Model Result –

From the model results (Appendix), we can get the price sensitivity for the refrigerated packaged juice category, the average price sensitivity is that for every 1% increase in price, the market share decreases by a percentage in the interval [-1.42 to -2.76] holding other factors the same. (Brand-level price sensitivity can also be calculated from the model).

Model Selection -

Since we are using market-level data to build the discrete choice model, we are facing the challenges of
heterogeneity and endogeneity issues. To deal with heterogeneity, we added brand and zone dummies to the model to allow for brand and zone heterogeneity. To deal with endogeneity, we used wholesale price and "Hausman-type" instrument (price in other zones) as instrument variables to build 2-stage least square models. For heterogeneity, model 1,4,6 didn't consider both brand and zone heterogeneity, model 2,5,8 only considered brand heterogeneity without accounting for zone heterogeneity. Model 3,6,9 considered both brand and zone heterogeneity. Comparing their results, we can see the brand heterogeneity is significantly making the price elasticity of model 2,5,7 changes much from model 1,4,6. This makes sense because consumers have different brand preference regardless of price. The zone heterogeneity is not quite significant to make the result of model 3,6,9 much different from the result of model 2,5,8. For endogeneity, after using instrumental variables in models 4 - 9, the absolute value of price elasticity increased. This indicates that the error term is correlated with both the dependent variable and the price. Using instrumental variables is valuable to get unbiased estimation of price elasticity.

Sanity Check Using Different Price Measures-
The price elasticity of normal price, weighted price with presales and weighted price with move are in the range of [-1.96,-2.76], [-1.64,-2.64], and [-1.42,-2.39] respectively (exclude model (4)). Among all three different price methods, the price elasticity
is only slightly different from each other. However, all of them represent that increase in price will decrease the sale
volume, which means our model is robust.

We can conclude that for Refrigerated Orange Juice Category, for every 1% increase in price, the point estimation of the market share decreases by a percentage in the interval [-1.42 to -2.76] holding other factors the same.

----- Appendix Follows -----
Table 1 – Discrete Choice Models Using Simple Average Price
Table 2 – Discrete Choice Models Using Weighted Price By Resales
Table 3 – Discrete Choice Models Using Weighted Price By Moves

Table 1 - Discrete Choice Models Result Using Simple Average Price

	Dependent variable:								
	Y = ln(sj/s0)								
	OLS	OLS	OLS	IV	IV	IV	IV	IV	IV
	3.1.1	3.1.2	3.1.3	3.1.4	3.1.5	3.1.6	3.1.7	3.1.8	3.1.9
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
reprice	-1.222***	-0.926***	-0.993***	-0.124**	-1.019***	-1.053***	-1.304***	-1.035***	-1.045***
	(0.035)	(0.025)	(0.026)	(0.051)	(0.053)	(0.053)	(0.038)	(0.029)	(0.029)
prom	-0.307***	0.634***	0.586***	0.133***	0.589***	0.556***	-0.340***	0.581***	0.559***
	(0.044)	(0.024)	(0.024)	(0.048)	(0.033)	(0.034)	(0.044)	(0.025)	(0.025)
FLDAGOLD		-0.851***	-0.836***		-0.832***	-0.824***		-0.829***	-0.825***
		(0.033)	(0.032)		(0.034)	(0.034)		(0.033)	(0.032)
FLORIDA		0.855***	0.880***		0.888***	0.901***		0.893***	0.898***
		(0.033)	(0.033)		(0.037)	(0.037)		(0.034)	(0.033)
HH		1.878***	1.899***		1.906***	1.917***		1.911***	1.915***
		(0.033)	(0.032)		(0.036)	(0.035)		(0.033)	(0.033)
MMAID		2.278***	2.295***		2.305***	2.312***		2.310***	2.310***
		(0.033)	(0.033)		(0.036)	(0.035)		(0.033)	(0.033)
Other		2.418***	2.384***		2.373***	2.354***		2.365***	2.358***
		(0.034)	(0.034)		(0.041)	(0.041)		(0.035)	(0.035)
TROP		3.228***	3.247***		3.257***	3.266***		3.262***	3.263***
		(0.033)	(0.033)		(0.036)	(0.036)		(0.033)	(0.033)
Zone FES	NO	NO	YES	NO	NO	YES	NO	NO	YES
Price Elasticity	-2.5826324	NA	NA	-2.0627558	-2.1535680	-2.2252599	-2.7567885	-2.1875886	-2.2099174
IV Used	NA	NA	NA	wbhprice	wbhprice	wbhprice	average price in other zones	average price in other zones	average price in other zones
Observations	11,426	11,426	11,426	11,426	11,426	11,426	11,426	11,426	11,426
R2	0.096	0.799	0.805	0.020	0.799	0.805	0.096	0.798	0.805
Adjusted R2	0.096	0.799	0.805	0.020	0.798	0.805	0.096	0.798	0.805
Residual Std. Error	1.461 (df = 11423)	0.690 (df = 11417)	0.679 (df = 11403)	1.522 (df = 11423)	0.690 (df = 11417)	0.679 (df = 11403)	1.462 (df = 11423)	0.690 (df = 11417)	0.679 (df = 11403)
F Statistic	607.322*** (df = 2; 11423)	5,666.094*** (df = 8; 11417)	2,142.030*** (df = 22; 11403)						

