Tear Down This Wall! Firms' Differential Price Responses to a Switching Costs Reduction Policy

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Abstract

In many markets, firms use switching costs as a marketing strategy to increase profits, often at the expense of consumers. In response, regulators in many countries have implemented or proposed public policies that reduce switching costs. To better understand the impact of such policies, in this paper we empirically examine the price effects of one of those policies—mobile number portability (MNP) implemented in the U.S. in 2003. We find that prices dropped following the implementation of MNP, and furthermore, firms' price responses were noticeably asymmetric along a couple of dimensions. In particular, within each market, the smaller firms reduced their prices more than the largest firm. Moreover, firms with lower quality service reduced their prices more significantly than firms with higher quality service. In fact, the largest firms reduced their prices more than the smaller firms after controlling for their quality differences. Our findings suggest that consumers benefited not only from lower prices but also the shifting of some market share from lower quality firms to higher quality firms.

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Statement of intended contribution

Our research contributes to the knowledge of switching cost and firms' pricing strategies by showing whether, how much and which type of firms react to the implementation of mobile number portability (MNP). First, we find that prices dropped following the implementation of NP overall. Then we find asymmetric price responses among the firms. In particular, within each market, the smaller firms reduced their prices more significantly than the largest firm. Moreover, among the largest firms, those with lower quality service (AT&T in our application) lost more market share than firms with higher quality service (Verizon). In our further analysis after controlling for quality differences, it became apparent that the largest firm in each market reduced its price more than the smaller firms. Our empirical results suggest that consumers benefited not only from lower prices but also the shifting of some market share from lower-quality firms to higher-quality firms.

Our findings offer insight about the effect of switching cost reduction on firms' price and market share changes, and its benefits for consumers. Because of the differing market shares and service quality across firms, the policy maker first must ascertain which firm is more or less vulnerable to the policy change. According to our results, large and low quality firms are forced to lower their prices more and lose more market share. Therefore, the consumers are better off because of lower prices and a less costly switch to the higher quality firms.

1 Introduction

In many markets, firms create or maintain consumer switching costs (in terms of money and/or effort) as a marketing strategy to lock in consumers and increase profits. Examples include frequent flyer programs in the airlines industry, frequent shopper loyalty programs in the grocery retailing industry, fixed-term contracts and early termination fees in the mobile phone industry and cable service industry, etc.

One particular kind of switching costs centers on the account numbers that firms assign to consumers. For example, in the mobile phone industry, if phone numbers are not portable between different providers, when a consumer switches from one provider to another, she needs to tell her new phone number to all her contacts, which costs her time and effort. Similarly, in the banking industry, when a consumer switches from one bank to another, she needs to tell her new account number to all the relevant parties (direct deposits, automatic payments, etc.).

Despite the technical feasibility of number portability (i.e., letting a consumer keep her phone/account number when she switches), firms often resist the implementation of number portability in order to keep consumers' switching costs in place. For example, when mobile number portability was proposed in the U.S. by the Federal Communications Commission in 1996, both the wireless provider Verizon Wireless and the industry advocate Cellular Telecommunications & Internet Association mounted legal challenges that resulted in lengthy delays in the implementation of the new rules (Kessing (2004)). Similarly, Shi et al. (2006) document that when number portability was proposed in Hong Kong in 1997, the established operators objected to and challenged its proposed implementation.

In recent years, regulators in many countries have implemented or proposed public policies to reduce consumer switching costs in order to promote competition and increase consumer welfare, often over the objection of the firms. In the mobile phone industry, number portability was implemented in more than 100 countries (Wikipedia

(2019)) in the past two decades (for examples, see ECC (2005) for the implementation in Europe and Park (2011) for the implementation in the U.S.). In the EU retail banking and payments systems markets, the European Competition Authorities Financial Services Subgroup proposed the establishment of switching facilities (objective and up-to-date comparison sites, switching services, etc.) and the implementation of account number portability to lower consumer switching costs (ECAFSS (2006)). In the software industry, many governments promote the adoption of open standards, such as Open Document Format (ODF) for office applications, in order to reduce customer switching costs (Casson & Ryan (2006)).

