Online Appendix to "Liquidity Constraints and Imperfect Information
in Subprime Lending," by Adams, Einav, and Levin

This appendix reports estimates of the key parameters from various imputation strategies and alternative specifications that attempt to isolate each key source of exogenous variation in the data. Overall, we show here that the key results we report in the paper are quite stable. The one possible exception is the parameter on car price in the purchasing model of Section II, which exhibits more variation. Nevertheless, we show that our qualitative conclusions are not at all sensitive to this variation.

There are three tables. Table A1 focuses on the robustness of the effect of minimum down on purchasing behavior, Table A2 focuses on the robustness of the effect of car price on purchasing behavior, and Table A3 focuses on the robustness of the effect of loan amount on default. A longer discussion of these alternative specifications, the underlying variation which motivates them, and our interpretation of the results is available from the authors upon request.

Table A1: Effect of Minimum Down on Purchase - Robustness

| | Sample Size* | Individual Level (dep. var. = sale dummy) | | | | | | | | Cell Level (dep. var. = log sales) | | | |
| | | No IV | | List Price IV[a] | | Cost Bucket IV[b] | | State IV[c] | | No IV[d] | | List Price IV[d] | |
		dF/dx	Std. Err.	dF/dx	Std. Err.	dF/dx	Std. Err.	dF/dx	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Alternative Imputation Methods													
City-Week-Credit Category-Income[†]	N	-0.0301	(0.0006)	-0.0299	(0.0006)	-0.0298	(0.0006)	-0.0303	(0.0006)	-0.0895	(0.0039)	-0.0889	(0.0039)
City-Month-Credit Category-Income	N	-0.0301	(0.0006)	-0.0302	(0.0006)	-0.0299	(0.0006)	-0.0302	(0.0006)	-0.1153	(0.0031)	-0.1131	(0.0033)
City-Week-Credit Category	N	-0.0301	(0.0006)	-0.0301	(0.0006)	-0.0300	(0.0006)	-0.0302	(0.0006)	-0.0933	(0.0023)	-0.0937	(0.0023)
City-Month-Credit Category	N	-0.0300	(0.0006)	-0.0302	(0.0006)	-0.0298	(0.0006)	-0.0302	(0.0006)	-0.0934	(0.0024)	-0.0938	(0.0025)
City-Month-Fine Credit Category	N	-0.0300	(0.0006)	-0.0302	(0.0006)	-0.0299	(0.0006)	-0.0300	(0.0006)	-0.1158	(0.0024)	-0.1190	(0.0026)
Dealership-Month-Credit Category	N	-0.0301	(0.0006)	-0.0304	(0.0006)	-0.0300	(0.0006)	-0.0304	(0.0006)	-0.1034	(0.0040)	-0.1035	(0.0040)
Regression Discontinuities													
Minimum Down Payment Changes													
7 day window	0.20N	-0.0244	(0.0016)	-0.0245	(0.0016)	-0.0245	(0.0016)	-0.0244	(0.0016)	-0.0631	(0.0059)	-0.0645	(0.0062)
14 day window	0.35N	-0.0238	(0.0009)	-0.0238	(0.0010)	-0.0239	(0.0009)	-0.0240	(0.0009)	-0.0620	(0.0053)	-0.0627	(0.0055)
30 day window	0.57N	-0.0245	(0.0008)	-0.0245	(0.0008)	-0.0245	(0.0008)	-0.0247	(0.0008)	-0.0674	(0.0054)	-0.0686	(0.0056)
60 day window	0.79N	-0.0267	(0.0007)	-0.0268	(0.0007)	-0.0266	(0.0007)	-0.0270	(0.0007)	-0.0781	(0.0051)	-0.0790	(0.0058)
Alternative Specifications													
No credit category fixed effects													
No instruments for minimum down	N	-0.0328	(0.0003)	-0.0326	(0.0004)	-0.0325	(0.0004)	-0.0328	(0.0004)	-0.1161	(0.0028)	-0.1143	(0.0034)
Credit categories inst. for min. down	N	-0.0335	(0.0004)	-0.0339	(0.0004)	-0.0336	(0.0004)	-0.0337	(0.0004)	-0.1320	(0.0026)	-0.1458	(0.0038)

Notes

* Sample size for individual-level purchasing estimates is reported as a fraction of N, where N >> 50,0000 is the number of applicants (see Table 1). Sample size for cell-level estimates is ~0.03N.

