An Empirical Study Of Moral Hazard In The NHS

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Introduction

The implementation of centralised healthcare in developed economies (PNHP, 2009), financed predominantly through general taxation (New Zealand, United Kingdom, Hong Kong) or public insurance schemes (Germany, France, Japan), has resulted in an ever-growing fiscal burden on governments (Hagist and Kotlikoff, 2008). A theory for this spending increase is that moral hazard in healthcare has resulted in overconsumption (Bardey & Lesur, 2006), given patients pay a fraction of the marginal cost of their healthcare. In this project, I begin by defining moral hazard in the context of healthcare and then test whether this type of moral hazard exists in the UK, using data collected by the Health Service for England. In the final sections, I present my results and discuss the implications of my findings, any restrictive assumptions and opportunities for further research.

Theoretical Background

Economic literature has defined 'ex post moral hazard' as the response of healthcare consumption to price changes, conditional on an individual's underlying health status (Pauly, 1968). Although this does not constitute a 'hidden action' problem in itself (since seeking healthcare is observed), the motivation behind seeking medical care is still hidden (Cutler and Zeckhauser, 2000). Since individuals are consuming healthcare that has been paid by others (Arrow, 1963), there is overconsumption (in comparison with what would have been consumed at full price) – representing a substitution effect where people spend more on medical care when the price is low (Cutler and Zeckhauser, 2000). I test this by exploiting the existence of exemption rules that provide an arbitrary boundary above which patients receive free medication. A significant change in consumption patterns resulting from this cut-off (after controlling for various explanatory variables), could be suggestive evidence for moral hazard. In the case of fee exemption, we would expect an upward discontinuity and an increase in slope as patients are inclined to consume more healthcare as they age.

Summary of literature

There have been numerous empirical studies about ex post moral hazard caused by health insurance, namely the RAND Health Insurance Experiment in 1974 (Brook et al, 2006), the Connecticut Study (Heaney and Riedel, 1970) and the Oregon Health Insurance Experiment in 2008 (Einav and Finklestein, 2018). The results displayed strong evidence for moral hazard, as individuals paying lower copayment rates consumed more healthcare than their counterparts on different insurance plans (after controlling for overall health, age and other explanatory variables).

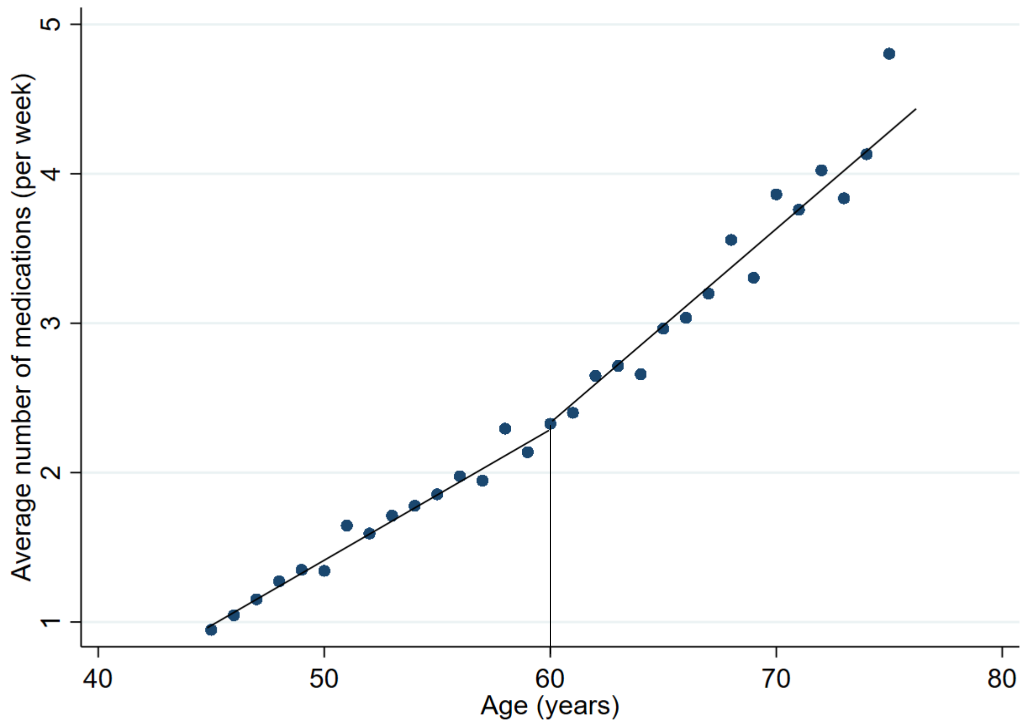
There is however a distinct lack of research into moral hazard in countries with publicly administered healthcare, which may have resulted from a lack of reliable data. Despite this, researchers have used estimation techniques based on regression discontinuity design (RDD) to overcome this problem. Ponzo and Scoppa (2016) use an RDD with instrumental variables to determine the effect of exemption on consumption of specialist visits, diagnostic tests and prescription drugs in Italy. They use a cross-sectional dataset with observations grouped into regions within Italy, which bears distinct similarities to the HSE dataset that I will be examining. The second study (Puig-Junoy et al, 2011) uses panel data that monitored the health status and healthcare consumption of 89,000 people in Spain from 2004 to 2006. Their strategy involves examining changes in consumption of daily medication of individuals who have become exempt within this timeframe.

