How Does Firm Scope Depend on Customer Switching Costs? Evidence from Mobile Telecommunications Markets

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Abstract: This paper examines the relative advantages of single-product and multiproduct firms following changes in customer switching costs. Whereas a single-product firm can closely tailor offerings to customers' needs, a multiproduct firm can create value for customers in the form of flexibility, allowing them to change between product varieties as preferences evolve without needing to switch providers. We argue that this value-creation mechanism is more effective when customers face high switching costs and explore this prediction in the mobile telecommunications sector, using an exogenous policy change (mobile number portability) that suddenly decreases customer switching costs. Our results reveal that when customer switching costs fall, multiproduct firms see lower growth than single-product firms, and entry with a multiproduct offering becomes less frequent than before. The study highlights how customer switching costs can enable or inhibit choices of firm scope.

Keywords: Firm scope, Customer switching costs, Multiproduct, Market frictions, Demand-side perspective, Flexibility

1. Introduction

From social media to operating systems to industrial machinery, switching costs are a ubiquitous feature of modern markets. With complex and interdependent products, users frequently find it costly to move from one company to another, and the strategies firms employ as well as the institutional context of the market can amplify this effect. The economics literature suggests that customer switching costs generally increase market power and reduce welfare through pricing and differentiation (Klemperer 1987a, b, 1995, Shi et al. 2006). Strategy research has explored the empirical effects of switching costs on firm performance (Gómez and Maícas 2011, Mas-Ruiz et al. 2014), but much less has been done to link this type of friction to the benefits of product breadth (Brush et al. 2012, Chatain and Zemsky 2007) or shifts in industry structure (Rhodes and Zhou 2019). We fill this gap by providing a theoretical framework and empirical evidence for how customer switching costs influence the economic performance and industry dynamics of single- and multiproduct firms.

Our theoretical framework shows how multiproduct firms create value by giving customers the flexibility to change products without switching providers as their preferences evolve over time. This multiproduct position is only economically attractive to firms, however, when it is paired with a 1 value-capture mechanism: the presence of high customer switching costs. Thus, when switching costs are reduced, multiproduct firms will experience lower growth than single-product firms, and the share of entrants choosing multiproduct positions will decrease. We provide a stylized model formalizing these intuitions. Our framework fits contexts in which interaction between customer and firm is prolonged, increasing the chances that customers will change their preferences. Ultimately, the paper shows that market frictions in the form of switching costs will shape the rewards to firm scope as well as the evolution of industry structure over time.

In our empirical analysis, we exploit time-varying, country-level changes in switching costs for mobile phone users across the global telecommunications industry to identify how these costs affect rewards to firms based on their scope. We capture product scope through the type of service package that firms offer to their customers. Mobile operators typically offer packages of prepaid and/or postpaid services for different customers: prepaid services, which are relatively cheap and affordable, are suitable for cost-conscious, younger subscribers, whereas postpaid services work better for heavy and professional users (Gruber 2005). Single-product firms compete by offering only one type of service, prepaid or postpaid,

and optimizing it for just one customer segment. Multiproduct firms offer both types of service, giving customers the flexibility to adjust product choice over time. It is challenging to estimate the performance effect of firm scope because the relative advantage of single- or multiproduct offerings varies with firm resource endowments. Thus, both the choice of scope and the subsequent outcomes will be endogenous. To address this issue, we use a global sample of national mobile operators that experienced a sharp drop in customer switching costs when national regulators implemented mobile number portability (MNP), allowing customers to carry their original number to a different service provider. This exogenous change allows us to estimate the relative performance of single-product and multiproduct firms in different demand environments: high and low switching costs.

The results of the analysis are consistent with our theoretical framework. Following an exogenous reduction in customer switching costs, multiproduct firms add comparatively fewer subscribers and have lower revenue growth than single-product competitors. Additional analysis shows that the source of this negative effect is a reduction in the number of customers moving across products within a firm. In addition, our results suggest that new entrants after MNP are more likely to shift away from multiproduct positions than those that enter before MNP.

These findings on the relationship between customer switching costs and firm scope have multiple implications. First, this study broadens the literature on switching costs to include their effect on strategic choices and the subsequent dynamics of industry evolution (Gómez and Maícas 2011, Brush et al. 2012). In addition, it contributes to demand-side approaches to strategy by identifying how market characteristics affect the firms' scope choices beyond the usual supply-side focus on resources (Cachon et al. 2008, Rhodes and Zhou 2019). Finally, since switching costs are an important type of market friction, this study advances our understanding of the role of market frictions in creating and capturing value (Chatain and Zemsky 2011, Mahoney and Qian 2013).

