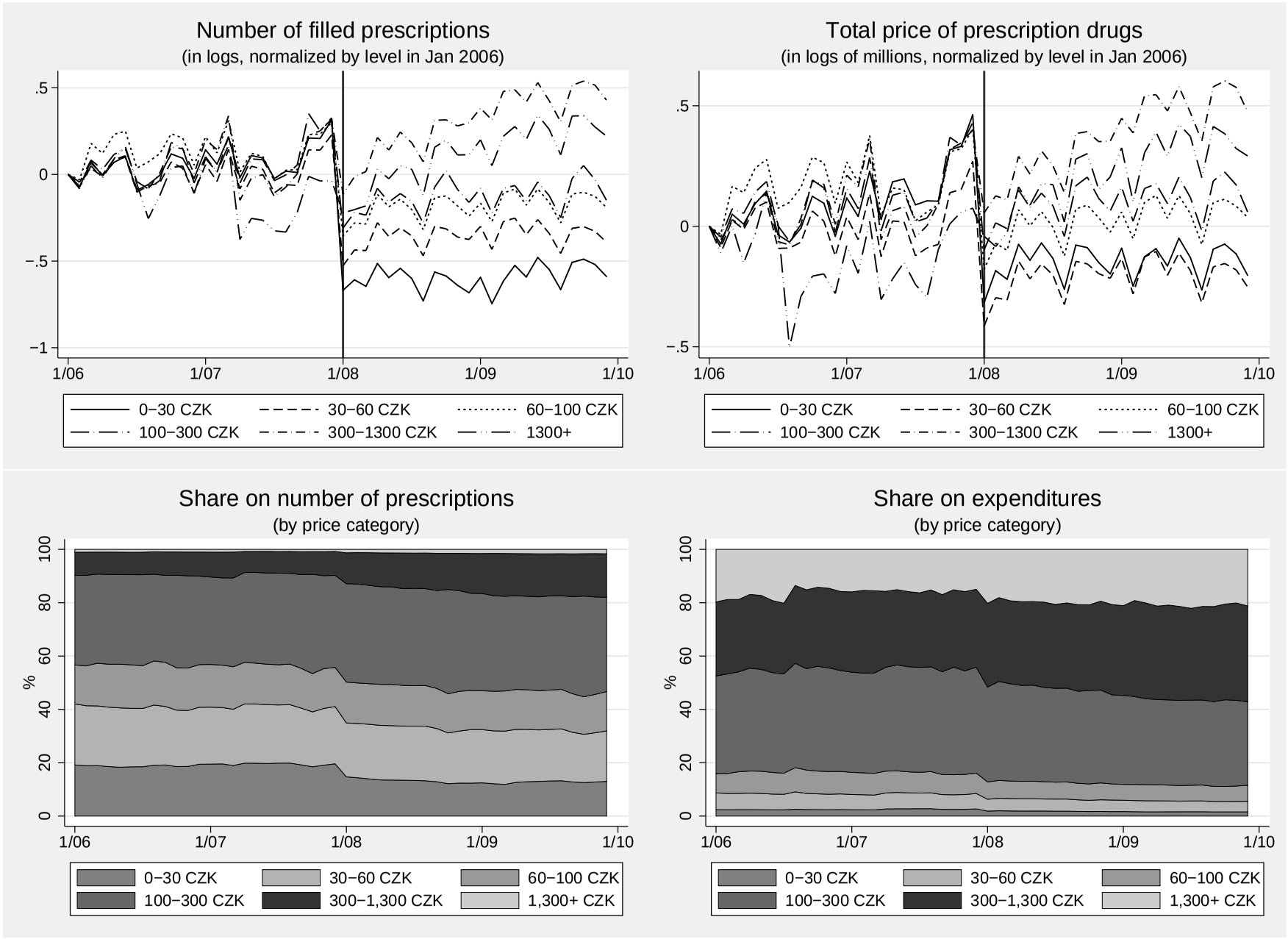

Figure 2: Evolution of total number of prescriptions, as well as of share on total number of prescriptions, by price per package.

Table 4: Effect of introduction and consequent reimbursement of copayments on the utilization of prescription drugs, by price category.

