



# Prescription drug use under Medicare Part D: A linear model of nonlinear budget sets<sup>☆</sup>

Jason Abaluck<sup>a, b, \*</sup>, Jonathan Gruber<sup>b, c</sup>, Ashley Swanson<sup>b, d</sup>

<sup>a</sup> Yale, USA

<sup>b</sup> NBER, USA

<sup>c</sup> MIT, USA

<sup>d</sup> University of Pennsylvania, USA

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## ABSTRACT

Medicare Part D enrollees face a complicated decision: they dynamically choose prescription drug consumption in each period given difficult-to-find prices and a nonlinear budget set. We use Part D claims data to estimate a flexible model of consumption that accounts for nonlinear prices, dynamic responses, and salience. We use reduced form price responses from a linear regression of consumption on coverage range prices to compare performance under several models of behavior. We find small price elasticities, substantial myopia, and that salient characteristics impact consumption beyond their effect on prices. A hyperbolic discounting model with salience fits the data best.

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## 1. Introduction

In many insurance markets, the structure of benefits is complex and difficult to understand. Coverage generosity often varies nonlinearly as a function of total insured consumption to date, and generosity varies across products in order to steer consumption toward more cost-effective options. From a policy perspective, we would like to know how variations in plan design impact consumption. But the complex nature of insurance contracts creates a dual problem: optimal behavior for rational consumers is hard to calculate, and consumers likely depart from this rational benchmark.

In the context we study, the Medicare Part D prescription drug benefit, plans vary widely in their deductibles, in the copayments and coinsurance for prescriptions above the deductible, and in their coverage of drugs in the infamous Part D “donut hole” where the

standard plan offers no coverage. Moreover, prices within a given plan and coverage phase vary across drugs due to some drugs' favorable formulary placement. Enrollees face a complicated nonlinear budget constraint for their consumption decisions, wherein both current and future prices are a function of consumption to date, uncertainty may be realized gradually over time, and prices for each unit of consumption may be difficult to discern. The complexity of this optimization problem may be particularly onerous for an elderly population such as those enrolled in Part D.

In this paper, we present a model of consumption with nonlinear budget sets which accounts for dynamic incentives given uncertainty and myopia as well as variation in the salience of different aspects of the insurance contract. We use reduced form regressions to determine how enrollees respond to price throughout the budget set and relate these to several structural models of consumption behavior. We identify causal responses to prices throughout the budget set using year-to-year changes in coverage phase-specific prices. Notably, our identification of responses to price changes will be appropriate for modeling counterfactuals such as filling in the donut hole, in that the vast majority of enrollees at any given time were enrolled in the same plan in the previous year. This framework is very flexible and admits a variety of different price responses – in particular, it allows for the possibility that inertial consumers do not notice year-to-year changes in cost-sharing but are very sensitive to within year changes in prices.

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\* Corresponding author.

E-mail address: [jason.abaluck@yale.edu](mailto:jason.abaluck@yale.edu) (J. Abaluck).

The standard approach to estimating demand in the presence of non-linear budget sets is to estimate a nonlinear structural model assuming a particular model of optimization behavior as in Hausman (1985) and Kowalski (2015). However, traditional models of a response to nonlinear budget sets assume that all price responses reflect a single underlying parameter that determines price elasticities. More recent examples relax this assumption to incorporate behavioral responses such as myopia, typically modeled using a discount factor; see Einav et al. (2015) and Dalton et al. (2015) for two excellent recent examples in the Part D context. A central element of these newer approaches is to achieve identification from the response of individuals near “kinks” in the budget constraint, such as the one created by the donut hole in Part D plans.

These approaches face three key limitations. First, as has been discussed in detail in the energy economics literature, lack of information or understanding about prices may lead consumers in nonlinear contracts (such as insurance contracts and electricity contracts) to use rules of thumb beyond discounting in determining their consumption.<sup>1</sup> Second, just as consumers may not be perfectly forward-looking in their consumption behavior, they may also be confused about how visible changes in benefit coverage impact the prices they face. A large recent literature in economics highlights the role of price “salience,” which leads consumers in complex or nontransparent environments to be inattentive to some prices (see Chetty et al., 2009 for a review). The structural empirical literature in health care has not typically allowed consumer responses to vary with price salience. Third, most individuals who consume prescription drugs in Part D are not near the budget constraint kink created by the donut hole. Indeed, only 10% of individuals in a given year end the year within \$200 of the donut hole, and that 10% is observably sicker than the average enrollee, with higher medical spending and more chronic illnesses.<sup>2</sup> Moreover, many individuals who are impacted by policy counterfactuals such as filling in the donut hole are those who end the year well past the donut threshold – according to our estimates, only 14% of the effect of filling in the donut hole is accounted for by enrollees ending the year within \$200 of the donut hole kink. It is therefore unclear whether the results identified by this particular variation extend more broadly to the population of Part D enrollees.

