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# **Price Dynamics in the Bourbon and Scotch Markets: 2006-2023**

## **Has the Wave Peaked?**

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# Disclaimer

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- "Researcher(s)' own analyses calculated (or derived) based in part on data from Nielsen Consumer LLC and marketing databases provided through the NielsenIQ Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business."
- "The conclusions drawn from the NielsenIQ data are those of the researcher(s) and do not reflect the views of NielsenIQ. NielsenIQ is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein."

# Motivation

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Short term—The past two decades have seen dramatic changes in the price and supply of bourbon. What factors account for the changes? Will it last?

- Compare changes in bourbon and scotch—are changes specific to bourbon or more general?
- Look at changes at various points in the price distribution
- How has the price distribution changed over time? What about the impact of attributes on price? How has the price, cross-price and income elasticities changed?
- Have prices started to fall? Why?

Long term—What do we think the future holds

# Data

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➤ NielsenIQ scanner data from 2006-2023

➤ Three main type of files:

1. Movement files

- One file for each year
- Record is average weighted price and unit sales volume for 1 UPC code from 1 store during 1 specific week
  - Have data for all weeks in a year
  - Unit size can be 750ML, 1.5L, other sizes

2. Store file

- One file for each year. Each record contains information for each year
  - Location--state, county, DMA, 3-digit zip
  - Store type—convenience, grocery, drug, mass merchandiser

3. Product file

- One master file updated yearly. Each record contains product information for each unique UPC code
- Product module—identify specific product—bourbon whisky, other American whisky (Jack Daniels), scotch, gin, tequila.
- Information about the product. For bourbon we know—age if indicated, proof, single barrel, small batch, barrel strength, reserve. For scotch we know-- age, proof, single barrel, barrel strength. Have obtained information of type of scotch (blend vs single-malt) and location (region distilled) from other sources.
- No time series variation by UPC code. If “product” changes it generates a new UPC code.

# Data

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## ➤ My sample

- For bourbon:
  - Focus on products defined as bourbon, not whiskey (drop Jack Daniels).
  - Non-flavored products, 750ml bottles, sold as a single unit
- For scotch
  - Focus on products defined as domestic or imported. Drop the few observations of scotch produced in countries other than Scotland or the U.S.
  - Attributes added shows region in Scotland where the product was distilled, or for blended products, whether the is was blended in Scotland or U.S. Single-malt scotches are ones distilled identified with a region
- All dollars converted to 2020 dollars.
- Convenience sample, retailers chose to participate, sample size changes over time

# What is Straight Bourbon Whisky?

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According to Code of Federal Regulations (CFR), 27 § 5.142:

- *Fermented mash not less than 51% corn*
- *Distilled to less than 160 proof*
- *Distilled in the United States*
- *Stored in new charred oak barrels at 125 proof or less for two years*
- *No neutral spirits or coloring, flavoring or blending materials can be added*

# What is Scotch whisky?

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According to Code of Federal Regulations (CFR), 27 § 5.142:

- Whisky which is a distinctive product of Scotland, manufactured in Scotland in compliance with the laws of the United Kingdom regulating the manufacture of Scotch whisky for consumption in the United Kingdom: *Provided*, that if such product is a mixture of whiskies, such mixture is “blended Scotch whisky” or “Scotch whisky—a blend”.
- Domestic scotch was grandfather in when CFR was passed

# Market Structure for Distilled Spirits

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- Since prohibition distilled spirits industry has been heavily regulated
- One regulation is the three tier distribution system—distillers, distributors and retailers must be separate legal companies
  - Prior to 2022 in KY if a distiller wanted to sell their product in a gift shop a wholesaler had to take possession of the product when it came out of the bonded warehouse, complete paperwork, pay taxes then sell it back to the distiller
  - Since Jan. 2022 distiller can process complete the process themselves to be able to sell their own product in their gift shop



# Market Structure for Distilled Spirits

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- Regulations and taxes also vary by state making it difficult for supply to quickly adjust to changes in demand. This is important for some of the analyses.
- Two types of retailers, on premises, and off-premises. All my data are off-premises sales.

# Sales Statistics for Bourbon and Scotch

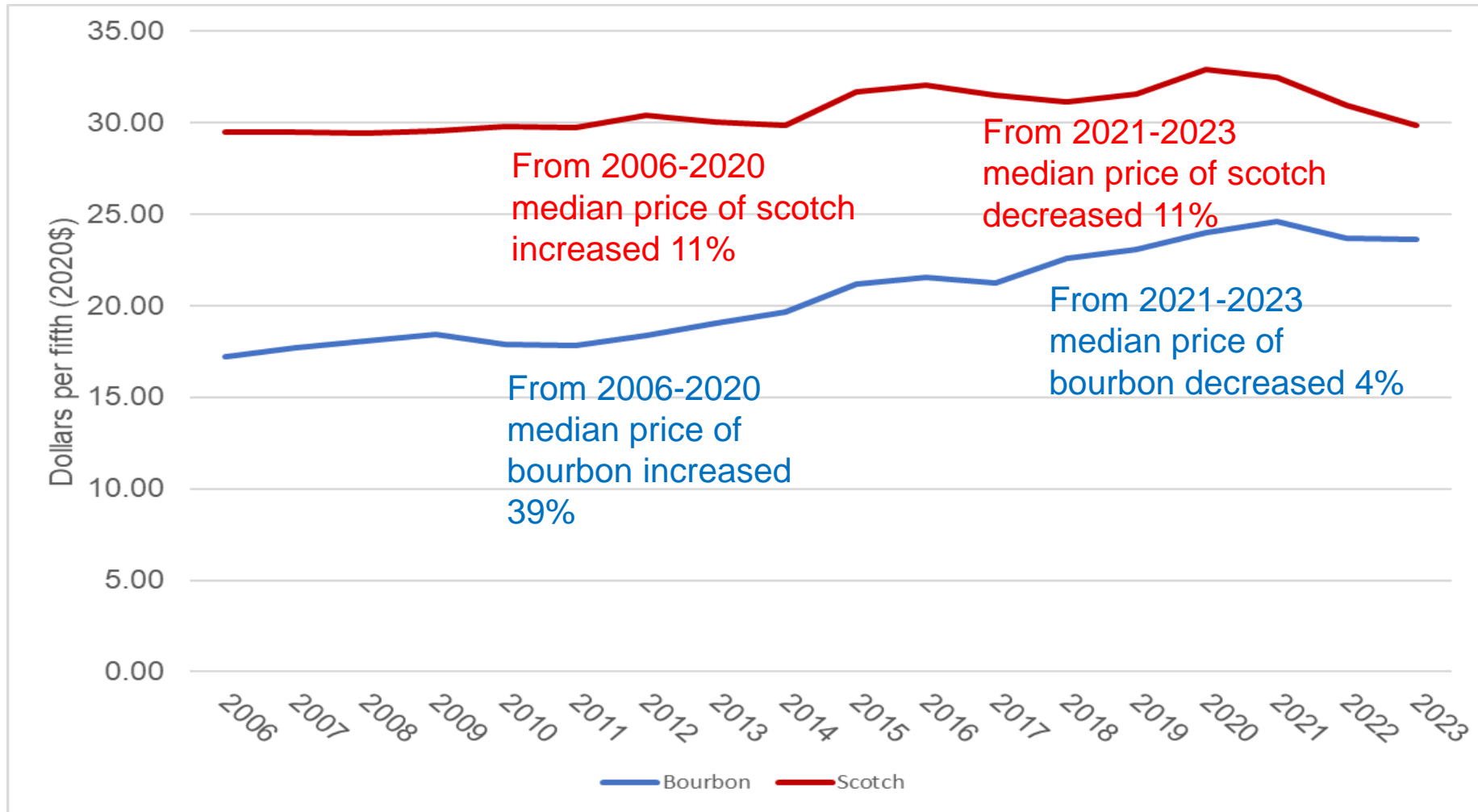
Year	Total Sales (2020\$)		Number of Stores		Sales per Store	
	Bourbon	Scotch	Bourbon	Scotch	Bourbon	Scotch
2006	\$114,827,784	\$142,220,512	4,409	4,297	\$26,044	\$33,098
2007	\$145,681,520	\$184,674,464	4,967	4,850	\$29,330	\$38,077
2008	\$146,752,800	\$178,367,024	5,041	4,926	\$29,112	\$36,209
2009	\$149,366,048	\$177,540,912	5,133	5,048	\$29,099	\$35,171
2010	\$155,605,216	\$181,565,232	5,348	5,168	\$29,096	\$35,133
2011	\$167,899,200	\$184,841,648	6,143	5,280	\$27,332	\$35,008
2012	\$186,653,680	\$185,747,584	7,229	6,699	\$25,820	\$27,728
2013	\$205,986,336	\$190,607,312	7,407	7,103	\$27,810	\$26,835
2014	\$222,786,928	\$189,371,184	7,314	7,016	\$30,460	\$26,991
2015	\$261,794,480	\$200,170,480	7,336	7,106	\$35,686	\$28,169
2016	\$296,478,688	\$205,648,512	7,386	7,139	\$40,141	\$28,806
2017	\$295,976,224	\$182,423,216	7,189	6,929	\$41,171	\$26,327
2018	\$459,450,080	\$274,403,360	10,113	9,340	\$45,432	\$29,379
2019	\$508,502,848	\$269,738,240	10,161	9,400	\$50,045	\$28,696
2020	\$653,715,456	\$296,576,448	10,194	9,460	\$64,127	\$31,351
2021	\$602,573,212	\$246,354,216	12,206	11,008	\$49,367	\$22,380
2022	\$591,361,175	\$211,258,884	12,828	11,089	\$46,099	\$19,051
2023	\$578,810,188	\$178,805,072	12,202	10,625	\$47,436	\$16,829