† Baseline imputation presented in Table 2.

a Instruments for negotiated price are list price (equal to zero if not available) and indicator equal to one if list price is not available. List prices are available for approximately 80 percent of the observations.

b Instruments for negotiated price are dummy variables corresponding to each of 11 cost buckets (see Figure 3 for illustration).

c Instruments for negotiated price are dummy variables corresponding to two states with APR caps below 29.9 percent.

d Cell-level regressions are weighted by number of apps and include log(apps) as an explanatory variable.

Individual-level estimates represent the marginal effect on the probability of sale of a $100 change in the minimum down payment. Cell-level estimates represent the percent change in sales resulting from a $100 change in the minimum down payment. Given the average sale probability of 0.34, individual and cell-level estimates can be roughly compared by dividing the latter by three.

Table A2: Effect of Price on Purchase - Robustness

| | Sample Size* | Individual Level (dep var = sale dummy) | | | | | | | | Cell Level (dep var = log sales) | | | | Min. Discount Rate (Ind)[e] | Min. Discount Rate (Cell)[f] |
| | | No IV | | List Price IV[a] | | Cost Bucket IV[b] | | State IV[c] | | No IV[d] | | List Price IV[d] | | | |
		dF/dx	Std. Err.	dF/dx	Std. Err.	dF/dx	Std. Err.	dF/dx	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.		
Alternative Imputation Methods															
City-Week-Credit Category-Income [†]	N	-0.0002	(0.0002)	-0.0010	(0.0011)	-0.0022	(0.0007)	-0.0032	(0.0006)	-0.0061	(0.0016)	-0.0102	(0.0063)	469%	434%
City-Month-Credit Category-Income	N	0.0002	(0.0002)	0.0008	(0.0011)	-0.0010	(0.0007)	-0.0031	(0.0006)	-0.0170	(0.0016)	-0.0267	(0.0051)	472%	170%
City-Week-Credit Category	N	-0.0008	(0.0002)	-0.0003	(0.0012)	-0.0013	(0.0007)	-0.0037	(0.0006)	-0.0262	(0.0013)	-0.0236	(0.0042)	401%	173%
City-Month-Credit Category	N	-0.0008	(0.0002)	0.0004	(0.0012)	-0.0020	(0.0007)	-0.0037	(0.0006)	-0.0254	(0.0013)	-0.0222	(0.0043)	407%	178%
City-Month-Fine Credit Category	N	-0.0008	(0.0002)	0.0005	(0.0011)	-0.0015	(0.0007)	-0.0042	(0.0006)	-0.0226	(0.0015)	-0.0041	(0.0058)	356%	199%
Dealership-Month-Credit Category	N	-0.0007	(0.0002)	0.0014	(0.0011)	-0.0017	(0.0007)	-0.0029	(0.0006)	-0.0110	(0.0016)	-0.0101	(0.0074)	505%	402%
Regression Discontinuities															
Sept. 2002 Margin Change (Figure 3)															