	A. Total prescriptions (log)					
	<30 CZK	30-60 CZK	60-100 CZK	100-300 CZK	300-1300 CZK	>1300 CZK
Reform	−0.608 ***	−0.296 ***	−0.261 ***	−0.186 ***	0.063 **	0.183 ***
	(0.030)	(0.024)	(0.021)	(0.015)	(0.027)	(0.016)
Reversal	−0.064	−0.012	0.007	−0.015	0.086 *	0.045
	(0.046)	(0.031)	(0.028)	(0.029)	(0.042)	(0.026)
Trend	0.003 ***	−0.001	−0.002 ***	0.001 **	0.003 **	−0.015 ***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Trend_after	−0.009 **	−0.001	0.000	−0.002	0.011 ***	0.026 ***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Trend_reverse	0.019 ***	0.005	0.007 ***	0.007 **	−0.002	0.000
	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
R-squared	0.921	0.927	0.933	0.939	0.928	0.733
N	45,430	45,540	44,145	45,626	41,924	33,169

	B. Total price of purchased drugs (log)					
	<30 CZK	30-60 CZK	60-100 CZK	100-300 CZK	300-1300 CZK	>1300 CZK
Reform	−0.228 ***	−0.119 ***	−0.115 ***	0.001	0.057 *	0.228 ***
	(0.024)	(0.023)	(0.020)	(0.017)	(0.031)	(0.024)
Reversal	−0.060	−0.024	0.025	0.012	0.099 **	0.006
	(0.040)	(0.025)	(0.025)	(0.029)	(0.043)	(0.031)
Trend	0.006 ***	−0.002 **	0.000	0.002 ***	0.007 ***	−0.002
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Trend_after	−0.012 ***	−0.000	−0.002	−0.004 ***	0.005 ***	0.016 ***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Trend_reverse	0.010 ***	0.004	0.007 ***	0.006 **	−0.001	0.000
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
R^2	0.904	0.919	0.925	0.936	0.917	0.686
N	45,430	45,540	44,145	45,626	41,924	33,169

Note: Each panel shows coefficients for different dependent variable for different price ranges. All regressions control for region, month and fixed effects, gender, as well as cohort effects (quadratic specification) ; SE are clustered on the level of regions. ***,** and * denote significance at 1%, 5% and 10% level, standard deviations are in the brackets

Table 4: (cont) Effect of introduction and consequent reimbursement of copayments on the utilization of prescription drugs, by price category.

	C. Total number of packages (log)					
	<30 CZK	30-60 CZK	60-100 CZK	100-300 CZK	300-1300 CZK	>1300 CZK
Reform	−0.364 ***	−0.121 ***	−0.113 ***	−0.016	0.060 **	0.177 ***
	(0.026)	(0.024)	(0.020)	(0.016)	(0.027)	(0.021)
Reversal	−0.061	−0.021	0.016	0.008	0.120 ***	0.027
	(0.046)	(0.027)	(0.025)	(0.029)	(0.033)	(0.029)
Trend	0.007 ***	−0.001 *	0.000	0.005 ***	−0.001	−0.003 **
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Trend_after	−0.012 ***	−0.002	−0.003	−0.007 ***	0.012 ***	0.015 ***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Trend_reverse	0.013 ***	0.004	0.007 ***	0.006 **	−0.000	0.001
	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
R^2	0.911	0.919	0.925	0.937	0.920	0.714
N	45,430	45,540	44,145	45,626	41,924	33,169

	D. Number of packages per prescription (log)					
	<30 CZK	30-60 CZK	60-100 CZK	100-300 CZK	300-1300 CZK	>1300 CZK
Reform	0.244 ***	0.175 ***	0.148 ***	0.170 ***	−0.004	−0.006
	(0.010)	(0.005)	(0.008)	(0.005)	(0.008)	(0.015)
Reversal	0.003	−0.010	0.009	0.023 *	0.034	−0.018
	(0.014)	(0.011)	(0.013)	(0.012)	(0.019)	(0.032)
Trend	0.004 ***	−0.000	0.002 ***	0.004 ***	−0.004 ***	0.012 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Trend_after	−0.003 **	−0.001	−0.003 ***	−0.005 ***	0.001	−0.011 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Trend_reverse	−0.006 ***	−0.001	0.001	−0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
R-squared	0.474	0.211	0.245	0.469	0.155	0.141
N	45,430	45,540	44,145	45,626	41,924	33,169

Note: Each panel shows coefficients for different dependent variable for different price ranges. All regressions control for region, month and fixed effects, gender, as well as cohort effects (quadratic specification) ; SE are clustered on the level of regions. ***,** and * denote significance at 1%, 5% and 10% level, standard deviations are in the brackets