- Yearly sales of bourbon grows from \$114M to \$653M, then falls to \$579M; scotch grows from \$142M to \$296M then falls to \$178M
  - Prior to 2012, scotch sales exceeded bourbon sales, by 2020 scotch sales half of bourbon sales
- Almost 150% growth in per-store bourbon sales through 2020. Since then, per-store sales fell by 26%. Overall decline in per-store sales of scotch of 46%
- 2017 Economic Census shows that NielsenIQ data capture about 14% of distilled spirits sales

# Sales by Store Type for Bourbon and Scotch

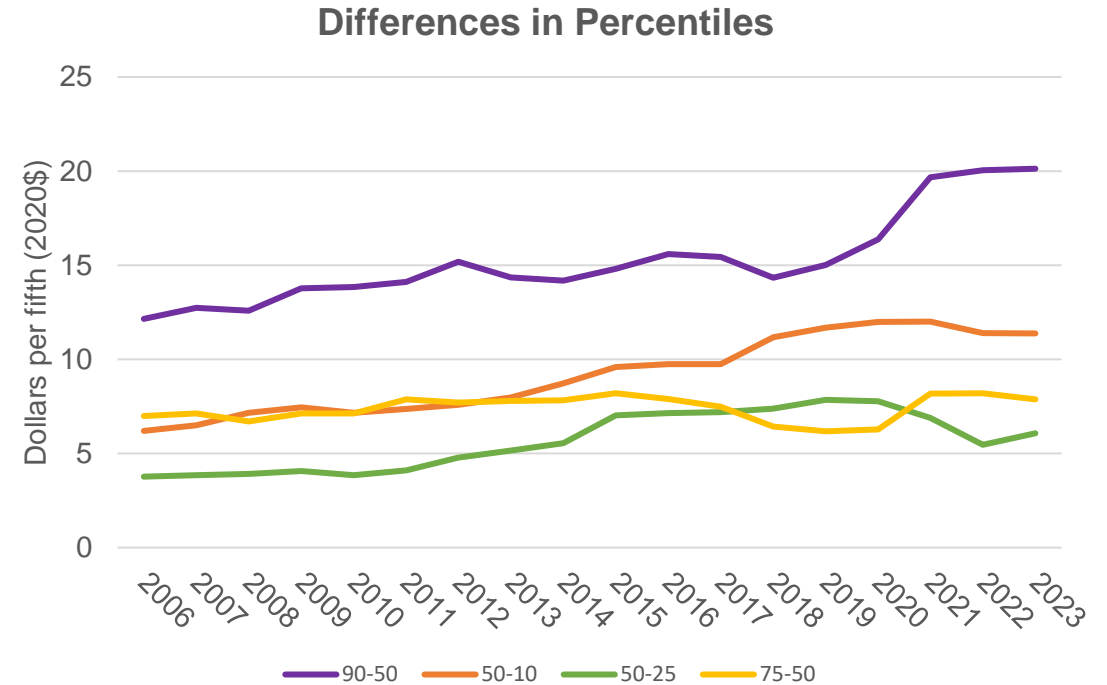
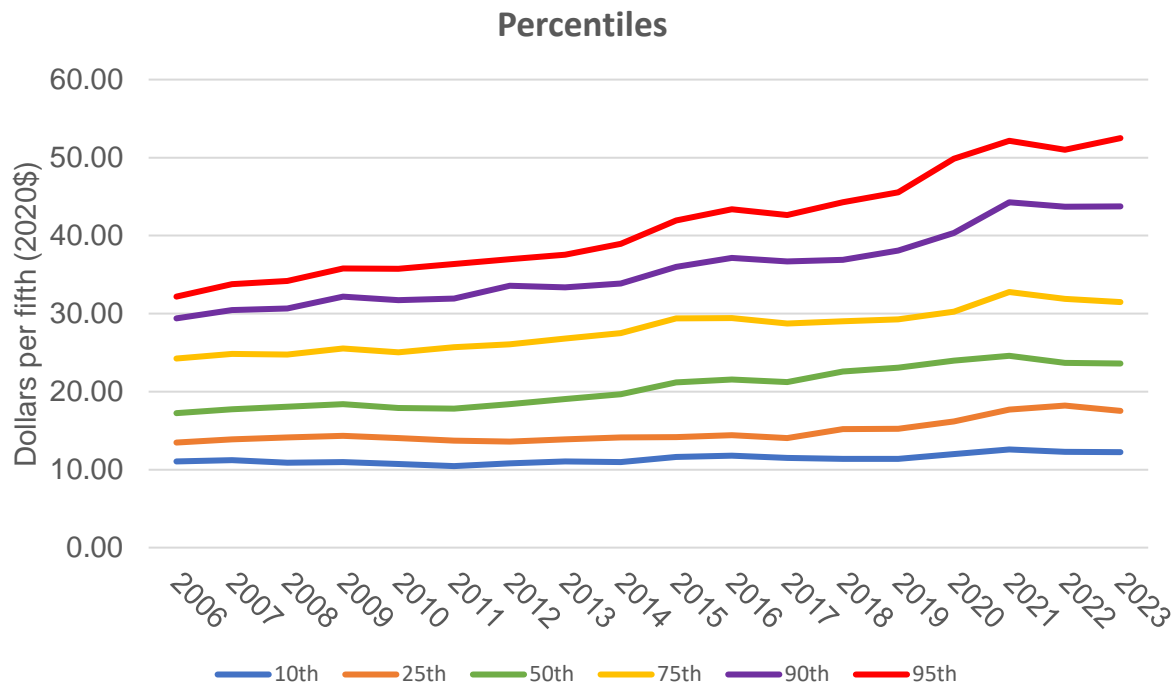
Year	Food Stores		Drug Store		Mass Mechandiser		Gas Station/Convenience		Liquor	
	Bourbon	Scotch	Bourbon	Scotch	Bourbon	Scotch	Bourbon	Scotch	Bourbon	Scotch
2006	0.60	0.65	0.39	0.34	0.01	0.00	0.00	0.00	0.00	0.00
2007	0.53	0.53	0.31	0.26	0.00	0.00	0.00	0.00	0.00	0.00
2008	0.53	0.53	0.30	0.26	0.00	0.00	0.00	0.00	0.00	0.00
2009	0.57	0.54	0.27	0.25	0.01	0.00	0.00	0.00	0.00	0.00
2010	0.59	0.55	0.25	0.23	0.01	0.00	0.00	0.00	0.00	0.00
2011	0.61	0.56	0.23	0.22	0.01	0.00	0.00	0.00	0.00	0.00
2012	0.61	0.58	0.24	0.20	0.01	0.00	0.00	0.00	0.00	0.00
2013	0.62	0.60	0.24	0.19	0.01	0.00	0.00	0.00	0.00	0.00
2014	0.63	0.59	0.23	0.20	0.01	0.01	0.00	0.00	0.00	0.00
2015	0.66	0.61	0.21	0.18	0.02	0.01	0.00	0.00	0.00	0.00
2016	0.68	0.61	0.19	0.18	0.02	0.01	0.00	0.00	0.00	0.00
2017	0.67	0.59	0.19	0.18	0.02	0.01	0.00	0.00	0.00	0.00
2018	0.62	0.55	0.12	0.12	0.02	0.01	0.12	0.10	0.12	0.10
2019	0.64	0.57	0.10	0.11	0.02	0.01	0.11	0.09	0.11	0.09
2020	0.66	0.58	0.10	0.10	0.02	0.02	0.10	0.09	0.10	0.09
2021	0.66	0.56	0.09	0.07	0.13	0.15	0.01	0.00	0.12	0.22
2022	0.68	0.58	0.08	0.07	0.13	0.15	0.01	0.00	0.11	0.21
2023	0.69	0.58	0.07	0.06	0.14	0.15	0.01	0.00	0.10	0.21