The papers yielded contrasting results, with Ponzo and Scoppa finding that there was a significant exemption effect on specialist visits but an ambiguous effect on prescription medication. Puig-Junoy et al however found that fee exemption has a significant, positive impact on consumption of medication. This contrast may have resulted from differing estimation strategies or may indicate a structural difference between these healthcare models.

Data

I use the HSE survey datasets from 2008 to 2013 which provides (pooled cross-sectional) data on 109,000 individuals' income and lifestyle and exploit an age exemption, which has been in place since 1975 (Parkin, 2018), where individuals over 60 receive free medication. After accounting for missing values in the dataset, the final number of observations within the window of interest (55 to 65 years old) is approximately 8,300. These missing values occurred in the variables measuring income, which may indicate an unobserved bias if the occurrence of missing values is correlated with the error term.

Figure 1. Average number of medications taken per week plotted against age



From initial inspection, there does not seem to be a significant jump in average number of medications consumed per week at the exemption boundary but there is a noticeable change in slope which could be preliminary evidence for a change in consumption patterns resulting from the cut-off.

Table 2. Summary Statistics

Variable	Mean	Std. Dev.	Min	Max	Observations
Medicines	2.4	2.9	0	22	12,977
Age	59.7	5.96	50	70	17,813
Female	0.535	0.499	0	1	17,813
Income (quintiles)	3.16	1.38	1	5	14,165
General health (1-5)	2.15	0.993	1	5	17,806
Age>=60	0.517	0.5	0	1	17,813
BMI	28.4	5.17	13.5	65.3	15,393

Estimation Strategy

To test whether there is a change in consumption patterns, I use an RDD framework similar to Ponzo and Scoppa's. This model is useful in this context given that age exemption is universal and individuals cannot self-select into the exemption criteria (a common issue in RDD estimations). I regress *Med* (number of different prescription medications taken per week) on the forcing variable (current age) and also include a squared polynomial of age to allow for changes in slope parameters. I then augment the specification with a dummy E_i which captures discontinuity in the exemption rule and interact this dummy with the forcing variable. This exemption dummy will be calculated using an indicator function that maps an individual's eligibility which can be written as $1 \cdot [Age_i \geq 60]$. The formal regression equation is stated below which includes the interaction terms between E_i and the age polynomials. Z_i is a vector of control variables (income, general health, BMI) that will be included to increase the precision of the estimates and u_i is an independent error term.

$$Med_i = \alpha + \beta_1 E_i + \beta_2 (Age_i - 60) + \beta_3 (Age_i - 60)^2 + E_i \cdot \beta_4 (Age_i - 60) + \gamma^T Z_i + u_i$$

The validity of this estimation will rely on the following assumptions:

1. Individuals either side of the cut-off should on average have similar underlying health
2. No credit constraints restricting consumption of medication before the cut-off
3. No change in slope at the discontinuity point for other covariates
4. No manipulation of assignment variable or self-selection at the kink point

Results

In model (1) of Table 1, I control only for *Age*, while in models (2) and (3) I control for income sorted into quintiles with *Income 2* referring to the second lowest income quintile. In model (4), I control for general health by including dummies that represent where an individual is ranked. The base case in this model is *Health – Fair* which has been omitted for collinearity reasons. General health is self-reported but has been approved by the nurse who asked the questions and recorded results. Finally, in model (5), I add a control for *BMI*.