Note: *p<0.1; **p<0.05; ***p<0.01

Table 2 – Discrete Choice Models Using Weighted Price By Resales

	Dependent variable:								
	Y = ln(sj/so)								
	OLS 3.1.1 (1)	OLS 3.1.2 (2)	OLS 3.1.3 (3)	IV 3.1.4 (4)	IV 3.1.5 (5)	IV 3.1.6 (6)	IV 3.1.7 (7)	IV 3.1.8 (8)	IV 3.1.9 (9)
reprice	-0.755***	-0.793***	-0.810***	-0.114**	-0.922***	-0.934***	-1.216***	-0.870***	-0.877***
	(0.028)	(0.015)	(0.015)	(0.047)	(0.046)	(0.045)	(0.036)	(0.023)	(0.023)
prom	-0.239***	0.605***	0.586***	0.119**	0.527***	0.508***	-0.497***	0.558***	0.544***
	(0.045)	(0.022)	(0.021)	(0.051)	(0.034)	(0.034)	(0.047)	(0.024)	(0.024)
FLDAGOLD		-0.886***	-0.881***		-0.860***	-0.856***		-0.870***	-0.868***
		(0.031)	(0.030)		(0.032)	(0.032)		(0.031)	(0.031)
FLORIDA		0.815***	0.822***		0.862***	0.868***		0.843***	0.847***
		(0.031)	(0.030)		(0.035)	(0.034)		(0.032)	(0.031)
HH		1.883***	1.890***		1.930***	1.935***		1.911***	1.914***
		(0.031)	(0.030)		(0.035)	(0.034)		(0.032)	(0.031)
MMAID		2.334***	2.339***		2.387***	2.390***		2.366***	2.367***
		(0.031)	(0.031)		(0.036)	(0.035)		(0.032)	(0.032)
Other		2.544***	2.536***		2.491***	2.485***		2.512***	2.508***
		(0.031)	(0.031)		(0.036)	(0.035)		(0.032)	(0.032)
TROP		3.298***	3.305***		3.356***	3.361***		3.333***	3.335***
		(0.031)	(0.031)		(0.037)	(0.036)		(0.032)	(0.032)
Zone FES	NO	NO	YES	NO	NO	YES	NO	NO	YES
Price Elasticity	-1.641628	-1.7239908	-1.7606708	-0.2478312	-2.0033025	-2.0312359	-2.6425893	-1.8913270	-1.9059522
IV Used	NA	NA	NA	whprice	whprice	whprice	average price in other zones	average price in other zones	average price in other zones
Observations	11,426	11,426	11,426	11,426	11,426	11,426	11,426	11,426	11,426
R2	0.062	0.818	0.824	0.018	0.817	0.823	0.039	0.817	0.823
Adjusted R2	0.061	0.818	0.823	0.018	0.817	0.822	0.039	0.817	0.823
Residual Std. Error	1.489 (df = 11423)	0.656 (df = 11417)	0.646 (df = 11403)	1.523 (df = 11423)	0.658 (df = 11417)	0.648 (df = 11403)	1.507 (df = 11423)	0.657 (df = 11417)	0.646 (df = 11403)
F Statistic	374.530*** (df = 2; 11423)	6,406.513*** (df = 8; 11417)	2,422.162*** (df = 22; 11403)						