# Change in the Median Price of a Fifth of Bourbon and Scotch Sold



Price in 2020 dollars. Only 750ML bottles

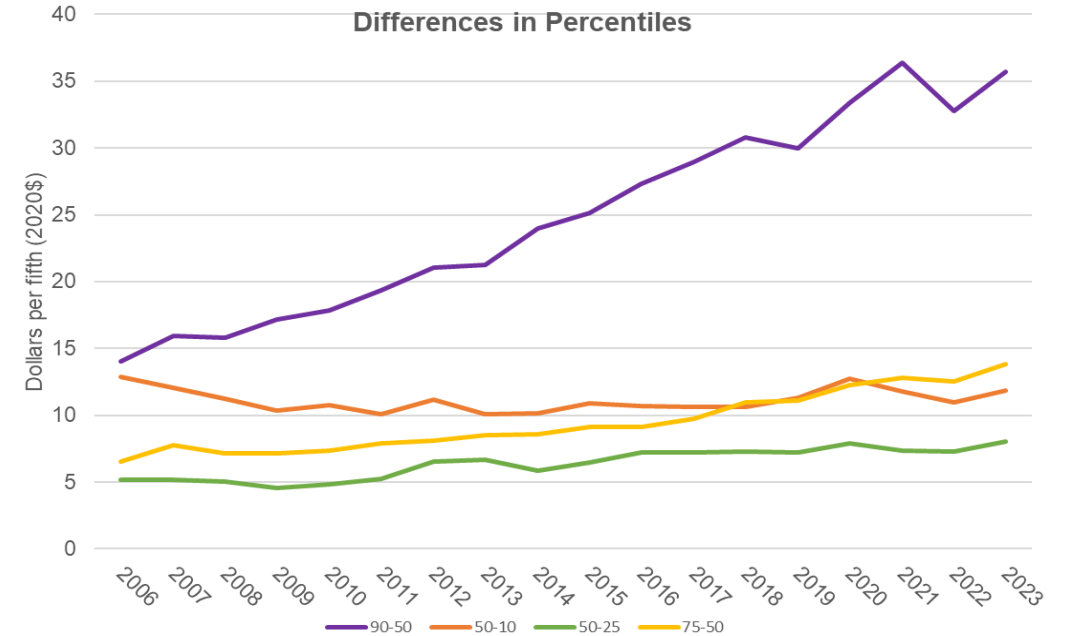
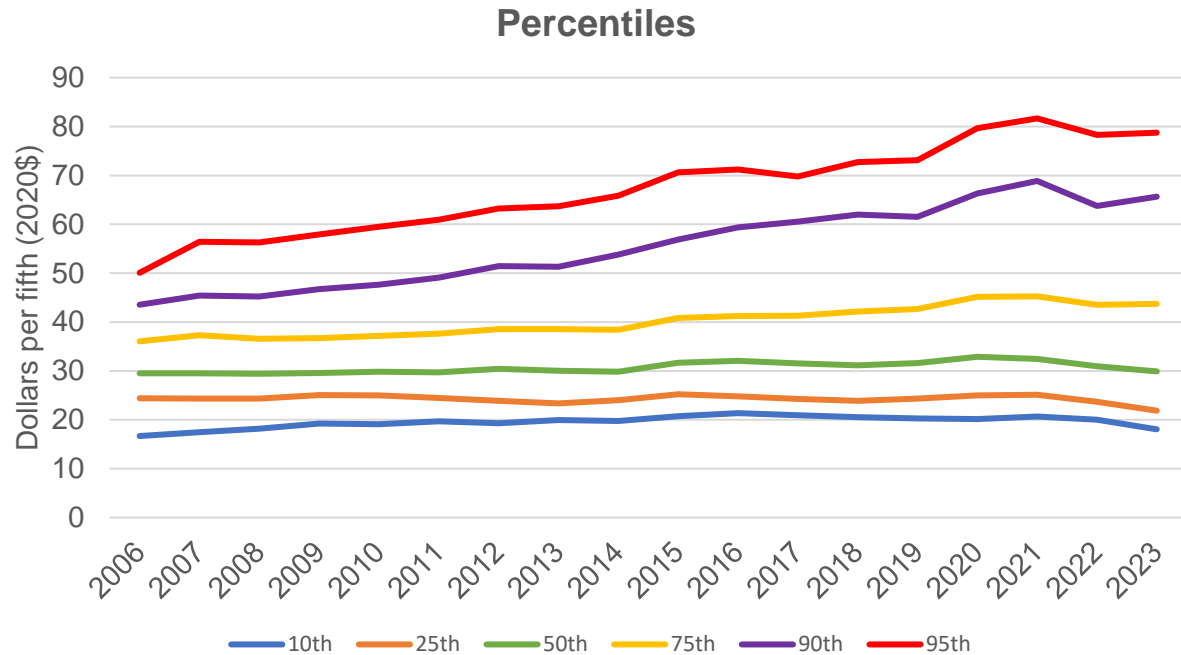
# Change in the Distribution of Bourbon Prices



