Production files for
The Extensive Margin of Aggregate Consumption Demand

by Claudio Michelacci, Luigi Paciello, Andrea Pozzi

This document describes the production files for the 13 tables and the 5 figures in the main text of the paper "The Extensive Margin of Aggregate Consumption Demand", by Claudio Michelacci, Luigi Paciello, and Andrea Pozzi.

We first discuss the data sources. Then we discuss how to use the programs to replicate the empirical results in Sections 2 and 3 of the paper and the model results in Sections 5, 6, and 7 of the paper. The folder paper contains the paper with figures and table.

A. Data availability statement

The analysis is based on data from the Nielsen Company (US), LLC and marketing databases provided through the Nielsen Datasets at the Kilts Center for Marketing Data Center at the University of Chicago Booth School of Business (https://www.chicagobooth.edu/research/kilts/datasets/nielsen). The databases used are the Nielsen Consumer Panel (The Nielsen Company LLC, 2004-2015); the Nielsen Retail Scanner (The Nielsen Company LLC, 2006-2015) and the Tax Rebate (The Nielsen Company LLC, 2008) datasets. The authors did not have special access privileges and interested parties can access the data by purchasing them through the Kilts Center. The Nielsen Retail Scanner and Nielsen Consumer Panel datasets can be purchased separately, the Tax Rebate dataset is part of the Panelview Survey database to which subscribers to the other two databases can have access at no additional cost. For inquiries, please contact marketingdata@chicagobooth.edu.

Ancillary data are obtained from the U.S. Bureau of Economic Analysis and from the U.S. Census Bureau. These are: the time series of expenditures in off-premises food and beverages (U.S. Bureau of Economic Analysis-A); the time series of the price index for off-premises consumption of food and beverages (U.S. Bureau of Economic Analysis-A) and the total number of US households (U.S. Census Bureau). The data were retrieved from FRED, Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org/series) and are freely available.

Table 1 lists all the original data files used in the analysis to produce tables and figures in the paper.

Table 1: List of original data files

File name	Source	Description	Provided
panelists_*yyyy*.tsv	Nielsen Consumer Panel	Panelist demographics for year *yyyy*	No
product_without_quotes.tsv	Nielsen Consumer Panel	Lookup file for UPCs	No
purchases_*yyyy*.tsv	Nielsen Consumer Panel	Detailed (UPC level) account of items purchased by panelists in each trip in year *yyyy*	No
retailers.tsv	Nielsen Consumer Panel	Lookup file for retailers. Matches each retailer code with the sector of activity	No
trips_*yyyy*.tsv	Nielsen Consumer Panel	Summary information (total expenditure, date, retailer) for all the shopping trips performed by the panelists in year *yyyy*	No
xxxx_yyyy.tsv	Nielsen Retail Scanner	Weekly revenues and quantities for each UPC in product module *xxxx* at each of the participating retailers in year *yyyy*	No
rms_versions_*yyyy*.tsv	Nielsen Retail Scanner	UPC versions for year *yyyy*	No
stores_*yyyy*.tsv	Nielsen Retail Scanner	Characteristics of participating stores for year *yyyy*	No
n280556_taxrebate_may08_wv1.dta	Panelview Survey[1]	Online survey, wave 1- parts 1 and 2	No
n280560_taxrebate_may08_wv2.dta	Panelview Survey	Online survey, wave 2 – part 2	No
n280683_taxrebate_may08_wv2.dta	Panelview Survey	Online survey, wave 2 – parts 1 and 2	No
n280756_taxrebate_may08_wv3.dta	Panelview Survey	Online survey, wave 3 – parts 1 and 2	No
n280757_taxrebate_may08_wv3.dta	Panelview Survey	Online survey, wave 3 – part 2	No
n280532_taxrebate_ppr_wv1.dta	Panelview Survey	Mail survey, wave 1 – parts 1 and 2	No
n280599_taxrebate_ppr_wv1.dta	Panelview Survey	Mail survey, wave 2 – parts 1 and 2	No
n280534_taxrebate_ppr_wv1.dta	Panelview Survey	Mail survey, wave 2 – part 2	No
data_bea_pce.mat	U.S. Bureau of Economic Analysis	Personal consumption expenditures: Nondurable goods: Food and beverages purchased for off-premises consumption [DFXARC1Q027SBEA]	Yes
data_bea_pce_p.mat	U.S. Bureau of Economic Analysis	Personal consumption expenditures: Nondurable goods: Food and beverages purchased for off-premises consumption (chain-type price index) [DFXARG3Q086SBEA]	Yes
data_households.mat	U.S. Census Bureau	Total Households [TTLHH]	Yes

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B. Descriptive analysis: description of programs

The folder *DESCRIPTIVE_ANALYSIS* in the replication package contains do-files (compiled with STATA 14, no additional ado files need to be installed for the code to compile in this version of the software) that construct the main databases used in the analysis and replicates the results contained in sections 2 and 3 of the manuscript. Below, we describe briefly the content of each program.

