CONSUMER RESPONSE TO CIGARETTE EXCISE TAX CHANGES

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MODEL APPENDIX

A. Model Derivation

In this section, we derive the first order conditions for the analytic solution to the Bellman model presented in (1), where the consumer does not face adjustment costs. Although we do not solve for a closed form solution of the more general model with adjustment costs, the intuition from the model without adjustment costs applies to the more general case.

Absent adjustment costs, consumers choose purchases x_t and consumption c_t

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defines the optimal path of consumption. Consumption falls with prices and follows a declining

(rising) trend if the discount rate is greater (less) than the interest rate on savings.

The third equation defines the subset of consumers who will purchase the low-quality tier

in a particular period. If a consumer's relativ

cigarettes following the tax change. Consumer with 0.833 always purchase low-quality cigarettes.

In this appendix, we focus on two parameters: (i

Figure A-2 graphs the quantity of the low-quality tier for four discount rates (the reference case $\delta = 0.1$ is omitted). As before, the discount rate is correlated with stockpiling as well as the long-term trend, but the short-term flight from quality is robust to the changes.

Figure A-2: Sensitivity Analysis: Discount Rate

C. Quantity Decomposition

In this section, we decompose the quantity of low-quality tier into consumption of the high and low-quality tiers. In particular, we separately examine consumption for each of three consumer "classes": (1) consumers who alwa

We first present the quantity decomposition for the reference case, the model without

adjustment costs, we no longer see a sharp discontinuity in consumption at the time of the tax increase. Rather, we see all three groups gradually taper their consumption to lower levels. Group 1, the consumers who always consume high-quality cigarettes absent adjustment costs, now smooth their transition path by consuming low-quality cigarettes for five periods after the tax change. Group 2, the consumers who switch immediately from low-quality to high-quality cigarettes absent adjustment costs, now delay switch substantially to mitigate adjustment costs. Group 3, which cannot substitute to low-quality cigarettes, responds by borrowing against future periods to smooth the transition path after the tax change.

Finally, we present the quantity decomposition for model 2 in figure 3. In this case, consumers can partially mitigate adjustment cost by stockpiling goods prior to the tax change at t=10. Although stockpiling does not change the general shape of the transition path, it does allow consumers to maintain a higher level of cigarette consumption in the post-tax period.

Figure A-4: Cigarette Consumption by Tier and Consumer Group: Adjustment Costs, No Stockpiling

Figure A-5: Cigarette Consumption by Tier and Consumer Stockpiling