Price in 2020 dollars. Only 750ML bottles

- Through 2020 prices increase across the distribution, but larger changes at the top of the distribution
- Since 2020 declines have mainly occurred at the low end of the distribution. Price of ultra-premium bourbon continues to increase

# Change in the Distribution of Scotch Prices



Price in 2020 dollars. Only 750ML bottles

- Through 2020 prices increase across the distribution, but largest changes occur at the very top of the distribution—switch to better scotch?
- Since 2020 prices have fallen across the distribution, but mainly at the lower parts of the distribution

# Price Regression

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$$\ln P_{u,s,w} = \alpha + \beta_0 ST_{s,w} + \beta_1 RUCC_{s,w} + \beta_2 \mathbf{SC}_{s,w} + \beta_3 \mathbf{A}_u + \delta_y + \gamma_i + \varepsilon_s$$

- $P$ —price of product  $u$  sold in store  $s$  in week  $w$ ;  $ST$ —store type;  $RUCC$ —Rural, Urban Continuum Code,  $\mathbf{SC}$ —vector of state/county controls,  $\mathbf{A}_u$ —vector of attributes of product  $u$ ;  $\delta_y$ —year dummies,  $\gamma_i$ —state dummies,  $\varepsilon_s$ —error clustered at store level
- Observations weighted by number of units of product  $u$  sold in store  $s$  in week  $w$
- Initially just include year dummies, then add other controls
- Pool data across all years

# Summary Statistics for Variables in Bourbon Regression

Variable	Mean	Std. Dev.	
Age	1.05	2.76	
Presence of Age	0.14	0.34	Only 14% of bottles sold have an age statement
Age Less than or equal to 3 years	0.88	0.32	
Age greater than 3 but less than 9 years	0.07	0.25	
Age 9 years or older bu less than 13 years	0.05	0.22	
Age 13 years or older	0.001	0.03	
Proof	87.49	7.54	Typical bottle sold is about 90 proof, around 1% is over 101 proof
Less than or equal to 80 proof	0.37	0.48	
Greater than 80 but less than or equal to 90 proof	0.48	0.50	
Greater than 90 but less than or equal to 101 proof	0.14	0.35	
Greater than 101 proof	0.01	0.12	
Bonded	0.01	0.12	Typical bottle does not list any attributes
Small Batch	0.03	0.17	
Single Barrel	0.01	0.12	
Barrel Strength	0.002	0.04	
Reserve	0.004	0.06	



# Summary Statistics for Variables in Bourbon Regression

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Variable	Mean	Std. Dev.
Control State	0.18	0.39
Real County Per-Capita Income (2020\$)	55,046.29	16,034.53
Log Real County Per-Capita Income (2020\$)	10.88	0.25
Real State Spirit Excise Tax (per-gallon, 2020\$)	7.94	7.82
Log Real State Spirit Excise Tax (per-gallon, 2020\$)	1.77	0.71
State Sales Tax	0.06	0.01
Miles to Nelson County, KY	714.66	712.07
Log Miles to Nelson County	6.46	1.10

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# Summary Statistics for Variables in Scotch Regression

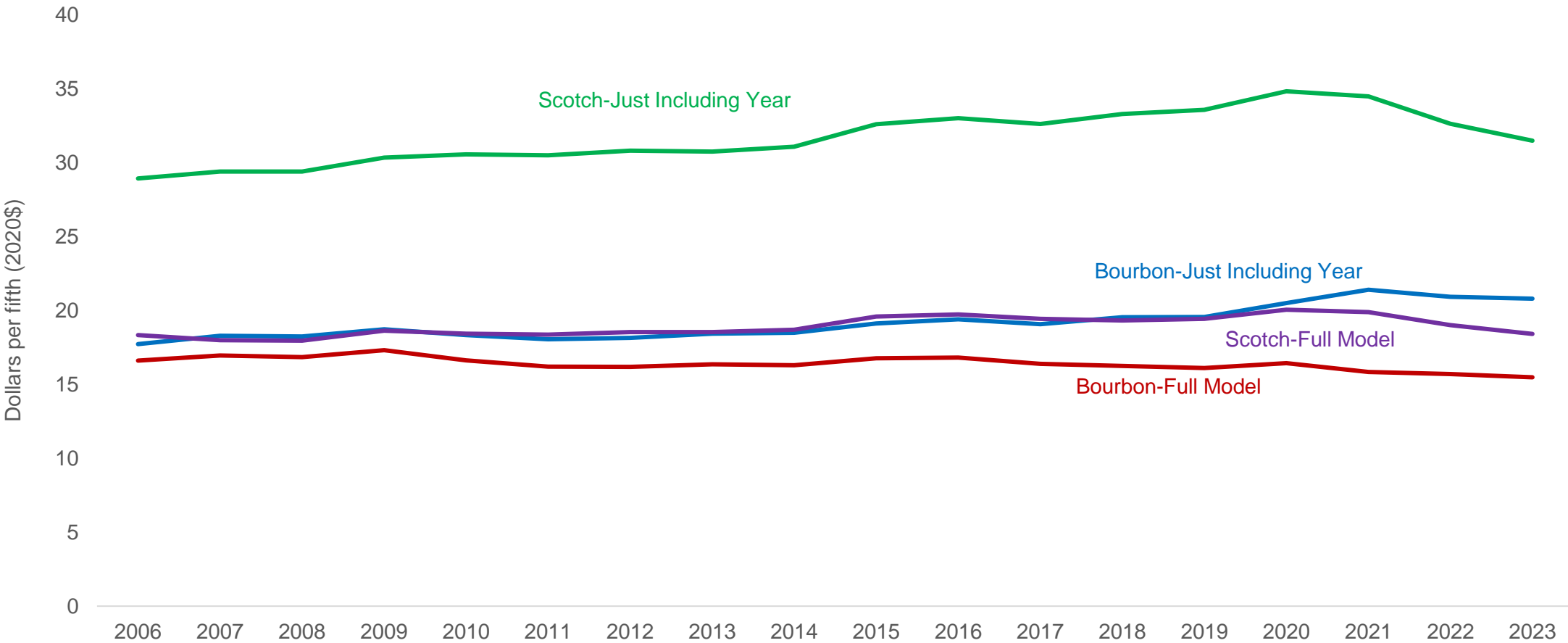
Variable	Mean	Std. Dev.	
Age	6.30	6.21	
Presence of Age	0.52	0.50	Over half of scotch sold has an age statement
Age Less than or equal to 3 years	0.49	0.50	
Age greater than 3 but less than 9 years	0.00	0.03	
Age 9 years or older bu less than 13 years	0.45	0.50	
Age 13 years or older	0.06	0.25	
Proof	81.69	8.27	Typical bottle sold is about 80 proof, less than 0.2% is over 101 proof
Less than or equal to 80 proof	0.66	0.47	
Greater than 80 but less than or equal to 90 proof	0.32	0.47	
Greater than 90 but less than or equal to 101 proof	0.02	0.13	
Greater than 101 proof	0.002	0.05	