- **data_cleaning.do:** imports the Nielsen original Retail Scanner and Consumer Panel data and selects the sample used for the analysis**.**
- **data_quality_bins.do**: constructs a measure of quality for varieties belonging to various product groups.
- **data_decomposition_yearly.do**: decomposes total expenditure, at yearly frequency, into the extensive and intensive margin.
- **data_decomposition_quarterly.do**: decomposes total expenditure, at quarterly frequency, into the extensive and intensive margin.
- **data_taxrebate.do**: imports the Nielsen original Panelview Survey data and constructs the datasets used to perform the regressions using the 2008 tax rebate as a shock to income.
- **figure_1.do**: produces the plots in Figure 1 (time series for intensive vs extensive margin and additions vs. removals at the yearly and quarterly frequencies).
- **main.do**: wrapper program that sets the paths and calls in all the other do-files.
- **table_1.do**: produce the statistics reported in Table 1 (standard deviations, correlations and beta-decomposition for expenditure growth, both at yearly and quarterly frequencies).
- **table_2.do**: calculates the statistics reported in Table 2 (beta-decompositions of expenditure growth, both at yearly and quarterly frequencies).
- **table_3_4.do**: performs the regressions reported in Table 3 and 4 detailing the impact of the 2008 tax rebate on growth of expenditure and of its components.

Descriptive analysis: Instructions for replication

1. Download all files and folders part of the release of the Nielsen Retail Scanner, Consumer Panel and Panelview survey data. The folder structure of the released data should be maintained and compressed files should be unzipped when necessary.[2] The code assumes the following structure for the directories is in place:

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2   The programs provided assume the folder structure of the 2018 Nielsen data release. For example, the path to the panelist demographics data for year *yyyy* is "*.../yyyy*/Annual_Files/panelists_*yyyy*.tsv". We cannot guarantee that

- **${rms1}**: directory where the Nielsen Retail Scanner data are stored
- **${hms}**: directory where the Nielsen Consumer Panel data are stored
- **${tax_survey}**: directory where the Panelview Survey data are stored
- **${data_elab}**: directory where dataset constructed using Nielsen data are stored
- **${data_temp}**: directory for temporary files
- **${do_files}**: directory where the Stata do-files are stored
- **${logs}**: directory where the log files are stored
- **${plots}**: directory where figures are stored

2. Adjust the paths in the do-file "DESCRIPTIVE_ANALYSIS/main.do"
3. Run the do-file "DESCRIPTIVE_ANALYSIS/main.do". This program calls all the others in sequence and generates as a final output all the tables and figures of sections 2 and 3 of the paper.

D. Model: Description of programs

The folder *MODEL* in the replication package contains the .m files (compiled with MATLAB 2017b equipped with the Econometrics and Optimization Toolboxes, and the Kalman filter toolbox written by Kevin Murphy, 1998) that estimate the model and describe its properties as reported in sections 5, 6 and 7 of the manuscript. Below, we describe briefly the content of the folder. We use Matlab to solve the model. Each folder SectionX replicates the results in Section X of the paper. Each code can be run independently.

Model: Calibration (Section 5)

To obtain the calibration targets reported in Table 5 run the m-file **Get_calibration_targets.m** that calls the following m-files:

- **calibrate_delta.m**: calibrates the attrition rate in the customer base useing the data contained in *data_Additions_forward_backward.mat*.
- **fun_min.m**: extrapolates the addition rate in 2007 backward for 36 quarters using the data on additions in 2013 contained in *data_robust_additions_2013.mat* and the data on additions in 2007 contained in *data_robust_additions_2007.mat*; for instance q1_2007 contains the addition rate of varieties purchased in Q1 of 2007 and not purchased in the previous 1,2,3….12 quarters; q1_2013 contains the addition rate of varieties

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future releases will maintain the same folder structure. In case of changes, the paths in data_cleaning.do should be adjusted.

purchased in Q1 of 2013 and not purchased in the previous 1,2,3….36 quarters. To extrapolate the addition rate in 2007 on varieties never purchased in any of the previous 36 quarters for each of the 5 quintiles of expenditure the file uses *data_robust_additions_2007_quintiles.mat* and *data_robust_additions_2013_quintiles.mat*. For instance, quint1 refers to the addition rate for the first quintile of expenditure in each of the 4 quarters of 2007 or 2013 (columns) robust to 1,2,3,4 quarters (rows).