We present a new model of prescription drug demand that addresses all of these concerns. To do so, we draw on the spirit of the nonparametric estimation approach in Blomquist and Newey (2002). Instead of imposing one structure that incorporates all budget segments (e.g., that a particular level of myopia completely explains the relative responses to current and future prices), this approach allows the data to tell us how enrollees’ consumption throughout the year responds to different budget set segment prices.<sup>3</sup> We also allow enrollees to respond to variables capturing nominally large changes in benefit coverage that may be more salient. This reduced form model is then embedded in a structural model of drug consumption which allows us to better assess which beneficiaries are impacted by changing prices and how these prices impact the time path of consumption.

We demonstrate that linear regression methods can be used to recover parameters from structural models of consumption for

individuals whose marginal prices are in the interiors of budget set segments. This approach allows us to estimate price sensitivity for individuals throughout the Part D spending distribution and not just within a relatively narrow spending range near the budget set kink.<sup>4</sup> One advantage of our approach relative to existing approaches is that we can estimate structural parameters without assuming knowledge of the full distribution of consumer uncertainty. Instead, we assume only that we can forecast with very high probability the likelihood that consumers will end the year in a particular portion of the budget set.<sup>5</sup> We also use our estimates to simulate nonlinear consumption behavior: we can test whether price responses for individuals in the estimation sample can be generalized to the (much smaller set of) individuals near the budget set kink.

The main data source is a 20% sample of Medicare Part D claims provided by the Centers for Medicare and Medicaid Services (CMS). The claims data include information on drugs consumed, as well as the date, quantity, retail price, and amount paid by both the insurer and beneficiary for each claim. Our primary identification strategy utilizes the significant year-to-year variation in the cost-sharing features of Part D plans for existing Part D enrollees. While new enrollees might be expected to pay more attention to prices, 90% of Part D enrollees remain in a given plan across years, so that the response of these consumers is most predictive for changes in the structure of Part D, such as filling in the donut hole. For this counterfactual and others impacting existing (inertial) enrollees in health insurance contracts, this strategy is more representative than others in the literature that consider price responses to the introduction of insurance. However, we separately present results allowing for switching of plans between years and find our conclusions unchanged.<sup>6</sup>

We begin by estimating reduced form regressions of year-to-year consumption changes on changes in the price along each budget segment and changes in salient coverage characteristics. Our results offer mixed support for previous approaches. We find that consumers’ responses to different coverage phase prices vary steeply with the proportion of enrollees currently in those coverage phases, even holding marginal coverage phase fixed. This is consistent with myopia, but would not occur if all consumers were responding to marginal prices. On the other hand, we find evidence of substantial price “salience.” In particular, we find that nominal changes in “donut hole” coverage impact consumption more than would be expected given their impact on either current or expected marginal price. Our most striking evidence of salience is that even low-spending individuals who are highly unlikely to enter the donut hole coverage phase are nonetheless responsive in their consumption to the presence or absence of donut hole coverage.

Our reduced form results suggest price elasticities of around  $-0.13$  on average, which is of a similar magnitude to the previous literature on prescription drug and health care services demand. The dynamics in the observed marginal price responses imply an estimated (quarterly)  $\beta$  (in a  $\beta - \delta$  discounting model) of 0.31, suggesting a very high degree of myopia. But we also estimate sizable salience effects – we find for example that low spending enrollees who are unlikely to hit the donut hole reduce consumption by about 6% when

<sup>1</sup> For example, Liebman and Zeckhauser (2004) note that individuals may respond average or local average prices, or to “spot” prices rather than to future marginal prices. Brot-Goldberg et al. (2015) find that individuals in nonlinear health insurance contracts respond only to spot prices, even when there is very little uncertainty regarding end of year price.

<sup>2</sup> See Appendix A.2 for further discussion comparing our estimation sample to individuals near the Part D kink.

<sup>3</sup> Unlike Blomquist and Newey (2002), which employed rich variation in the locations of budget set kinks as well as in the level of prices in each budget set segment, we only have variation in the latter.

<sup>4</sup> Our approach involves explicitly dropping individuals from our estimation sample who are “close” to the kink. It is important to note that, for identification purposes, we are using a greater range of identifying variation than other studies focusing on behavior near the kink for identification.

<sup>5</sup> A concern with this approach is that consumers may still be responding to their low probability of bunching or switching. To probe robustness, we estimate a version of our model which explicitly allows for uncertainty and endogenous coverage phase transitions using conventional methods and find that our results are largely unchanged.

<sup>6</sup> See, e.g., Duggan et al. (2008) regarding the response of new enrollees when Part D was introduced.

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