# Summary Statistics for Variables in Scotch Regression

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Variable	Mean	Std. Dev.
Region/Type		
Missing	0.03	0.17
Domestic Blend	0.63	0.48
Scotland Blend	0.02	0.13
Cambeltown	0.00	0.01
Highland	0.05	0.21
Island	0.02	0.14
Islay	0.02	0.15
Lowland	0.00	0.03
Speyside	0.23	0.42
Single Barrel	0.0002	0.01
Barrel Strength	0.0002	0.01

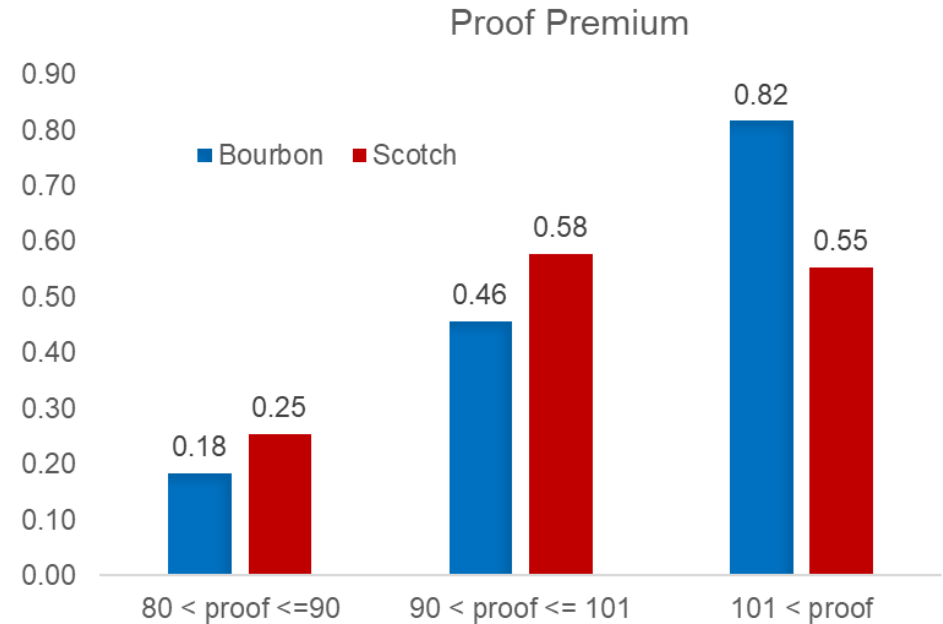
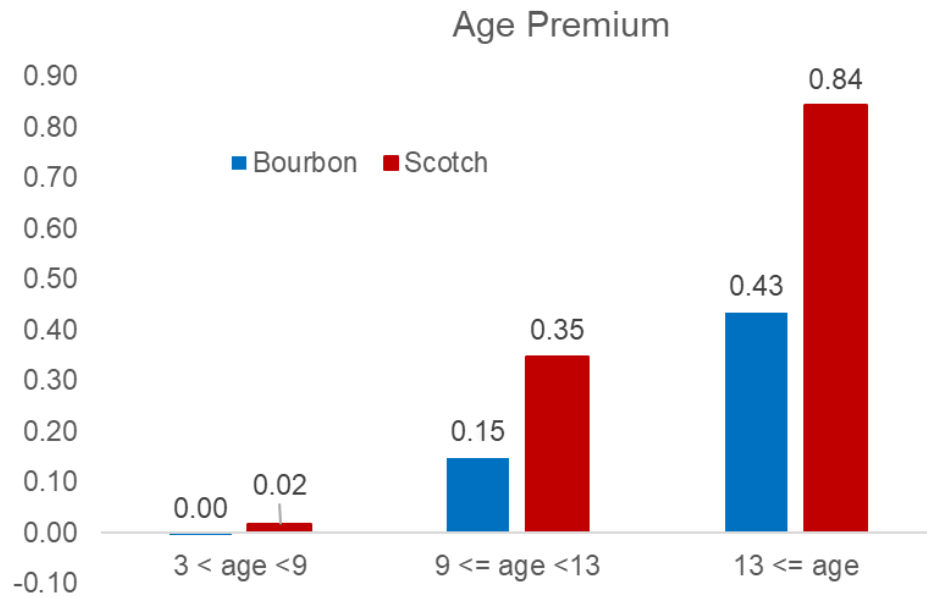
# Estimated Change in Log Price: Just Year and Full Model