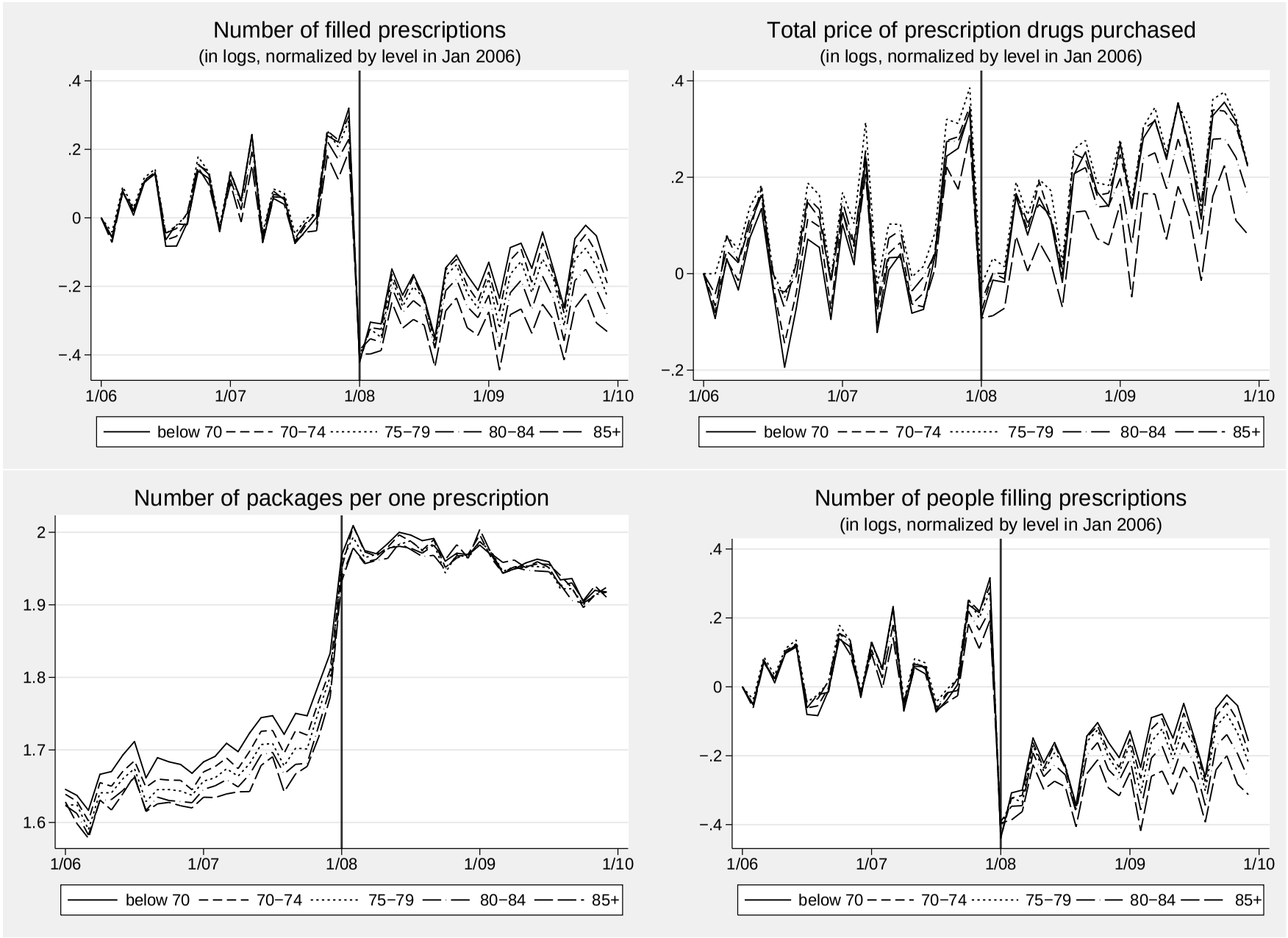

Figure 3: Effect of introduction and consequent reimbursement of copayments on the utilization of prescription drugs, by age category.

Table 5: Effect of introduction and consequent reimbursement of copayments on the utilization of prescription drugs, by age category.