7 day window	0.01N	0.0008	(0.0017)	0.0536	(0.0143)	0.0103	(0.0148)	0.0012	(0.0097)	-0.0080	(0.0154)	-0.0492	(0.3353)	n/a	94%
14 day window	0.02N	-0.0006	(0.0013)	0.0489	(0.0101)	0.0031	(0.0100)	-0.0002	(0.0067)	-0.0083	(0.0076)	-0.0145	(0.0457)	2596%	307%
30 day window	0.04N	-0.0002	(0.0006)	0.0291	(0.0086)	-0.0035	(0.0060)	-0.0027	(0.0025)	-0.0075	(0.0067)	0.0302	(0.2756)	420%	587%
60 day window	0.08N	-0.0004	(0.0004)	0.0281	(0.0037)	-0.0036	(0.0014)	-0.0011	(0.0016)	-0.0048	(0.0049)	0.0768	(0.0419)	419%	913%
All Margin Changes (9/02, 6/04, 9/04)															
7 day window	0.02N	0.0011	(0.0011)	0.0446	(0.0125)	0.0096	(0.0058)	-0.0039	(0.0039)	0.0036	(0.0130)	0.0983	(0.0084)	381%	n/a
14 day window	0.03N	(1E-05)	(0.0008)	0.0313	(0.0058)	0.0027	(0.0047)	-0.0045	(0.0035)	-0.0034	(0.0070)	0.0520	(0.0075)	330%	1300%
30 day window	0.07N	(5E-06)	(0.0004)	0.0188	(0.0032)	0.0023	(0.0036)	-0.0043	(0.0021)	-0.0065	(0.0052)	0.0246	(0.0082)	344%	675%
60 day window	0.13N	-0.0002	(0.0004)	0.0140	(0.0021)	-0.0034	(0.0018)	-0.0033	(0.0014)	-0.0055	(0.0039)	0.0233	(0.0073)	436%	798%
Cost bucket changes ($50 window) [g]															
Bucket change #1	0.02N	0.0009	(0.0012)	0.0003	(0.0360)	-0.0207	(0.0045)	-0.0014	(0.0162)	-	-	-	-	75%	n/a
Bucket change #2	0.02N	-0.0031	(0.0009)	0.0303	(0.0323)	-0.0047	(0.0020)	-0.0047	(0.0125)	-	-	-	-	316%	n/a
Bucket change #3	0.03N	0.0005	(0.0011)	0.0156	(0.0261)	-0.0075	(0.0034)	-0.0059	(0.0085)	-	-	-	-	202%	n/a
Bucket change #4	0.03N	-0.0006	(0.0010)	0.0086	(0.0094)	-0.0273	(0.0045)	0.0006	(0.0171)	-	-	-	-	57%	n/a
Bucket change #5	0.03N	-0.0005	(0.0010)	-0.0067	(0.0114)	-0.0091	(0.0039)	-0.0033	(0.0076)	-	-	-	-	168%	n/a
Bucket change #6	0.03N	-0.0005	(0.0007)	0.0147	(0.0060)	0.0032	(0.0037)	-0.0008	(0.0030)	-	-	-	-	1906%	n/a
Bucket change #7	0.01N	-0.0008	(0.0016)	-0.0074	(0.0070)	-0.0134	(0.0034)	0.0001	(0.0070)	-	-	-	-	115%	n/a
Alternative Specifications															
No credit category fixed effects															
No instruments for minimum down	N	-0.0001	(0.0002)	-0.0017	(0.0010)	-0.0026	(0.0005)	-0.0034	(0.0005)	-0.0020	(0.0022)	-0.0115	(0.0073)	441%	384%
Credit categories inst. for min. down	N	-0.0001	(0.0002)	0.0028	(0.0009)	0.0005	(0.0005)	-0.0015	(0.0005)	-0.0004	(0.0022)	0.0607	(0.0072)	973%	5190%

Notes

* Sample size for individual-level purchasing estimates is reported as a fraction of N, where N >> 50,0000 is the number of applicants (see Table 1). Sample size for cell-level estimates is ~0.03N.