Given the prevalence of switching costs as a marketing strategy used by firms to lock in consumers, as well as regulators' interest in curtailing such switching costs, it is critical to better understand the impact of switching costs reduction policies. Towards that end, in this paper we empirically examine the price and market share effects of one of those policies—mobile number portability (MNP) implemented in the U.S. in 2003. We are particularly interested in assessing whether and how the policy led to a better outcome for consumers.

Our estimation uses a detailed dataset on cell phone plans offered by major cell phone companies in the 25 largest markets in the U.S., as well as a consumer survey dataset that records around 60,010 U.S. consumers' survey responses about their technology consumptions.

We find that prices dropped following the implementation of MNP, and furthermore, firms' price responses were noticeably asymmetric along a couple of dimensions. In particular, within each market, the smaller firms reduced their prices more significantly than the largest firm. Moreover, firms with lower quality service lost market share, despite reducing their prices more significantly than firms with higher quality service. After controlling for quality difference, however, it becomes apparent that in fact the largest firms cut prices more than smaller firms did. Our results thus shed light on how this particular switching costs reduction policy led to a better out-

come for consumers, who benefited not only from lower prices but also the shifting of some market share from lowr-quality firms to high-quality firms.

Related Literature. The marketing and economics literature on switching costs has identified two incentives that firms have with respect to switching costs: the *harvesting incentive*, i.e., the incentive to charge higher prices in order to exploit locked-in consumers, as well as the *investment incentive*, i.e., the incentive to charge lower prices in order to build a larger customer base for higher future profits. The traditional view in the theoretical literature is that the harvesting incentive dominates the investment incentive, and therefore switching costs increase equilibrium prices (Beggs & Klemperer (1992), To (1996)). This is the view on which many switching costs reduction policies are based, as it implies that if regulations are imposed on firms to reduce switching costs, prices will be reduced and therefore consumers will benefit.

However, some more recent theoretical studies find that switching costs can lead to a reduction in prices (Arie & Grieco (2014), Cabral (2009), Doganoglu (2010), Doganoglu & Grzybowski (2013)). Similarly, empirical studies on this subject also reach opposing findings. For instance, whereas Viard (2007) and Park (2011) find that prices increase with switching costs, Dubé et al. (2009) find the opposite.

Our paper contributes to this stream of literature by studying the relation between switching costs and prices from a different angle. Whereas the studies cited above abstract from the issue of quality differences among firms, we specifically assess how firms' asymmetric levels of quality led to their differential price responses following MNP, as well as the asymmetric impact of MNP on their market shares. Those results allow us to better understand the mechanism by which the switching costs reduction policy that we study led to a better outcome for consumers.

In particular, existing theoretical studies in the switching costs literature, which typically assume symmetric quality, suggest that given switching costs, the larger firm raises its price more than the smaller firm, since the larger firm has more partially

locked-in consumers and therefore benefits more from raising its price. As a result, the larger firm tends to lose market share to the smaller firm, leading to a lower market concentration (see, for example, Beggs & Klemperer (1992) and Chen & Rosenthal (1996)). Correspondingly, when a switching costs reduction policy is implemented, the prediction is that the larger firm will lower its price more than the smaller firm.

In comparison, our analysis shows that taking into account the asymmetric quality among firms is crucial in understanding firms' asymmetric price responses. Without controlling for quality differences, we find that following MNP, the largest firm in each market reduced its price less than the smaller firms. However, when firms' quality scores are incorporated into the regression, we find that higher-quality firms cut price less significantly; and furthermore, controlling for quality, the largest firm in each market reduced its price more than the smaller firms. Our findings thus contribute to the literature by highlighting the importance of considering firms' asymmetric levels of quality.

Our paper is also related to the literature on number portability in various markets. Among the papers in this literature, Viard (2007) and Park (2011) study the effects of number portability on prices in the toll-free service industry and the mobile phone industry, respectively. Shi et al. (2006) study the effects of mobile number portability on market concentration. Aoki & Small (2010) and Buehler & Haucap (2004) theoretically study the effects of mobile number portability on welfare. Our paper complements those studies and contributes to a more comprehensive understanding of the effects of number portability regulations.

2 Data

The main data for this paper comes from two sources: pricing plans from Econ One (a research firm) and a consumers survey from Forrester Research.