	A. Total prescriptions (log)				
	65-69	70-74	75-79	80-84	85+
Reform	−0.287 ***	−0.291 ***	−0.307 ***	−0.283 ***	−0.285 ***
	(0.022)	(0.020)	(0.018)	(0.016)	(0.031)
Reversal	−0.027	−0.018	−0.032	−0.014	0.017
	(0.034)	(0.034)	(0.035)	(0.031)	(0.039)
Trend	0.002 ***	0.002 ***	0.001 ***	0.001 *	−0.002 *
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Trend_after	0.003	0.001	0.001	−0.002	−0.000
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Trend_reverse	0.006 *	0.007 **	0.007 **	0.009 ***	0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
R^2	0.946	0.959	0.965	0.966	0.866
N	9,408	6,720	6,720	6,720	17,409

	B. Total price of purchased drugs (log)				
	65-69	70-74	75-79	80-84	85+
Reform	0.016	0.013	−0.017	0.041 **	0.003
	(0.020)	(0.019)	(0.022)	(0.015)	(0.049)
Reversal	−0.003	0.007	0.001	0.015	0.042
	(0.031)	(0.026)	(0.027)	(0.026)	(0.053)
Trend	0.003 ***	0.003 ***	0.004 ***	0.002 ***	−0.002 *
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Trend_after	0.007 ***	0.006 ***	0.005 **	−0.000	0.006 *
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Trend_reverse	0.002	0.002	0.002	0.008 **	0.002
	(0.003)	(0.002)	(0.003)	(0.003)	(0.006)
R^2	0.889	0.904	0.935	0.937	0.833
N	9,408	6,720	6,720	6,720	17,409

Note: Each panel shows coefficients for different dependent variable for different price ranges. All regressions control for county and month fixed effects, as well as the average age of patients; SE are clustered on the level of regions. ***,** and * denote significance at 1%, 5% and 10% level, standard deviations are in the brackets

Table 5: (cont) Effect of introduction and consequent reimbursement of copayments on the utilization of prescription drugs, by age category.

	C. Total number of packages (log)				
	65-69	70-74	75-79	80-84	85+
Reform	−0.148 ***	−0.142 ***	−0.150 ***	−0.122 ***	−0.108 ***
	(0.019)	(0.018)	(0.017)	(0.015)	(0.032)
Reversal	−0.008	−0.004	−0.020	0.003	−0.002
	(0.026)	(0.030)	(0.030)	(0.029)	(0.039)
Trend	0.005 ***	0.004 ***	0.004 ***	0.003 ***	−0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Trend_after	−0.002	−0.003 **	−0.003 **	−0.006 ***	−0.003 *
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Trend_reverse	0.005 **	0.006 **	0.007 **	0.008 ***	0.005
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
R^2	0.942	0.956	0.961	0.964	0.857
N	9,408	6,720	6,720	6,720	17,409

	D. Number of packages per prescription (log)				
	65-69	70-74	75-79	80-84	85+
Reform	0.139 ***	0.149 ***	0.158 ***	0.162 ***	0.177 ***
	(0.005)	(0.005)	(0.004)	(0.005)	(0.011)
Reversal	0.019	0.014	0.012	0.017	−0.018
	(0.011)	(0.011)	(0.010)	(0.012)	(0.012)
Trend	0.003 ***	0.003 ***	0.002 ***	0.002 ***	0.001 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trend_after	−0.005 ***	−0.004 ***	−0.004 ***	−0.004 ***	−0.003 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trend_reverse	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
R^2	0.898	0.891	0.892	0.829	0.197
N	9408	6720	6720	6720	17409

Note: Each panel shows coefficients for different dependent variable for different price ranges. All regressions control for county and month fixed effects, as well as the average age of patients; SE are clustered on the level of regions. ***,** and * denote significance at 1%, 5% and 10% level, standard deviations are in the brackets

Table 6: Changes in utilisation of selected drug categories after introduction of copayments, by age categories.