Price in 2020 dollars. Only 750ML bottles

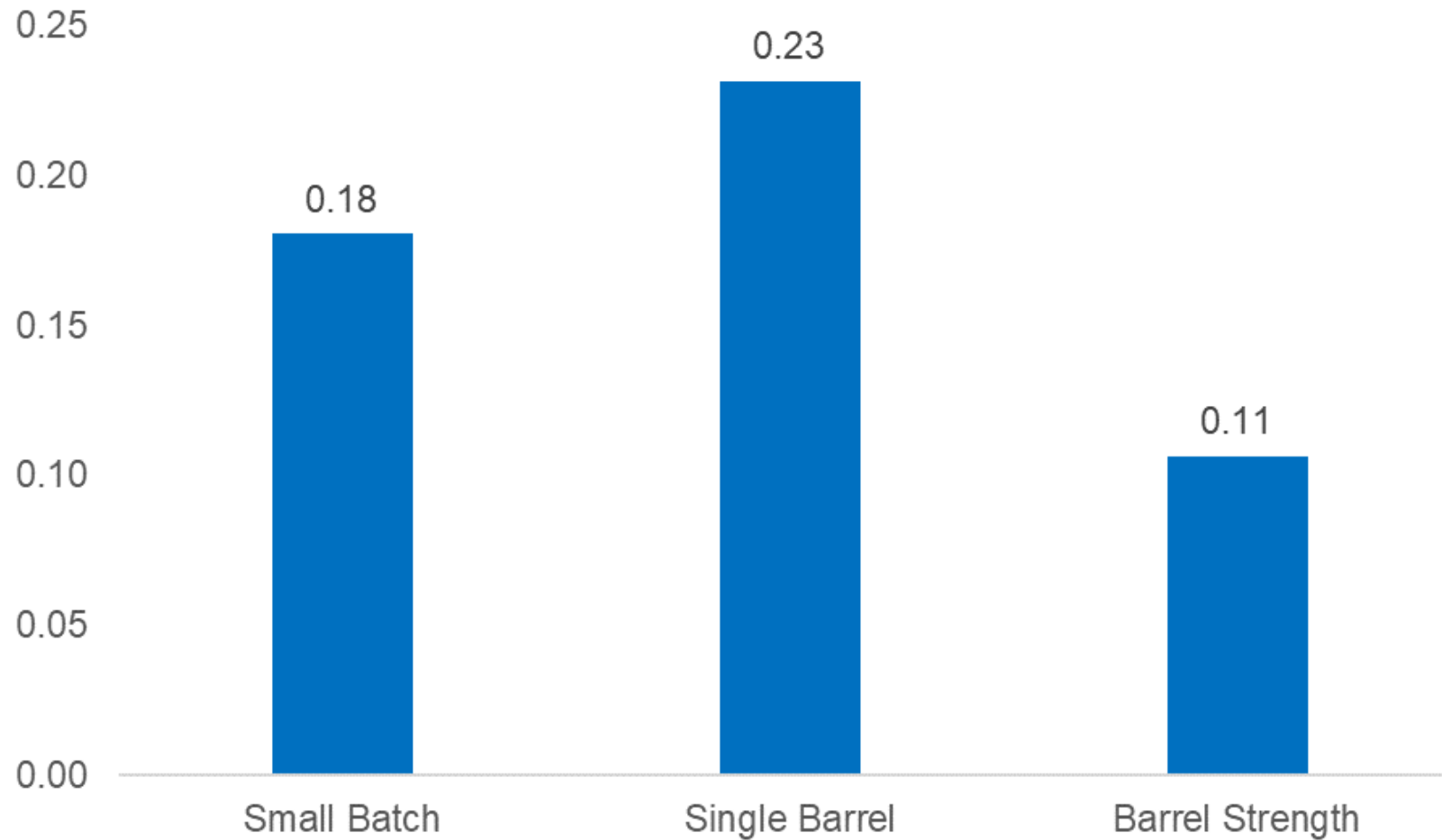
Once we control for attributes see very small year effects