Table 1. Regression Discontinuity Estimates of Fee Exemption Effects on Prescription Medication Consumption.

	(1)	(2)	(3)	(4)	(5)
Exemption - Jump	0.0247	0.00905	0.00747	0.0194	0.00343
	(0.130)	(0.105)	(0.105)	(0.105)	(0.114)
Exemption - Slope	0.0286	0.0519*	0.0516*	0.0380*	0.0240
	(0.0341)	(0.0272)	(0.0273)	(0.0214)	(0.0201)
Age	0.0880***	0.06285***	0.0633***	0.0718***	0.0787***
	(0.0265)	(0.0210)	(0.0210)	(0.0212)	(0.0229)
Health – V. Bad		4.26***	4.26***	4.04***	3.97***
		(0.320)	(0.320)	(0.362)	(0.403)
Health – Bad		2.29***	2.29***	2.15***	2.08***
		(0.165)	(0.165)	(0.166)	(0.181)
Health – Good		-1.89***	-1.90***	-1.72***	-1.75***
		(0.0777)	(0.0777)	(0.0795)	(0.893)
Health – V. Good		-2.81***	-2.81***	-2.54***	-2.54***
		(0.0750)	(0.0751)	(0.0776)	(0.0878)
Female			0.0630	0.0980	0.0656
			(0.0511)	(0.0510)	(0.557)
BMI				0.0804***	0.0827***
				(0.0965)	(0.00620)
Inc2					0.159
					(0.116)
Inc3					-0.0382
					(0.105)
Inc4					-0.141
					(0.104)
Inc5					0.147
					(0.102)
Constant	2.30***	3.58***	3.55***	1.10***	1.18***
	(0.106)	(0.107)	(0.110)	(0.199)	(0.230)
Adjusted R^2	0.0182	0.364	0.364	0.375	0.381
Observations	8,305	8,302	8,302	7,666	6,848

Notes: Standard errors are reported in parentheses. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. Polynomials Age^2 and Age^3 are omitted as they were statistically insignificant and caused large swings in values for other parameters.

In each case, the coefficients for *Exemption – Jump* are negative but given the large standard errors, the coefficients are unlikely to statistically differ from zero. The slope coefficient (which was estimated by interacting cut-off with age) was positive and statistically significant which is suggestive evidence that individuals above the cut-off consume more medication as they age compared to individuals below (after controlling for the age effect itself and other explanatory variables). For example, considering model (3), a 70-year old patient above the cut-off would consume 0.380 more medications per week in comparison with the case if there was no exemption (assuming the assumptions hold). If our previous assumptions hold, this can be interpreted as a moral hazard issue within the market for prescription medication in the UK as individuals' consumption patterns have responded to changes in price (implemented through an exemption rule). The control variables for general health, BMI and age were all significant and in line with the theory.

The absence of a jump effect is compatible with previous studies using similar estimation strategies but this result changes when the method is changed (as highlighted previously). This sensitivity to methodology may indicate a flaw in the estimation strategy itself, given the strong assumptions needed to build this model. The time grid used in this estimation (to measure age) may have also contributed to this issue as it was only measured in years which created difficulties when attempting to estimate a sudden cut-off. This may have dampened the jump effect leading to a negative bias on the coefficient on *Exemption – Jump* resulting in misleading results. With regards to the assumptions behind the model, Assumption 2 is least likely to hold as there may be certain members of the population unable to consume enough healthcare before the cut-off (due to credit constraints) and are priced out of the market. Hence these individuals' 'hidden motivation' (as explained previously) may stem from various credit constraints and not through moral hazard itself. Assumption 1 may also not hold due to age effects on health but this bias has been mitigated through the use of control variables for general health and age itself.