Econ One collects cell phone plans offered by major cell phone companies in the

25 largest markets in the United States. Econ One examines each carrier's web site in order to collect the data. The data cover single-user plans and do not include any pre-paid plans or multiple line plans. The dataset includes information on providers, markets, monthly access fees, numbers of minutes included in the plans and their composition (anytime minutes, peak minutes and night and weekend minutes), activation fees, lengths of contracts and other relevant information. The dataset contains almost all relevant information on plan characteristics except information on handset prices. We use data from January of 2003 to June of 2004 to study the price impact of the implementation of number portability. All the markets in the sample implemented number portability in November, 2003. There is no new entrant during this time period. More detailed description about the Econ One data can be found in Park (2011). Table 1 summarizes the key variables before and after the implementation of number portability in November of 2003 from Econ One data. From the table we see that the mean price of plans offered after number portability is slightly lower than the mean price of plans offered before number portability. In addition, post-NP plans offer more minutes than pre-NP plans on average.

We complement the cell phone plan data with a consumers survey from Forrester Research, which surveys approximately 60,010 consumers across the U.S. about their technology consumptions. The survey includes information about whether the consumer uses a cell phone and if so, which company provides their service. The data also include the MSA of the consumer, and we were able to match the MSA to the market name in the Econ One data. Using Forrester Research data, we were able to construct the cell phone penetration in each market and identify the largest firm in each market in the years of 2003 and 2004. Table 2 summarizes the markets we were able to merge with the Econ One data, the number of survey respondents in each market, the cell phone penetration in the market in 2003 and the largest firm in the market and its market share in 2003 and 2004. It is interesting to observe that as the largest firms, Cingular and AT&T had lower marketing shares in 2004 than 2003, but the market

share for Verizon did not change much in 2004 after the NP policy implementation.

3 Empirical Analysis

We conduct our empirical analysis in three stages. In the first stage, we simply want to see if the implementation of number portability has an impact on the price; in the second stage, we include the largest firm dummy and the interaction between it and number portability dummy to observe the asymmetric responses between different types of firms; and in the third stage, we run a similar regression on market leaders with high and low quality services and look at the change in market shares of these firms to demonstrate a possible explanation behind the asymmetric response. We then incorporate the quality ratings for all the major service providers and find the heterogenous effects of price responses to the NP policy for firms with different service quality. We include plan characteristics and a time trend variable t in all regressions. t is defined as the month of the data if the year is 2003 and the month of the data plus 12 if the year is 2004.

3.1 Overall Impact of Number Portability on Prices

In stage I, we regress the log of monthly access fee on the number portability dummy, various plan characteristics, market dummy and firm dummy to investigate the impact of number portability on price. We estimate the following pricing equation of wireless carriers:

$$ln(PRICE_{ipmt}) = \alpha_1 + \delta_1 NP_t + \theta X_{ipmt} + t + \epsilon_{ipmt} \quad (1)$$

We follow Park (2011) in constructing the dependent variable $PRICE_{ipmt}$, which is the monthly access fee for carrier i's plan p in market m at time t, adjusted for the activation fee and any promotional reduction in the monthly access fee: PRICE =

(Monthly Access Fee * Length of Contract + Activation Fee - Promotional Access Fee Reduction * Length of Promotion) / Length of Contract.

A dummy variable NP_t is equal to one if numbers were portable at time t and zero otherwise. NP_t = 1 for December 2003 through June 2004, and NP_t = 0 before December 2003. A vector of all other controls that could affect the plan price, such as carrier and market dummies as well as various plan characteristics, is represented by X_{ipmt}. t measures the time trend. We also include markets dummies and firms dummies in the regression.

Table 3 reports regression results for the stage I empirical analysis. It is clear that the coefficient on the number portability dummy is negative and significant. This is the evidence that the reduction in switching cost resulting from the implementation of number portability indeed has reduced prices. On average, the plan prices decreased 7.3%after the policy change. The other estimates are also intuitive – the better the product features, the higher the plan price.

3.2 Impact on Largest Firm and the Smaller Firms

As discussed in the Introduction, existing theoretical studies in the switching costs literature, which typically assume symmetric quality, suggest that given switching costs, the larger firm increases its price more than the smaller firm does. Correspondingly, when a switching costs reduction policy is implemented, the prediction is that the larger firm will lower its price more than the smaller firm.