ATC	Description	% share on total consumption					Estimated change in # of prescriptions				
		<70	70-74	75-79	80-84	85+	<70	70-74	75-79	80-84	85+
A - Alimentary tract and metabolism											
A02	Drugs for acid related disorders	2.6	2.5	2.7	2.9	3.2	-0.135	-0.152	-0.145	-0.087	-0.040§
A10	Drugs used in diabetes	4.7	4.1	4.1	1.3	1.7	-0.117	-0.129	-0.147	-0.091‡	-0.040§
B - Blood and blood forming organs											
B01	Antithrombotic agents	5.1	5.8	6.1	6.3	6.3	-0.312	-0.282	-0.272	-0.247	-0.172
C - Cardiovascular system											
C01	Cardiac therapy	2.8	4.1	5.3	6.6	8.0	-0.110	-0.088	-0.066‡	-0.038§	0.082‡
C03	Diuretics	5.4	5.7	6.3	6.8	7.5	-0.123	-0.112	-0.135	-0.102	-0.087†
C04	Peripheral vasodilators	2.0	2.6	3.1	3.8	4.6	-0.177	-0.129	-0.126	-0.053§	-0.068§
C05	Vasoprotectives	3.6	4.0	4.3	4.6	4.8	-0.207	-0.216	-0.197	-0.224	-0.082†
C07	Beta blocking agents	7.3	6.8	6.3	5.7	4.8	-0.129	-0.110	-0.126	-0.092	-0.012§
C08	Calcium channel blockers	5.3	5.2	4.9	4.7	4.3	-0.091	-0.083	-0.075	-0.040†	-0.005
C09	Agents acting on the renin-angiotensin system	11.0	10.3	9.8	9.3	8.5	-0.033†	-0.029	-0.041‡	-0.020	0.020
C10	Lipid modifing agents	6.2	5.4	4.4	3.1	1.8	-0.088	-0.104	-0.091	-0.079†	-0.103§
M - Musculo-skeletal system											
M01	Anti-inflammatory and antirheumatic products	5.5	5.3	5.2	5.1	4.9	-0.265	-0.223	-0.257	-0.239	-0.129
N - Nervous system											
N05	Psycholeptics	2.7	2.7	2.8	3.2	3.8	-0.674	-0.782	-0.808	-0.778	-0.467
N06	Psychoanaleptics	2.7	3.0	3.3	3.7	3.9	-0.063†	-0.027§	-0.079	-0.040	0.016
R - Respiratory system											
R03	Drugs for obstructive aerial disease	2.6	2.6	2.4	2.1	1.9	-0.077†	-0.078†	-0.091	-0.067‡	0.051‡

Note: Drug categories were chosen as top 10 categories used at least by one age group. Dependent variable is the number of packages, all regressions control for county and month fixed effects and control for stock pilling; SE are clustered on the level of regions.
Estimates are all significant at 1% level, if not stated otherwise († - at 5%, ‡ - at 10%, § - not stat. significant).

Table 7: Drug categories with greatest utilisation drop (# of packages) after introduction of copayments.

ATC	Description	<70	70-74	75-79	80-84	85+
J07	Vaccines	-0.816	-0.837	-0.810	-0.636	-0.311§
N05	Psycholeptics	-0.674	-0.782	-0.808	-0.778	-0.467
M02	Topical products for joint/muscular pain	-0.635	-0.573	-0.532	-0.434	-0.224
R05	Cough and cold preparations	-0.569	-0.565	-0.533	-0.413	-0.127§
D08	Disinfectants	-0.444	-0.374	-0.337	-0.440	0.007§
L03	Immunostimulants	-0.418	-0.279	-0.297	-0.082§	0.172§
N02	Analgesics	-0.383	-0.343	-0.311	-0.321	-0.201†
D01	Antifungals	-0.369	-0.265	-0.282	-0.183	0.056‡
B01	Antithrombotic agents	-0.312	-0.282	-0.272	-0.247	-0.172
H03	Thyroid therapy	-0.309	-0.277	-0.314	-0.261	-0.084†
M01	Anti-inflammatory and antirheumatic products	-0.265	-0.223	-0.257	-0.239	-0.129
D06	Antibiotics (dermatological)	-0.252	-0.222	-0.247	-0.151	-0.022§
D07	Corticosteroids	-0.225	-0.123	-0.184	-0.117†	0.020§
C05	Vasoprotectives	-0.207	-0.216	-0.197	-0.224	-0.082†

Note: Categories were chosen by the drop estimated for the age category of people younger than 70. Dependent variable is number of packages, all regressions control for county and month fixed effects and adjust for stock pilling; SE are clustered on the level of regions.
Estimates are all significant at 1% level, if not stated otherwise († - at 5%, ‡ - at 10%, § - not stat. significant).