† Baseline imputation presented in Table 2.

a I Instruments for negotiated price are list price (equal to zero if not available) and indicator equal to one if list price is not available. List prices are available for approximately 80 percent of the observations.

b Instruments for negotiated price are dummy variables corresponding to each of 11 cost buckets (see Figure 3 for illustration).

c Instruments for negotiated price are dummy variables corresponding to two states with APR caps below 29.9 percent.

d Cell-level regressions are weighted by number of apps and include log(apps) as an explanatory variable.

e,f Minimum discount rate is the buyer's annual subjective discount rate that is required to rationalize the relative demand responses to price and minimum down payment in the absence of liquidy constraints.

e Individual level discount rates are based on the minimum down coefficient presented in Column 2 of Table 2 (-0.0299) and the most negative individual-level price coefficient for a given specification.

f Cell level discount rates are based on the minimum down coefficient presented in Column 6 of Table 2 (-0.0889) and the most negative cell-level price coefficient for a given specification.

g Cost bucket discontinuity results are not presented since cost windows include too few sales for each cell.

Individual-level estimates represent the marginal effect on the probability of sale of a $100 change in negotiated price. Cell-level estimates represent the percentage change in sales resulting from a $100 change in negotiated price. Given the average sale probability of 0.34, individual and cell-level estimates can be roughly compared by dividing the latter by three.

Table A3: Effect of Amount Financed on Default - Robustness

	Sample Size*	With Default Residual		Without Default Residual	
		Haz. Rat.	Std. Err.	Haz. Rat.	Std. Err.
Alternative Specifications					
Cox PHM on Fraction of Payments Made					
No price or delayed-down residuals[†]	0.34N	1.016	(0.001)	1.024	(0.001)
With negotiated price residual	0.34N	1.024	(0.001)	1.036	(0.001)
With delayed-down residual	0.34N	1.016	(0.001)	1.023	(0.001)
With both residuals	0.34N	1.024	(0.001)	1.034	(0.001)
Tobit on Fraction of Payments Made[a]					
Default equation only	0.34N	-	-	1.020	(0.001)
Joint estimation with down equation	0.34N	1.014	(0.001)	-	-
Joint estimation with price & down equations	0.34N	1.014	(0.001)	-	-
Regression Discontinuities					
Minimum Down Payment Changes					
7 day window	0.07N	1.017	(0.001)	1.022	(0.001)
14 day window	0.13N	1.017	(0.001)	1.022	(0.001)
30 day window	0.20N	1.017	(0.001)	1.023	(0.001)
60 day window	0.27N	1.017	(0.001)	1.023	(0.001)
Sept. 2002 Margin Change (Figure 3)					
7 day window	0.003N	1.018	(0.006)	1.023	(0.005)
14 day window	0.01N	1.013	(0.005)	1.023	(0.004)
30 day window	0.01N	1.021	(0.002)	1.023	(0.002)
60 day window	0.03N	1.019	(0.002)	1.025	(0.002)
All Margin Changes (9/02, 6/04, 9/04)					
7 day window	0.01N	1.017	(0.008)	1.020	(0.004)
14 day window	0.01N	1.012	(0.005)	1.023	(0.003)
30 day window	0.02N	1.018	(0.004)	1.025	(0.002)
60 day window	0.04N	1.018	(0.002)	1.027	(0.001)
Cost bucket changes ($50 window)					
Bucket change #1	0.01N	1.013	(0.007)	1.030	(0.005)
Bucket change #2	0.01N	1.010	(0.004)	1.017	(0.004)
Bucket change #3	0.01N	1.021	(0.004)	1.024	(0.003)
Bucket change #4	0.01N	1.029	(0.003)	1.029	(0.003)
Bucket change #5	0.01N	1.012	(0.004)	1.023	(0.003)
Bucket change #6	0.01N	1.023	(0.004)	1.027	(0.003)
Bucket change #7	0.01N	1.025	(0.005)	1.034	(0.004)

Notes
* Sample size for individual-level purchasing estimates is reported as a fraction of N, where N >> 50,0000 is the number of applicants (see Table 1). The number of sales is 0.34N.
† Baseline specifications presented in Columns 1 and 2 of Table 4.
a Results presented as the hazard ratio in a proportional hazard model that would yield a marginal effect of amount financed on the probabilty of default equivalent to the one estimated by the given Tobit specification.