To examine whether the above price pattern predicted in the literature is borne out in our data, in stage II of our analysis, we incorporate the largest firm dummy and the interaction between largest firm dummy and the number portability dummy to see the asymmetric responses between different types of firms. We estimate the following

pricing equation of wireless carriers:

$$ln(PRICE_{ipmt}) = \alpha_1 + \delta_1 NP_t + \beta_1 L_m + \beta_2 NP_t L_m + \theta X_{ipmt} + t + \epsilon_{ipmt}, \quad (2)$$

where L_m is the largest firm dummy in market m. The largest firm in each market is defined based on the firms' market share in 2003. All the other variables are defined as in stage I . We also include markets dummies and firms dummies in the regression. Table 4 reports regression results for the stage II empirical analysis. The coefficient for the interaction term is positive and significant, which means that the largest firms cut prices less than the smaller firms after the implementation of number portability. We find that on average, the smaller firms' prices decreased 8.1%, and prices of largest firms decreased 5.1% respectively.

To test the robustness of our results, we run a similar regression as the first stage for the largest firm and non-largest firms separately to more clearly demonstrate the asymmetric price responses. Table 5 shows the price response of the largest firms and non-largest firms to the implementation of number portability respectively. The largest firms cut their price around 3% while the non-largest firms cut their prices around 7%.

Therefore, our empirical finding appears to contradict the prediction in existing literature in terms of whether the larger firm or the smaller firm lowers its price more significantly when switching costs are reduced. This apparent discrepancy leads us to our stage III analysis, described below, which takes into consideration firms' asymmetric levels of quality.

3.3 Impact on Firms with Different Quality Levels

To understand the asymmetric price responses by different types of firms, we propose the intuition that firms' qualities are different. Before number portability—when switching costs were higher—it was harder for consumers to switch to higher quality

firms; the implementation of number portability helps consumers to overcome this difficulty. To support this intuition, we consulted with Consumer Reports about consumers overall satisfactions in major markets in the year of 2003. The average score for Verizon was 72.75 for 2003 while the average score for AT&T was 62.33 for the same year. It is clear that Verizon had much better quality than AT&T.

We further run the regression from stage I of empirical analysis in the previous section for Verizon and AT&T individually, taking out the firm dummies. Table 6 shows price responses of Verizon and AT&T to the implementation of number portability respectively. Verizon cut its price around 5.6% while AT&T cut its price around 5.7%.

Even though AT&T cut its price more aggressively than Verizon after the implementation of number portability, from table 7 we can see that AT&T lost much more market share compared with Verizon after the implementation of number portability. This finding supports our intuition that after the switching cost was reduced, it became much easier for consumers to switch to higher quality firms. Our findings shed new light on how we should model the impact of switching cost on price of different types of firms. Our empirical findings suggest that quality difference is a key factor, and consumers benefit not only from price reduction, but also from greater ease of acquiring better quality services.

To further investigate the role of service quality, we incorporate the quality score into the regression. Please refer to table 8 for quality score data of different firms in different markets from Consumer Reports. We use the computed average for each firm as the quality score data for each market in the regression analysis. We estimate the following pricing equation:

$$ln(PRICE_{ipmt}) = \alpha_1 + \delta_1 NP_t + \beta_1 L_m + \beta_2 NP_t L_m + \gamma_1 Q_{fm} + \gamma_2 NP_t Q_{fm} + \theta X_{ipmt} + t + \epsilon_{ipmt} \quad (3)$$

where Q_{fm} is the quality score of firm f in market m. Table 9 shows the regression

results. The interaction term between quality scores and NP is positive and significant, which indicates that higher quality firms cut price less significantly. Furthermore, the interaction term between the largest firm dummy and NP is negative and significant, which shows that controlling for quality, large firms cut price more aggressively than small firms do. This finding is consistent with previous theoretical predictions.