2. Relevant Literature

Firm scope—the breadth of products offered by a company—is a defining issue in strategy. Although the evidence on the strategic value of broader product lines and diversification is mixed (Zahavi and Lavie 2013), markets show interesting variation between those dominated by multiproduct competitors and those that favor more focused, single-product firms. The dominant explanation for the decision to broaden firm scope from a single to multiple products comes from the supply-side approach to strategy: theories that explain multiproduct positions, whether within or across industries, through shared inputs to production. These input-based explanations have evolved from managerial capacity (Penrose 2009) to broader categories of shared resources (Montgomery 1994) to a focus on intertemporal redeployment synergies (Lieberman et al. 2017). As strategy scholarship has focused more on the concrete activities that create or support synergies, the findings have also pointed to diseconomies of scope across shared activities and coordination costs (Rawley 2010, Zhou 2011, Natividad and Rawley 2015, Brahm et al. 2017, Zhou and Wan 2017). The limits of the supply-side explanation naturally point to the potential for demand-side explanations to understand scope choices.

The demand-side perspective arose as a corrective to the relative neglect of customer and market characteristics in the resource-based view of the firm (Priem and Butler 2001). With a focus on value creation through consumer consumption and production (Priem 2007), this approach helps explain sustainable competitive advantage (Adner and Zemsky 2006), interindustry synergies (Ye et al. 2012), and competitive position (Adner et al. 2014). When it comes to firm scope, this emerging literature has tended to focus on the effect that customer heterogeneity can have on the variety and nature of product-breadth choices (Adner et al. 2016). Customer needs can be seen as an important driver of expanding firm scope: as existing customers' needs become more diverse, firms are provided with new opportunities, which lead to customer-driven diversification (Schmidt et al. 2016, Mawdsley and Somaya 2018). What tends to be overlooked, especially from an empirical perspective, is how frictions that customers face might create incentives for firm scope choices.

Market frictions are a broad class of market characteristics that encompass market incompleteness (Denrell et al. 2003) and market failures as well as the costs of accessing a market (Chatain and Zemsky 2011). These frictions play an important role in the theory of strategic management since different approaches to understanding strategy emphasize different combinations of market frictions (Mahoney and Qian 2013). Models have suggested that falling search costs, in particular, can expand the product variety that firms offer (Cachon et al. 2008) and influence market structure in equilibrium (Rhodes and Zhou 2019). In this paper, we focus on how frictions that arise between suppliers and their buyers—customer switching costs—affect firms' opportunities to create and capture value from different scope choices (Chatain and Zemsky 2007, 2011). We introduce a framework explaining how multiproduct firms create value by giving customers the opportunity to change between product types ex-post, without the need to switch provider. This opportunity gives customers flexibility

as their preferences evolve and change over time. This flexibility is particularly valuable when the cost to switch to another provider is high and the interaction between customer and firm is prolonged, increasing the chances that customers will change their preferences. In the absence of customer switching costs, however, firms will see higher payoffs if they narrowly target their capabilities to create and capture value serving a specific segment of customers than if they build a multipurpose business model designed to shift customers from one product to another.

The importance of customer switching costs in shaping firm scope has occasionally appeared in the economic literature but has not been thoroughly analyzed from an empirical perspective. Klemperer (1995), for instance, suggested that the presence of switching costs might put specialized producers at a disadvantage relative to full-line producers. The Airbus Consortium, for example, has explained that "without a family of aeroplanes to rival Boeing's, Airbus would be at a serious disadvantage in the market" (Klemperer 1995, p. 533). Producing a full line of aircraft allows a manufacturer to offer an airline flexibility: a pilot accustomed to flying a short-haul Airbus can more easily adapt to flying a medium- or long-haul Airbus. Similarly, extant strategic management literature has explored the benefits of switching costs for firms empirically, suggesting that these costs favor first movers (Gómez and Maícas 2011) and reduce rivalry in an industry (Mas-Ruiz et al. 2014). Yet, little attention has been given to the implications of switching costs for product breadth. One exception is a study of the online banking sector (Brush et al. 2012), which found that firms with stronger cross-selling capabilities benefited more from customers that spent time learning how to use a firm platform, thus increasing firm-specific switching costs.

The mobile telecommunications industry, where we conduct our empirical analysis, is also a good example of the benefits of a multiproduct position. Mobile operators segment the market into packages that are prepaid, in which customers are debited a balance at the beginning of a period to cover a set of predetermined features, or postpaid, in which customers pay for a monthly package, plus additional services offered on an ad hoc basis, at the end of a period of use. Some firms offer prepaid services to attract new and young customers, generate the lock-in effect, and incentivize them to convert to more profitable postpaid services as their needs and preferences evolve (Banker et al. 1998, Shi et al. 2016). Intuitively, this strategy works better in the presence of high switching costs.