Although there was no observed jump effect, there was a change in slope coefficient (represented by *Exemption – Slope*) which shows that individuals become more inclined to consume healthcare as they age, instead of responding immediately to a sudden change in medication price. The intuition behind this result is that individuals above the cut-off become more receptive to their healthcare requirements (given it's now free) and therefore consume more medication as they progressively develop more illnesses (through old age). This seems to make sense as we would not expect people to suddenly experience illnesses at an arbitrary cut-off and subsequently start to overconsume healthcare. Nevertheless, this change in consumption patterns is still characterised as moral hazard since patients are consuming more medication given their exemption. Another explanation for the absence of a jump effect is that prescription medications can only be accessed through GP referral, which limits overconsumption since patients must first undergo a medical examination before being allowed to consume medication. A more revealing study would be to examine GP appointments but since they are free universally, there is no exemption rule or change in price to be examined. Finally, we must also recognise that 90% of all medication in the UK is already provided for free (Parkin, 2018) through a number of other exemption rules, which means a large proportion of patients are already receiving medication for free, before reaching the age cut-off. Therefore, consumers may be ‘pricing in’ free medication before the cut-off is reached and so they do not alter their consumption patterns immediately.

Concluding Remarks

The results from this project are suggestive of ex post moral hazard due to changing consumption patterns given free medication but there is no strong evidence for an immediate jump in consumption arising at this price cut-off. This can be interpreted as an individual’s demand for medication becoming more responsive to this individual’s needs, given the price is now fully subsidised. For this to occur, there must be an underlying health-based demand for medication which is unlikely to change dramatically solely due to an arbitrary cut-off. These results are significant as they suggest moral hazard is present in the NHS but they also do not indicate that a population’s demand for healthcare will not immediately respond to price changes – a potential tool for policymakers looking to implement socially efficient public healthcare systems. However, the estimation has only considered a small part of the NHS and the strategy used may also be vulnerable to various methodological issues that would need to be examined in further research. Therefore, this project is only a preliminary foray into a multi-faceted problem facing public healthcare provision and there remains potential to explore this issue further.