# Association of Age & Proof with Price



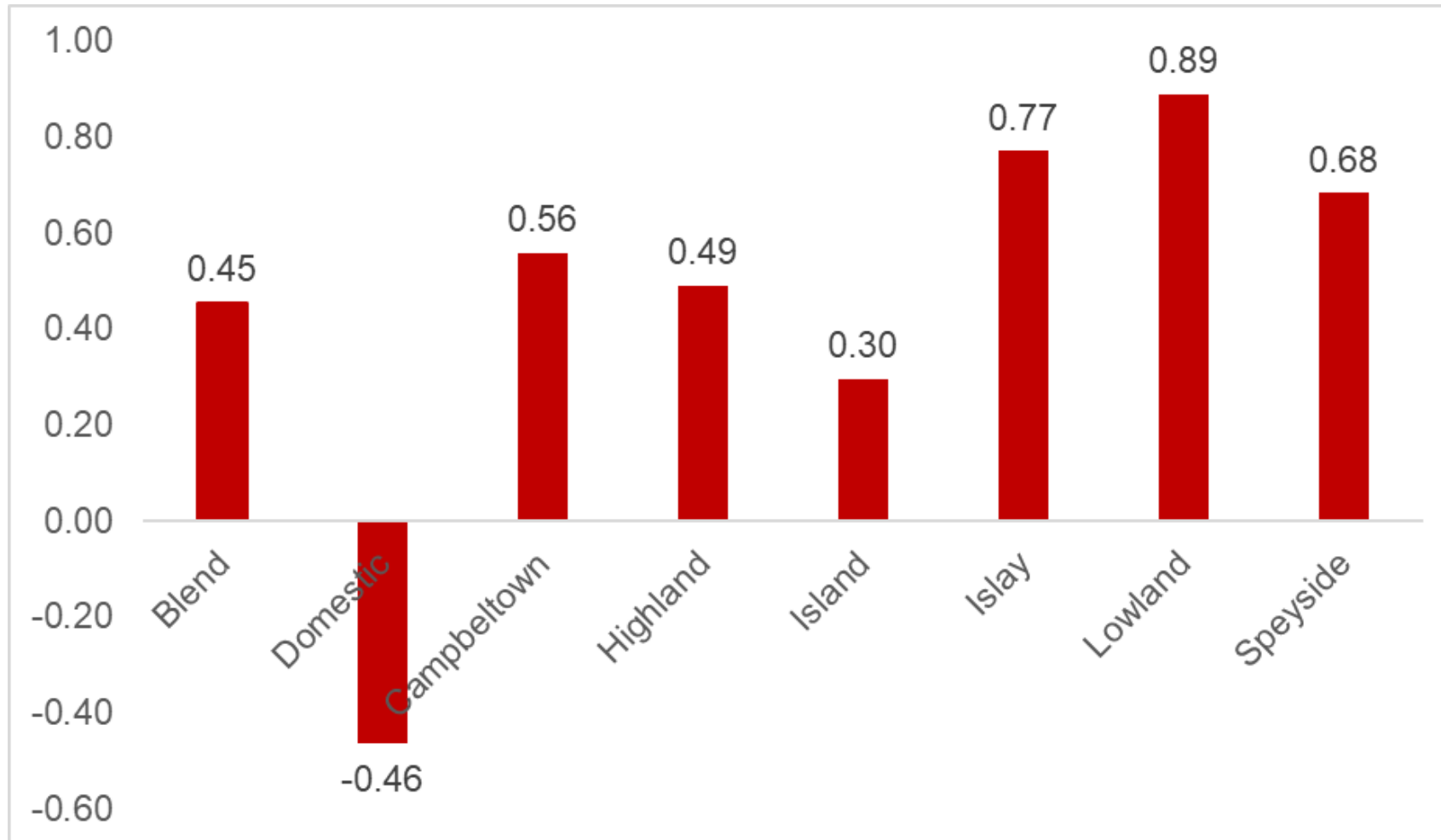
# Premium for Other Bourbon Attributes

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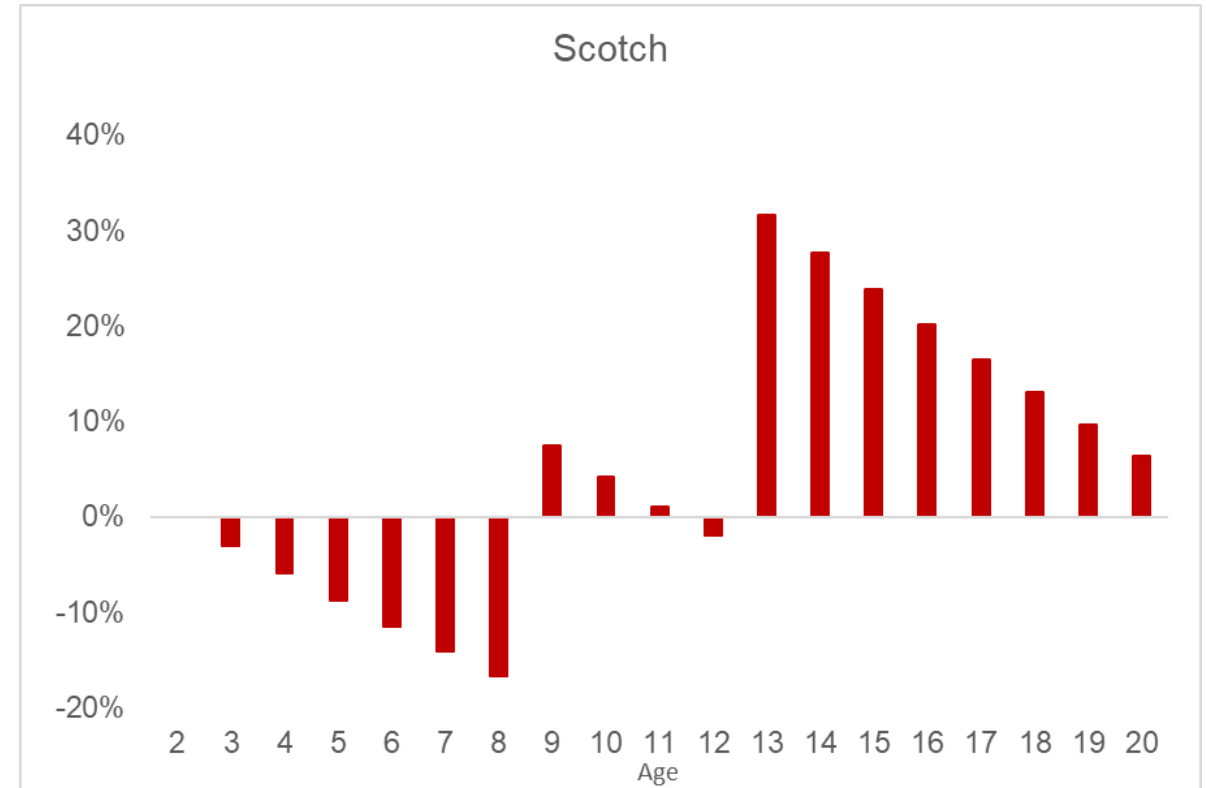
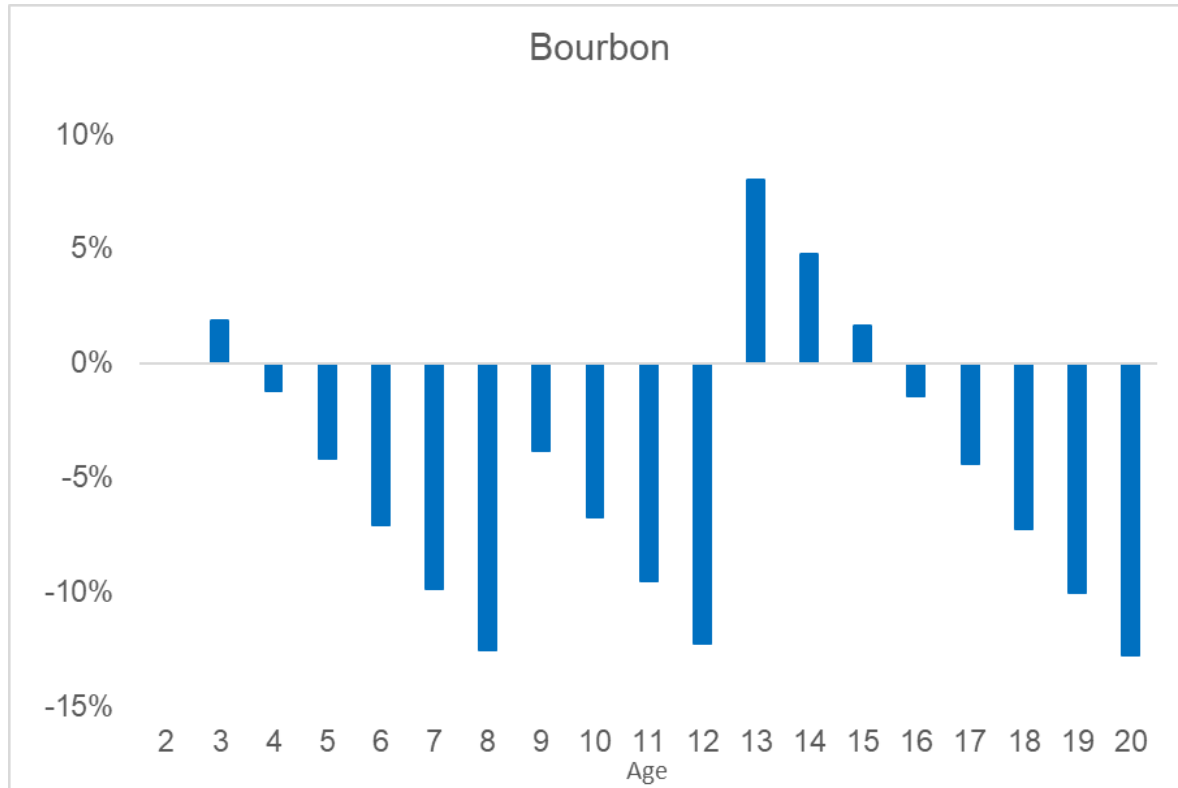


# Premium by Region for Scotch

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# Percent Change in Revenue From Aging Longer than 2 Years (3% Evaporation Rate)



14% of bourbon sold lists an age; 52% of scotch sold lists an age



# Age of Bourbon

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- According the reports from the Kentucky Distillers Association (KDA) prepared by Paul Coomes
  - The most common age for bottling bourbon is four years
  - In 2012 10% of inventory was older than 6 years
  - By 2023 6% of inventory was older than 6 years
- Return to producing old bourbon seems to be smaller than return to producing old scotch. Why?