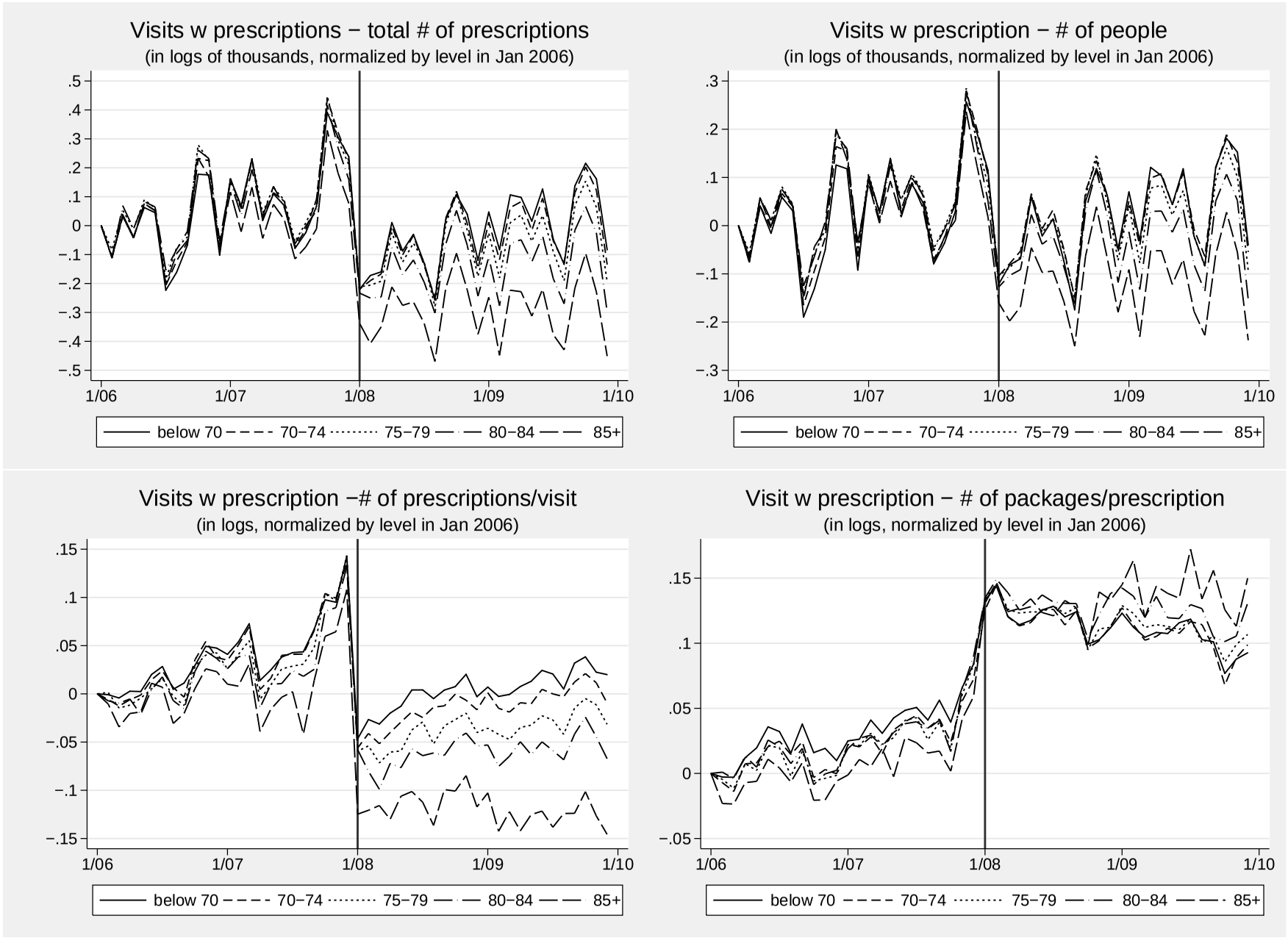

Figure 4: Visits to a physician with associated prescription.