Appendix

Figure 2. Histogram displaying medication consumption for individuals aged 59

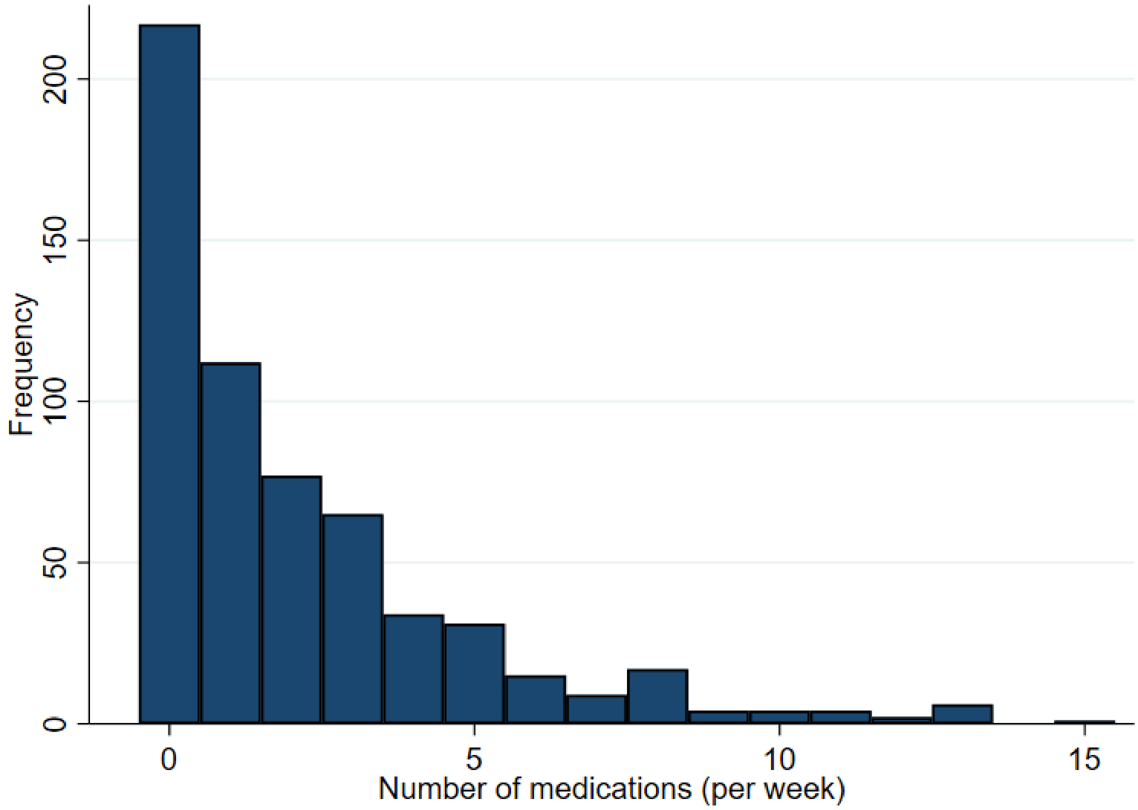
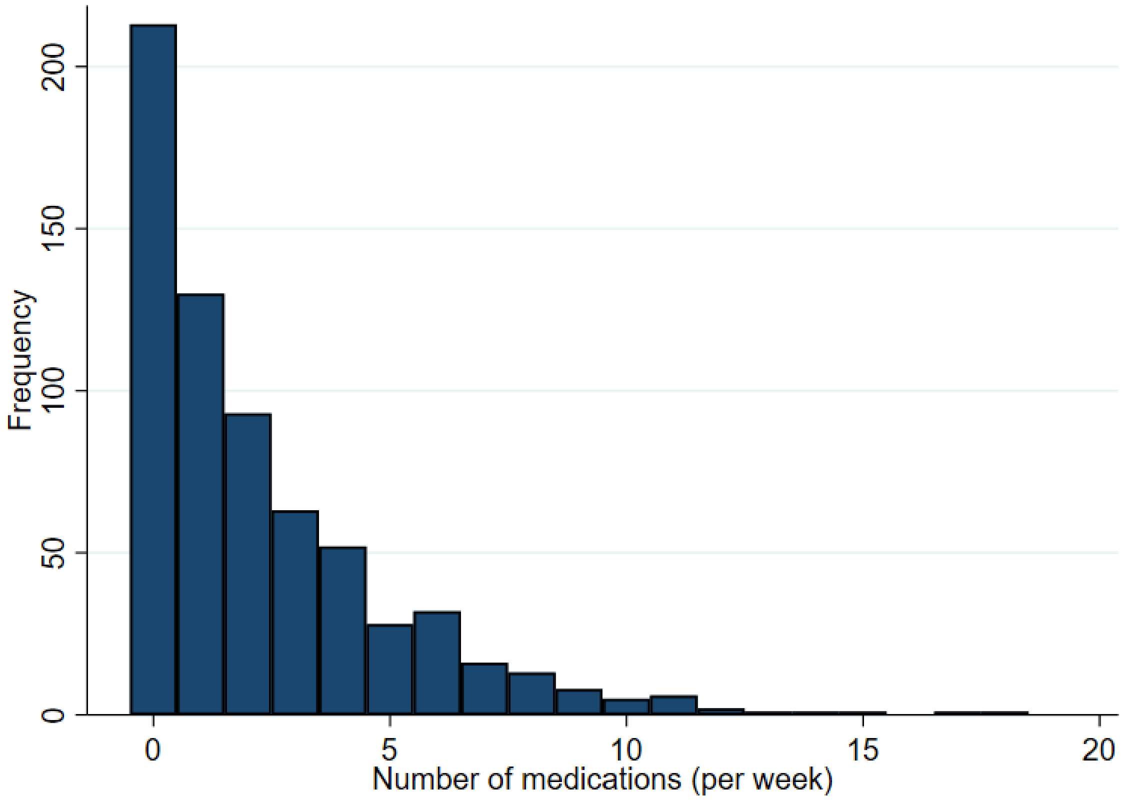


Figure 3. Histogram displaying medication consumption for individuals aged 60



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