Note: *p<0.1; **p<0.05; ***p<0.01

Table 3 – Discrete Choice Models Using Weighted Price By Moves

	Dependent variable:								
	Y = ln(sj/so)								
	OLS	OLS	OLS	IV	IV	IV	IV	IV	IV
	3.1.1	3.1.2	3.1.3	3.1.4	3.1.5	3.1.6	3.1.7	3.1.8	3.1.9
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
reprice	-1.176***	-0.696***	-0.707***	-0.124**	-0.871***	-0.883***	-1.240***	-0.874***	-0.880***
	(0.026)	(0.015)	(0.015)	(0.051)	(0.044)	(0.044)	(0.035)	(0.024)	(0.024)
prom	-0.347***	0.693***	0.680***	0.127***	0.594***	0.577***	-0.376***	0.592***	0.579***
	(0.042)	(0.022)	(0.022)	(0.049)	(0.032)	(0.032)	(0.043)	(0.024)	(0.024)
FLDAGOLD		-0.909***	-0.906***		-0.875***	-0.871***		-0.874***	-0.871***
		(0.032)	(0.031)		(0.033)	(0.032)		(0.032)	(0.031)
FLORIDA		0.778***	0.783***		0.841***	0.847***		0.842***	0.845***
		(0.032)	(0.031)		(0.035)	(0.035)		(0.033)	(0.032)
HH		1.666***	1.667***		1.683***	1.685***		1.683***	1.684***
		(0.031)	(0.031)		(0.032)	(0.031)		(0.031)	(0.031)
MMAID		2.111***	2.111***		2.136***	2.137***		2.137***	2.136***
		(0.031)	(0.031)		(0.032)	(0.032)		(0.032)	(0.031)
Other		2.473***	2.466***		2.373***	2.364***		2.371***	2.366***
		(0.032)	(0.032)		(0.040)	(0.040)		(0.034)	(0.034)
TROP		3.080***	3.082***		3.116***	3.118***		3.117***	3.117***
		(0.031)	(0.031)		(0.033)	(0.032)		(0.032)	(0.031)
Zone FES	NO	NO	YES	NO	NO	YES	NO	NO	YES
Price Elasticity	-2.4039501	-1.4224291	-1.4443681	-0.2538846	-1.7795363	-1.8053318	-2.5338177	-1.7863432	-1.7982003
IV Used	NA	NA	NA	whprice	whprice	whprice	average price in other zones	average price in other zones	average price in other zones
Observations	11,426	11,426	11,426	11,426	11,426	11,426	11,426	11,426	11,426
R2	0.149	0.809	0.815	0.031	0.807	0.812	0.148	0.807	0.812
Adjusted R2	0.148	0.809	0.814	0.031	0.807	0.812	0.148	0.807	0.812
Residual Std. Error	1.418 (df = 11423)	0.672 (df = 11417)	0.663 (df = 11403)	1.513 (df = 11423)	0.676 (df = 11417)	0.666 (df = 11403)	1.419 (df = 11423)	0.676 (df = 11417)	0.666 (df = 11403)
F Statistic	997.097*** (df = 2; 11423)	6,043.325*** (df = 8; 11417)	2,276.234*** (df = 22; 11403)						

Note: *p<0.1; **p<0.05; ***p<0.01