# Other Coefficients from Price Regression including Attributes

Variables	Bourbon		Scotch	
	Coefficient	Std. Error	Coefficient	Std. Error
State Sales Tax	2.22	0.177	1.13	0.165
Log Real State Spirit ExciseTax	0.02	0.005	0.05	0.004
Log Real County Per Capita Income	0.12	0.005	0.03	0.005
Log Miles to Nelson County	0.01	0.004	--	--
Control State	0.09	0.005	-0.01	0.004
Gas Station/Convenience	--	--		
Drug Store	-0.04	0.008	-0.02	0.016
Food Store	0.03	0.007	0.00	0.016
Liquor Store	0.09	0.009	0.06	0.016
Mass Merchandise	0.15	0.008	0.08	0.017
Constant	1.26	0.066	2.42	0.065
Observations	96,655,250		47,570,330	
Adjusted R-squared	0.39		0.53	

# Estimation of Elasticity

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$$\ln Q_{u,c,yq} = \alpha + \beta_0 \ln P_{u,c,yq} + \beta_1 \ln Y_{u,c,yq} + \beta_2 \ln PS_{v,c,yq} + \beta_4 RUCC_{c,yq} + \beta_5 \mathbf{SC}_{s,w} + \eta_u + \delta_{yq} + \gamma_i + \varepsilon_s$$

- $Q$ —per-capita quantity of product  $u$  sold in county  $c$ , in year/quarter  $yq$ ;  $P$ —price of product  $u$  sold in county  $c$ , in year/quarter  $yq$ ;  $Y$ —real per-capita income in county  $c$ , in year/quarter  $yq$ ;  $PS$ —mean price of substitute  $v$  (scotch or bourbon) sold in county  $c$ , in year/quarter  $yq$ ;  $RUCC$ —Rural, Urban Continuum Code;  $\mathbf{SC}$ —vector of state/county controls,  $\eta_u$ —product  $u$  fixed effect,  $\delta_{Yq}$ —year/quarter dummies,  $\gamma_i$ —state dummies,  $\varepsilon_u$ —error clustered at product level
- Again, pooling data across all years
- Using cross-county variation to identify coefficients
- Similar to methodology used by Diaz, et al. (2024) which uses NielsenIQ data to estimate demand for e-cigarettes

# Estimate of Price, Income and Cross-Price Elasticity for Bourbon and Scotch

	Bourbon				Scotch			
Log price	-1.13 (0.018)	-1.69 (0.117)	-1.68 (0.116)	-1.73 (0.117)	-0.89 (0.020)	-1.65 (0.124)	-1.65 (0.123)	-1.73 (0.127)
Log mean price of substitute				1.14 (0.083)				1.37 (0.081)
Log real per-capita income				0.40 (0.061)				0.42 (0.049)
Other state and county controls	No	No	Yes	Yes	No	No	Yes	Yes
UPC fixed effect	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Observations	1,316,170	1,316,170	1,316,170	1,309,198	1,233,870	1,233,870	1,233,870	1,233,457
Adjusted R-squared	0.34	0.29	0.29	0.31	0.35	0.21	0.21	0.23

# Estimate of Price, Income and Cross-Price Elasticity for Bourbon and Scotch, Separately by Price of Bottle

Percentiles	0-10 percentile	11-25 percentile	26-50 percentile	51-75 percentile	75th-90th percentile	90th-100th percentile
Bourbon						
Log price	-0.20 (0.219)	-1.94 (0.237)	-2.49 (0.152)	-2.95 (0.274)	-2.00 (0.265)	-0.68 (0.174)
Log mean price of substitute	-0.02 (0.126)	0.76 (0.075)	1.22 (0.077)	1.57 (0.076)	1.87 (0.087)	1.79 (0.144)
Log real per-capita income	0.05 (0.125)	0.10 (0.081)	0.49 (0.075)	0.59 (0.089)	0.50 (0.075)	0.05 (0.059)
Observations	90,426	222,650	450,260	349,838	161,706	34,318
Adjusted R-squared	0.26	0.28	0.29	0.34	0.39	0.45
Scotch						
Log price	-0.45 (0.188)	-2.10 (0.253)	-3.16 (0.174)	-2.53 (0.118)	-1.77 (0.162)	-1.64 (0.323)
Log mean price of substitute	0.71 (0.241)	1.20 (0.160)	1.62 (0.117)	1.42 (0.075)	1.24 (0.084)	1.06 (0.084)
Log real per-capita income	0.42 (0.105)	0.58 (0.088)	0.46 (0.072)	0.41 (0.077)	0.25 (0.071)	0.30 (0.071)
Observations	97,452	241,491	446,316	302,603	101,444	44,151
Adjusted R-squared	0.22	0.26	0.24	0.30	0.35	0.37

# Estimate of Price, Income and Cross-Price Elasticity for Bourbon and Scotch, Separately by Years

Years	Bourbon			Scotch		
	2006-2010	2011-2015	2016-2020	2006-2010	2011-2015	2016-2020
Log price	-2.24 (0.191)	-2.43 (0.153)	-1.61 (0.103)	-2.05 (0.185)	-1.93 (0.261)	-1.79 (0.103)
Log mean price of substitute	0.65 (0.102)	0.96 (0.085)	1.25 (0.075)	1.01 (0.099)	1.64 (0.090)	1.63 (0.094)
Log real per-capita income	0.46 (0.107)	0.51 (0.088)	0.39 (0.054)	0.76 (0.058)	0.54 (0.059)	0.24 (0.047)
Other state and county controls	Yes	Yes	Yes	Yes	Yes	Yes
UPC fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	207,511	350,603	751,084	262,820	356,323	614,314
Adjusted R-squared	0.35	0.32	0.31	0.25	0.25	0.25

# Summarizing

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Large increases in the median price of a bottle of both bourbon and scotch from 2006-2020.

- Bourbon saw price increase across all parts of the distribution, but larger increases at the upper end of the distribution.
- For scotch all of the action occurred at the top of the distribution.
- Both experienced large increases in price dispersion.

Declines in the median price of a bottle of both bourbon and scotch from 2020-2023.

- For both bourbon and scotch, the declines primarily occurred in the below the 75<sup>th</sup> percentile of the distribution. Price of premium whiskeys continues to rise, or at least not fall

# Summarizing

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Controls for location, store type, taxes and attributes accounts for much of the changes in price over time.

- Age and proof are associated with higher prices for both bourbon and scotch
- In isolation, does not appear profitable to produce very old bourbon
- High proof produces a higher return in bourbon



# Summarizing

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See very similar levels and trends in the estimates of own-price, cross-price and income elasticities

- Both become more price and income inelastic over time
- Both appear to be less price sensitive at top and bottom of the price distribution

Results seem consistent with a general increase in demand for whiskies and higher quality whiskies, initially and then a general decrease later.

# But Why?

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## Simple demographic changes provides a compelling explanation

- As young baby boomers started entering the alcohol market in the mid- to late-60s demand shifted towards products favored by the young—beer and wine
- As boomers aged and became wealthier demand for whiskeys (and other spirits) returned to previously levels and then grew
  - See WSJ article on tequila
- Now, as boomers age out of the market, demand for spirits falls
  - Shifts toward cannabis? Good story, very little data
  - Likely among younger drinkers and, even if true, impact will be limited
- Normal consolidation of a recently expanding industry also seems to be occurring

# But Why?

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## What about tariffs?

- Tariffs are never good but,
- At least currently exports are not a big share of bourbon production
- According to data KDA data, exports grew during the first Trump administration (2017-2020) when tariffs were in place, but fell during COVID like much of world trade
- But ...

# Is there a glut of bourbon?

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## Some numbers:

- Scotland: population—5.5M; number of scotch barrels aging—22M; number of distilleries—151; size of global market—approx. \$61B
- Kentucky: population—4.6M; number of bourbon barrels aging—13M; number of distilleries—over 100; size of global market—approx. \$6B

Size of bourbon industry is consistent with trying to compete with scotch in the global marketplace

- Appears that there is plenty of opportunity to grow globally
- A trade war over tariffs would likely hurt these efforts

Future growth of bourbon likely contingent on expanding globally

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# Thank You



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