(DIS)CONNECTING PEOPLE? 2016 INDIAN DEMONETISATION AND MOBILE PHONE MARKETS

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APPENDIX

ESTIMATION STRATEGY:

We rely upon an event study framework which will facilitate in understanding the change in sales associated with post-demonetisation focussed on the four-month period between November 2016 to February 2017; with March to October 2016 as the pre-event period. We acknowledge that this strategy does not enable us to estimate the causal effects of demonetisation. Random assignment, either through researcher or natural experiment setup was not possible, given the study context. We estimate the relationship between our outcomes of interest - log sales of mobile phones - and demonetisation-related explanatory variables with Equation 1:

$$\begin{aligned}\ln(sales)_{i,t} = \alpha &+ \beta_1 Post\ demonetisation_{i,t} + \beta_2 Smartphone_{i,t} + \beta_3\, Chinese\ firm_{i,t} \\ &+ \beta_4\, Post\ demonetisation * Smartphone_{i,t} \\ &+ \beta_5\, Post\ demonetisation * Chinese\ firm * Smartphone_{i,t} \\ &+ \beta_6 Post\ demonetisation * Chinese\ firm_{i,t} + \beta_7\, Chinese\ firm * Smartphone_{i,t} \\ &+ \beta_8 \ln(retail\ price)_{i,t} + X_{i,t} + v_i + \pi_t + u_{i,t}\end{aligned}$$

In the above model, β_1 measures the average sales of mobile phones during November 2016 to February 2017, relative to pre-demonetisation period. Coefficients β_4, β_5 and β_6 measures the average change in sales during post-demonetisation for smartphones (relative to feature phones), average change in smartphone sales by Chinese firms (relative to their Indian and global counterparts and feature phones) and average change in sales by Chinese firms (relative to their Indian and global counterparts). We introduce the individual dummies and double interactions to account for unobserved heterogeneities. Since prices are a determinant of quantity demanded, they are controlled for with log retail price and the variable X_{it} is a vector that captures non-price characteristics such as import status, presence of camera, screen size and others. Our unit of observation is SKU_i. Here, t is time varying by month; ν_i in our model represents the firm dummies to account for time-invariant unobserved firm heterogeneity, and π_t denotes the month-wise dummies control for seasonality and other unobserved time varying heterogeneity coming from macroeconomic factors like inflation in the economy.

We estimate the mobile phone demand model using two stage least square (2SLS here on) and generalized method of moments estimator (GMM2s here on). We adopt GMM2s as it ensures that the standard errors are derived from asymptotically optimal weighting matrix and are robust to any arbitrary heteroscedasticity (Wooldridge, 2001). Log retail prices on the right hand side of Equation 1 are endogenous and is instrumented with log production costs and log average production costs of competitors (Angrist and Krueger, 2001). Standard errors were clustered at the firm-level to account for any auto-correlation between models within a firm. Due to clustering of standard errors at the firm level, we face the singleton problem which is circumvented

by applying the Frisch-Waugh-Lovell theorem and partialling out the firm dummies and constant to be able to estimate the optimal weighting matrix (Baum, Schaffer and Stillman, 2007).

FINDINGS:

Table 1 reports the 2SLS and GMM2s estimates of the demand equation. Since the results of 2SLS and GMM2s are very similar, GMM2s estimates are described here. The coefficient estimates reported in Table 1 are in log-linear form which is converted to percentages for our discussion here. Our estimates reveal that average mobile phone sales (smartphones and featurephones) has increased by 102.79 % post-demonetisation and no significant change was observed for smartphones, relative to featurephones, post demonetisation. Chinese mobile phone sales in aggregate dropped by 32.50% relative to the counterparts since demonetisation in November 2016. But strikingly, average sales of Chinese smartphones increased by 105.65% post-demonetisation, relative to the counterparts. To test for robustness, we re-estimate equation 1 with only those firms which had products sold in the market during March 2016 to February 2017, without any gaps in our data.

There is possibility that the sales were generally low between March to October 2016 compared to November 2016 to February 2017 - thereby driving the results observed here. To check for this, we extended our period of analysis by including data for the period January 2015 - February 2016. Thus, the period of analysis consists of 22 months of pre-demonetisation months (January 2015 - October 2016) and four months of post-demonetisation months (November 2016 to February 2017).

Table 1: Regression Estimates - Chinese Smartphones Sales Increase After Demonetisation

Selected Independent Variables	First Stage [OLS]	M1	M2
		2SLS	GMM2S
Dummy for Chinese Smartphones Post Demonetization	-0.035	0.721***	0.721***
	[0.040]	[0.259]	[0.259]
Dummy for Chinese Mobile phones Post Demonetization	0.075***	-0.392**	-0.393***
	[0.028]	[0.152]	[0.149]
Dummy for Smartphones Post Demonetization	0.026	-0.108	-0.109
	[0.018]	[0.141]	[0.138]
Dummy for Chinese Smartphones	0.242***	0.059	0.057
	[0.072]	[0.231]	[0.216]
Dummy for Post Demonetization	0.001	0.703*	0.707**
	[0.036]	[0.381]	[0.349]
Dummy for Smartphones	0.093	0.313	0.316
	[0.086]	[0.343]	[0.309]
Dummy for Chinese Firms	0.129**	0.735***	0.736***
	[0.055]	[0.209]	[0.208]
Log of Retail Price (US$)		-1.265***	-1.264***
		[0.197]	[0.184]
Dummy for Import Status	-0.047***	0.814***	0.813***
	[0.012]	[0.187]	[0.178]

Dummy for 3G Technology	0.079**	0.138	0.141
	[0.036]	[0.221]	[0.179]
Dummy for 4G Technology	0.263***	0.858***	0.858***
	[0.054]	[0.197]	[0.197]
Screen Size	0.160***	0.185**	0.184***
	[0.024]	[0.077]	[0.060]
Log of Production Cost (US$)	0.581***		
	[0.053]		
Log of Average Production Cost of Competitors (US$)	-0.907**		
	[0.363]		
Other Controls			
Dummies for Firms	Yes		Yes
Dummies for Month	Yes		Yes
Tests			
First Stage F-Stat		58.69	
Under Identification Test (Chi-sq P-value of Kleibergen-Paap rk LM statistic)		0.00	
Over Identification Test (Chi-sq P-value of Hansen J statistic)		0.98	
Endogeneity Test (Chi-sq P-value)		0.01	
Number of Observations	9,738	9,738	9,738
R-square	0.966	0.127	0.128

Notes: Significance level: *** p<0.01, ** p<0.05, * p<0.1. In the above table, Chi-square P < 0.05 for endogeneity tests indicates that the log retail price is not exogenous and therefore should be instrumented. A value of 58.69 for F-statistics in the first stage indicates the strong statistical validity of the instruments (following the Stock-Yogo critical value of first stage F to be at least 10). The instruments also pass the Hansen J test (Chi-square P-value = 0.9815) for validity of instruments after the second stage estimation. In addition, due to space constraints, the above table does not report regression estimates of number of competitors in the market (significant and low magnitude) and dummy for camera (insignificant) but these are available with authors.

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