- **fun_add.m**: gives the outcome of fun_min.m.
- **simulate_model_ss**: simulates the model in steady state

To obtain the model parameters reported in Table 5 run the m-file **Main_Table5.m** that calls the following m-files:

- **fun_lambda_prime.m**: solves for the elasticity of the function Lambda to x.
- **fun_lambda.m**: solves for the function Lambda.
- **calibrate_pars.m, fun_x.m, fun_m.m**: solves for the target statistics in the model for given parameters.

Model: Response to the ESP (Section 6.1)

To replicate Table 6 in Section 6.1 run the m-file **Main_Table6.m** that calls the following m-files:

- **fun_lambda_prime.m**: solves for the elasticity of the function Lambda to x.
- **fun_lambda.m**: solves for the function Lambda.
- **get_analytical_additions.m, fun_m_varying**: solves for the times series of the addition rate and its decomposition.
- **fun_foc, fun_p**: solves for the first order condition in equation 30.
- **fun**: solves for the elasticity of the household price index in equation 32.
- **get_prob_repurchase_16periods_ss**: computes the probability that a variety is not purchased for 16 quarters in steady state.
- **get_prob_repurchase_4periods_shock, get_prob_repurchase_4periods_ss**: computes the probability that a variety is not purchased for 4 quarters in steady state and after the tax rebate.

Model: Business cycle properties (Section 6.2)

To replicate Tables 7-10 in Section 6.2 run the m-file **Main_Tables7_10.m** that calls the following m-files:

- **fun_lambda_prime.m**: solves for the elasticity of the function Lambda to x.
- **fun_lambda.m**: solves for the function Lambda.
- **fun_additons_removals.m, fun_lambda_delta.m**: solves for the addition rate and its decomposition in steady state.
- **get_analytical_additions.m, fun_m**: solves for the times series of the addition rate and its decomposition.

- **fun_likelihood_timeaggregation.m, fun_model_timeaggregation.m**: computes the log-likelihood for given set of parameters.
- **get_table_additions.m**: computes the statistics of Table 9.
- **solvea.m**: solves the linearized model around the non-stochastic steady state using the solution algorithm by Christiano (2002) using the Matlab codes in the folder "*christiano*". The codes are downloaded from https://faculty.wcas.northwestern.edu/~lchrist/research/Solve/main.htm

Main_Tables7_10.m calls 5 mat-files containing data on the deflator for personal consumption expenditure (*data_bea_pce_p.mat*), on the consumption expenditure (*data_bea_pce.mat*), on additions and removals (*data_addition.mat*), on the entry of new varieties (*data_new_varieties.mat*) and on the number of households (*data_households.mat*).

Main_Tables7_10.m uses the Kalman filter toolbox written by Kevin Murphy, 1998, downloaded from https://www.cs.ubc.ca/~murphyk/Software/Kalman/kalman.html and available in the folder *"KalmanFilter"*.

Model: Fiscal transfers over the Great Recession (Section 7.1)

To replicate Figure 3 and Table 12 in Section 7.1 run the m-file **Main_Figure3Table12.m** that calls the following m-files:
- **get_linearized_model.m**: solves the linearized model around the non-stochastic steady state by using the solution algorithm by Christiano (2002) using the matlab codes in the folder "*christiano*". The codes are downloaded from https://faculty.wcas.northwestern.edu/~lchrist/research/Solve/main.htm
- **get_counterfatual_no_romer.m**: solves the linearized model around the non-stochastic steady state in the absence of innovation spillover.
- **fun_phi.m**: solves for the equilibrium markup.
- **fun_lambda_prime.m**: solves for the elasticity of the function Lambda to x.

Model: Measurement of inflation (Section 7.2)

To replicate Figure 5 and Table 16 in Section 7.2 run the m-file **Main_Figure5Table13.m** that calls the following m-files:
- **fun_lambda_prime.m**: solves for the elasticity of the function Lambda to x.
- **fun_lambda.m**: solves for the function Lambda.

Main_Figure5Table13.m calls 3 mat-files containing data on the deflator for the personal consumption expenditure (*data_bea_pce_p.mat*), the model estimated time series for the series of adoption expenditures (*smoothed_estimates.mat)* and the mass

of varieties in the economy (*smoothed_N_varieties.mat*) which are produced by the codes in Section 6.2.

References

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