4 Conclusion

Our research contributes to the knowledge of switching cost and firms' pricing strategies by showing whether, how much and which type of firms react to the implementation of mobile number portability (MNP). First, we find that prices dropped following the implementation of NP overall. Then we find asymmetric price responses among the firms. In particular, within each market, the smaller firms reduced their prices more significantly than the largest firm. Moreover, among the largest firms, those with lower quality service (AT&T in our application) lost more market share than firms with higher quality service (Verizon). In our further analysis after controlling for quality differences, it became apparent that the largest firm in each market reduced its price more than the smaller firms. Our empirical results suggest that consumers benefited not only from lower prices but also the shifting of some market share from lower-quality firms to higher-quality firms.

MNP is one of the policies that can reduce the consumers' switching cost. The government plans to impose new regulations on mobile phone operators to cut cancellation penalties or early termination fees. Recently, Japan recently announced plans to slash mobile phone contract penalties by about 90 percent to 1,000 Yen ($9) or less to make it easier for users to switch mobile carriers and to spur competition. [1] Our

[1] https://www.japantimes.co.jp/news/2019/06/11/business/japan-plans-cut-mobile-phone-contract-penalties-1000/

findings offer insight about the effect of switching cost reduction on firms' price and market share changes, and its benefits for consumers. Because of the differing market shares and service quality across firms, the policy maker first must ascertain which firm is more or less vulnerable to the policy change. According to our results, large and low quality firms are forced to lower their prices more and lose more market share. Therefore, the consumers are better off because of lower prices and a less costly switch to the higher quality firms.

We recognize that firms could strategically respond in other dimensions besides price reductions. For example, a firm could improve its service quality by investing more in its infrastructures, customizing its service packages based on consumers' needs, and making its service more convenient and friendly for consumers to use. However, most of these long-term investments are difficult to observe immediately after the NP implementation. In addition, the reduction of switching cost could potentially affect the market structure of the local markets. It may encourage more smaller firms to enter the market, or merger or exit of the existing firms. To model the dynamics of the market structure is beyond the scope of our study but is an interesting topic for future research.

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Table 1: Summary Statistics from Econ One Data

		Entire Sample	
		Before NP	After NP
Price		$100.12	$96.45
Activation Fee		$24.67	$23.01
Monthly Access Fee		$87.63	$81.11
Unlimited Anytime Minutes		0.27%	0.86%
Unlimited Peak Minutes		0%	0%
Unlimited Night&Weekend		4.49%	4.50%
Anytime Minutes		1427.03 min	1910.51 min
Peak Minutes		177.22min	318.45 min
Night&Weekend		5668.81min	6868.04min
Coverage	National	32.32%	34.54%
	Network	8.98%	5.00%
	Regional	1.53%	1.80%
	Local	23.09%	17.81%
	Missing	34.07%	42.46%
Contract Len	No Contract	0.08%	0.04%
	1 Year	45.71%	45.30%
	2 Year	54.21%	54.66%
Cancellation Fee		$172.73	$170.06
Availability of Promotion		7.54%	10.19%
Per-Minute Charge	Peak	$0.35	$0.33
	Evening	$0.35	$0.33
Early Nights (7PM)		6.00%	15.00%
Rollover		11.62%	10.29%
Push2Talk		0.96%	0.40%
PCS		47.59%	47.68%
Number of Observations		64041	46154