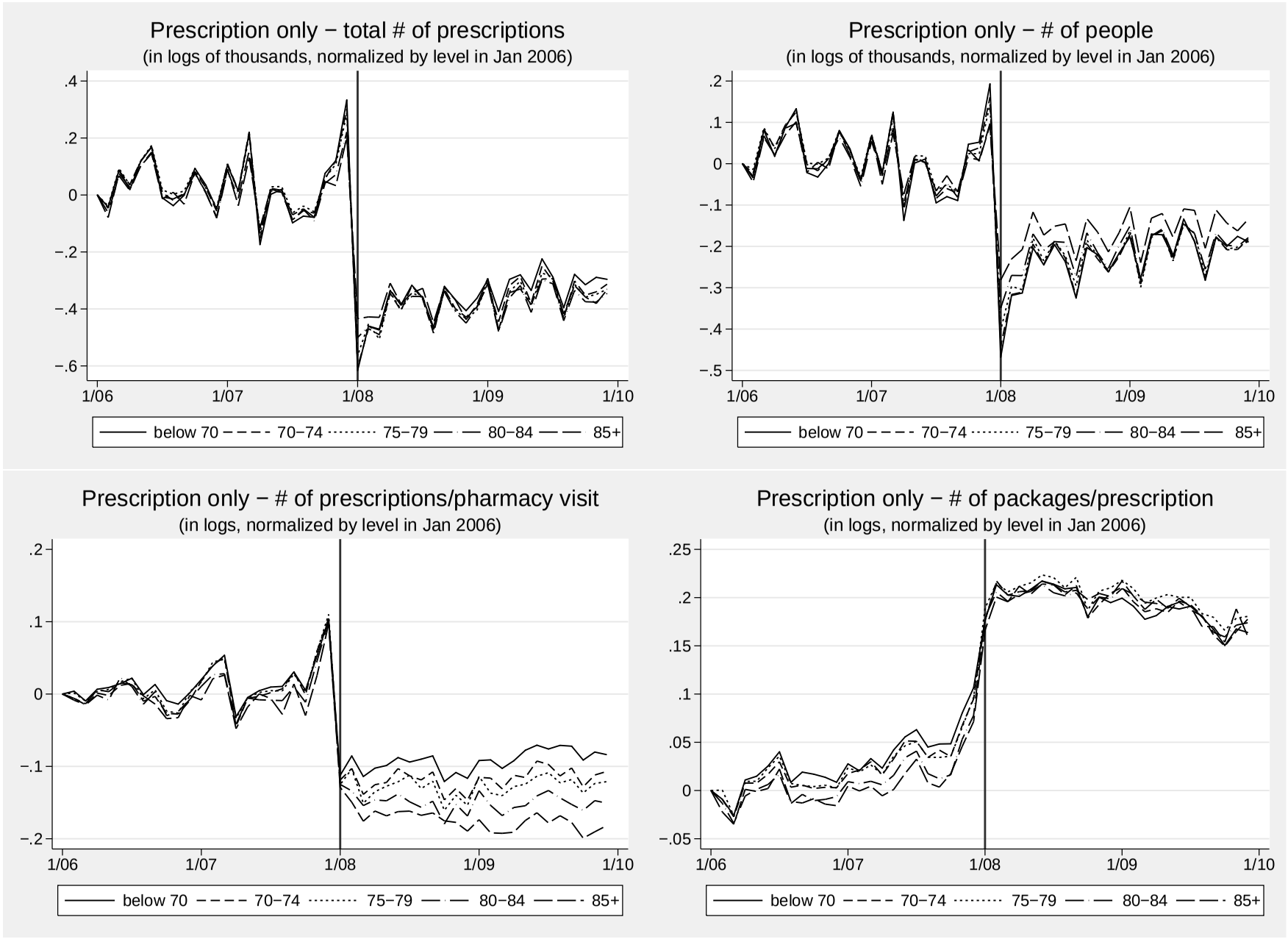

Figure 5: Prescriptions filled at a pharmacy, without a related visit to a physician.