Table 2: Data Summary from Forrester Research Survey

Market	Number of Survey Respondents	Cell Phone Penetration in 2003	Largest Firm 2003	Market Share in 2003	Largest Firm 2004	Market Share in 2004
Atlanta	920	77.28%	Cingular	36.99%	Cingular	22.50%
Boston	1144	68.97%	Verizon	33.59%	Verizon	33.59%
Chicago	1738	69.85%	Cingular	25.45%	Verizon	25.29%
Cincinnati	525	63.24%	Verizon	33.43%	Verizon	33.43%
Cleveland	957	63.43%	Verizon	37.56%	Verizon	37.56%
Dallas	1096	71.90%	Cingular	31.85%	Cingular	9.39%
Denver	692	71.24%	Verizon	33.27%	Verizon	33.27%
Detroit	1051	72.12%	Verizon	30.87%	Verizon	30.87%
Houston	924	75.97%	Cingular	33.33%	Cingular	25.36%
Kansas City	524	73.47%	Cingular	24.42%	Cingular	21.56%
Los Angeles	2313	72.33%	Verizon	34.61%	Verizon	34.61%
Miami	566	78.09%	Cingular	33.03%	Cingular	11.76%
Minneapolis	941	68.01%	Verizon	19.69%	Verizon	18.13%
New York	3466	69.59%	Verizon	36.32%	Verizon	36.32%
Philadelphia	1504	68.75%	Verizon	32.98%	Verizon	32.98%
Phoenix	735	72.65%	Verizon	27.53%	Verizon	27.53%
Pittsburgh	949	62.91%	Verizon	40.54%	Verizon	40.54%
Portland	787	65.44%	AT&T	37.28%	Verizon	28.93%
Sacramento	702	72.93%	AT&T	38.87%	AT&T	25.39%
San Diego	555	63.06%	Verizon	37.71%	Verizon	37.71%
Seattle	884	66.63%	Verizon	41.26%	Verizon	41.26%
St. Louis	610	68.36%	Verizon	32.37%	Cingular	32.37%
Tampa	877	65.11%	AT&T	19.79%	Verizon	19.09%
Washington D.C.	1144	70.02%	Verizon	29.96%	Verizon	29.96%

Table 3: Regression Results for Stage I Empirical Analysis

	ln(Prices)	
	Est.	SE
NP dummy	-0.076**	0.005
Anytime Minutes	0.474**	0.001
Peak Minutes	0.449**	0.001
Weekend Minutes	-0.008**	0.001
Contract 24	-0.031**	0.003
7PM	0.057**	0.006
National	0.074**	0.003
Rollover	0.094**	0.007
PushToTalk	0.140**	0.013
PCS	0.007	0.004
Free National LD	0.221**	0.007
Free In Network LD	-0.056 **	0.006
Time Trend	0.007**	0.001
# Observations:	91,248	
R-Squared	0.7249	

Note: ** Significant at 1% level. Coefficients for carrier dummies and market dummies are not reported.

Table 4: Regression Results for Stage II Empirical Analysis

	ln(Prices)	
	Est.	SE
NP dummy	-0.084**	0.005
Largest Firm Dummy	0.009**	0.004
NP * Largest Firm	0.031**	0.005
Anytime Minutes	0.474**	0.001
Peak Minutes	0.449**	0.001
Weekend Minutes	-0.008**	0.001
Contract 24	-0.031**	0.003
7PM	0.061**	0.006
National	0.072**	0.003
Rollover	0.093**	0.007
PushToTalk	0.145**	0.013
PCS	0.013**	0.005
Free National LD	0.222**	0.007
Free In Network LD	-0.056**	0.006
Time Trend	0.007**	0.000
# Observations:	91,248	
R-Squared	0.7251	

Note: ** Significant at 1% level. Coefficients for carrier dummies and market dummies are not reported.

Table 5: Largest Firm and Non Largest Firm Price Response to NP

	Largest Firm: ln(Prices)		Non Largest Firm: ln(Prices)	
	Est.	SE	Est.	SE
NP dummy	-0.028**	0.006	-0.072**	0.006
Anytime Minutes	0.671**	0.002	0.419**	0.001
Peak Minutes	0.632**	0.002	0.412**	0.001
Weekend Minutes			-0.013**	0.006
Contract 24	-0.041**	0.003	-0.020**	0.003
7PM	0.296**	0.026	0.040**	0.006
National	0.118**	0.003	0.101**	0.003
Rollover	-0.212**	0.008	-0.052**	0.006
PushToTalk	0.140**	0.011	0.157**	0.022
PCS	0.079**	0.008	-0.068**	0.004
Free National LD	0.120**	0.007	0.262**	0.009
Free In Network LD	-0.085**	0.008	-0.098**	0.008
Time Trend	0.002**	0.001	0.004**	0.001
# Observations:	22,635		68,613	
R-Squared	0.9032		0.6383	

Note: ** Significant at 1% level. Coefficients for carrier dummies and market dummies are not reported.