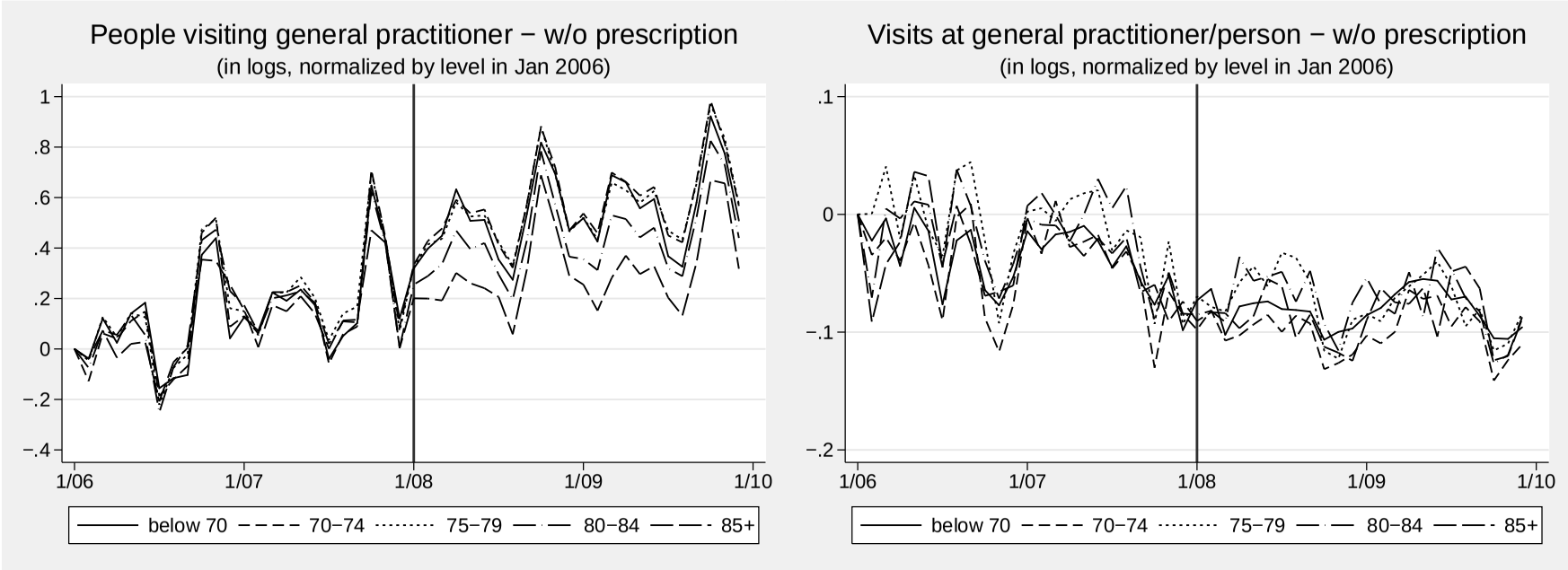

Figure 6: Visits to a general practitioner without associated prescriptions.

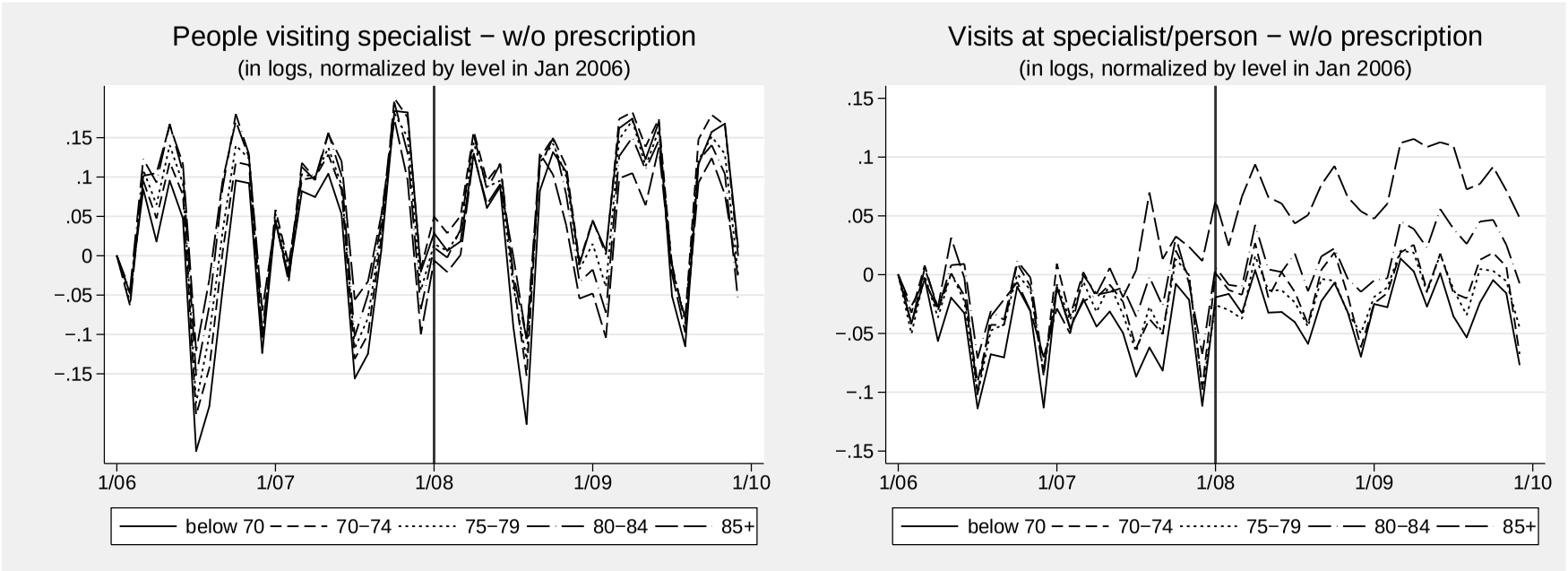

Figure 7: Visits to a specialist without associated prescriptions.

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