Table 6: Verizon and AT&T Price Response to NP

	Verizon: ln(Prices)		AT&T: ln(Prices)	
	Est.	SE	Est.	SE
NP dummy	-0.056**	0.005	-0.057**	0.009
Anytime Minutes	0.705**	0.001	0.578**	0.002
Peak Minutes	0.661**	0.001	-0.035**	0.004
Contract 24	-0.043**	0.002	-0.047**	0.013
National	0.155**	0.002	-0.050**	0.004
PushToTalk	0.123**	0.007	0.104**	0.006
Free National LD	0.103**	0.005	0.255**	0.010
Free In Network LD	-0.069**	0.006	-0.200**	0.011
Time Trend	0.004**	0.001	-0.003**	0.001
# Observations:	25,927		23,478	
R-Squared	0.9296		0.8469	

Note: ** Significant 1% level. Coefficients for market dummies are not reported.

Table 7: Effects of NP on Verizon and AT&T Market Shares

Market	Verizon Market Share Before NP	Verizon Market Share After NP	AT&T Market Share Before NP	AT&T Market Share After NP
Atlanta	22.50%	24.27%	8.44%	5.50%
Boston	33.59%	37.46%	14.96%	9.46%
Chicago	25.29%	25.88%	10.54%	8.76%
Cincinnati	33.43%	27.58%	10.84%	8.21%
Cleveland	37.56%	36.63%	12.69%	8.62%
Dallas	9.39%	8.86%	21.95%	15.80%
Denver	33.27%	32.36%	23.94%	16.83%
Detroit	30.87%	29.23%	9.50%	7.04%
Houston	25.36%	24.75%	8.55%	7.99%
Kansas City	21.56%	16.92%	1.30%	1.49%
Los Angeles	34.61%	35.31%	23.91%	16.82%
Miami	11.76%	9.53%	20.14%	16.91%
Minneapolis	18.13%	22.03%	15.47%	12.70%
New York	36.32%	38.20%	20.40%	14.59%
Philadelphia	32.98%	33.51%	17.02%	11.47%
Phoenix	27.53%	27.38%	14.04%	8.21%
Pittsburgh	40.54%	41.44%	20.60%	17.49%
Portland	28.93%	27.72%	37.28%	24.59%
Sacramento	25.39%	25.81%	38.87%	28.21%
San Diego	37.71%	36.58%	14.00%	11.53%
Seattle	41.26%	38.15%	19.52%	14.06%
St. Louis	32.37%	23.37%	8.87%	7.04%
Tampa	19.09%	17.58%	19.79%	13.66%
Washington D.C.	29.96%	28.57%	12.61%	9.81%
Average	**28.72%**	**27.88%**	**16.88%**	**12.37%**

Table 8: Quality Scores of Different Firms in Different Markets from Consumer Reports

Market/Company	Verizon	T-Mobile	Nextel	Cingular	AT&T	Sprint
ATLANTA	75	70	66	64	64	63
BOSTON	72		66	62	62	58
CHICAGO	71	66	69	67	63	60
DALLAS	75	65		67	66	68
DENVER	73	65			65	63
HOUSTON	70	67		67	62	65
LOS ANGELES	72	63	67	63	58	64
NEW YORK	71	59	62		58	58
PHILADELPHIA	73	64	67	64	61	60
SAN FRANCISCO	73			60	64	61
SEATTLE	74	67			62	65
WASHINGTON DC	74		68	61	63	60
Average	**72.75**	**65.11**	**66.43**	**63.89**	**62.33**	**62.08**

Table 9: Price Response to NP including Largest Firm Dummy and Quality Scores

	ln(Prices)	
	Est.	SE
NP dummy	-0.810**	0.037
Largest Firm Dummy	0.036**	0.004
NP * Largest Firm	-0.019**	0.006
Quality Score	0.013**	0.001
NP*Quality Score	0.011**	0.001
Anytime Minutes	0.501**	0.001
Peak Minutes	0.471**	0.001
Weekend Minutes	-0.022**	0.001
Contract 24	-0.035**	0.002
7PM	0.044**	0.006
National	0.085**	0.003
Rollover	-0.059**	0.004
PushToTalk	0.172**	0.013
PCS	0.011**	0.004
Free National LD	0.211**	0.006
Free In Network LD	-0.087**	0.006
Time Trend	0.004**	0.001
# Observations:	88,008	
R-Squared	0.7473	

Note: ** Significant at 1% level. Coefficients for carrier dummies and market dummies are not reported.