3. Proposition Development

We use a stylized model to formalize our intuition for how customer switching costs can create a relative competitive advantage for multiproduct firms and derive our propositions (Tirole 1988). Our intention is not to develop a generally applicable model, but rather to derive our propositions logically.[1] The core idea is that multiproduct firms create value by providing customers whose preferences are evolving with the flexibility to change between products without switching firms. Naturally, this value-creation mechanism is more effective when switching firms entails a cost. The model leads to the following propositions: (1) when customer switching costs drop, the relative customer base and economic performance of multiproduct firms decrease; and (2) when switching costs are low, entrants are less inclined to be multiproduct than when these costs are high.

3.1. Customers, Products, and Firms

We assume there are two different products—i and j. For each product, there is a group of customers, with a mass standardized to 1, who prefer it. When customers consume their preferred product, they enjoy a positive utility θ_i or θ_j. Otherwise, they obtain utility equal to 0. For simplicity, we consider these utilities to already incorporate the price of the product, which is exogenously adopted by firms.[2] The model includes two periods, t_1 and t_2. Customers know their preferences at t_1, but are heterogeneous in their ability to foresee their future preferences. In t_2, a customer c changes preferences in favor of the other product with a probability q_c. For both products, we assume that q_c values are uniformly distributed between [0,1].

There are two single-product firms, each offering one of the products, and there is one multiproduct firm offering both products. Customers who change firms in t_2 must pay switching costs S (Beggs and Klemperer 1992, Klemperer 1995, Burnham et al. 2003). We assume that switching costs are lower than the utility provided by the products ($S < \theta_i$ and $S < \theta_j$). Single-product firms have an advantage in terms of economies of specialization: They can tailor their technology, operations, brand, and marketing closely to the needs of customers who prefer each product (Chen et al. 2012, Natividad and Rawley 2015). Thus, customers buying from single-product firms obtain an additional utility E. To simplify the algebra, we assume that E ranges between $[0, S/2]$. The multiproduct firm creates value in terms of flexibility: If customers' preferences change over time, they will be able to switch products without having to switch firms and incur switching costs S.[3] The tradeoff between economies of specialization and flexibility generates a market structure in which there is no best position: both single- and multiproduct firms can coexist.

Customers are rational and choose a provider based on the expected combined utility across two periods.

The expected utility for a customer with an initial preference for product i is: $u_s = \theta_i + E + (1 - q_c)(\theta_i + E) + q_c(\theta_j + E - S)$ if the customer buys from the single-product firm $u_m = \theta_i + (1 - q_c)\theta_i + q_c\theta_j$ if the customer buys from the multiproduct firm

These equations rely on two equilibrium conditions. First, a customer who selects a single-product firm in t_1 will never switch to the multiproduct firm in t_2. This condition derives from the existence of parameter E. Indeed, single-product firms always provide more utility to customers in the absence of uncertain preferences. Second, a customer who selects the multiproduct firm in t_1 will never switch to a single-product firm in t_2. This condition derives from the assumption that E cannot be higher than $S/2$. The violation of such an assumption will lead to a market structure in which all firms are single-product because the economies of specialization are too high.

3.2. Switching Costs and Firm Scope

Because of symmetry, we can solve the equations for customers with initial preferences for products i and j separately, focusing on the multiproduct firm and corresponding single-product firm. One advantage of our model is that the position of the customer (defined by the customer's q_c) that is indifferent in buying from the single-product or multiproduct firm also identifies the market share of single-product firm for the relevant product in t_1.[4] Thus, for product i:

$$\text{Single-product firm } i \text{ market share} = \frac{2E}{S}$$

$$\text{Multiproduct firm market share of product } i = 1 - \frac{2E}{S}$$

Two competing forces drive the relative market share of single- and multiproduct firms. On one hand, there is the intensity of economies of specialization E, which increases the single-product firm's market share. On the other hand, there are switching costs S, which increase the value of flexibility and favor the multiproduct firm. Notice that in the extreme case in which $E = S/2$ the multiproduct firm's market share will collapse to zero. Conversely, when economies of specialization are at the minimum level, $E = 0$, the multiproduct firm will take over the market. The equilibrium equations help us to make some predictions about the effect of a reduction in switching costs S on the relative market share of single- and multiproduct firms, keeping all the other parameters constant. Finally, notice that in our stylized model, firm economic performance (revenue) is derived by multiplying market share and product price, which we assumed constant for simplicity. Thus, we propose Proposition 1.

Proposition 1. *A reduction in customer switching costs decreases the (relative) customer base and economic performance of multiproduct firms in comparison with single-product firms.*

The theoretical intuition behind Proposition 1 is that a reduction in switching costs reduces the value of the flexibility provided by the multiproduct firm and thus its relative performance. An implicit condition in our model is that firm position is fixed. We can reasonably assume that changing firm scope (from multiproduct to single-product and vice versa) is a slow and costly process. Thus, we should be able to observe an effect on firm performance before players adjust their scope.

3.3. Market Entry and Firm Scope

The changing rewards for single-product and multiproduct firms following switching cost reduction can affect the entry strategy of newcomers in addition to the performance of established firms. Assuming that new entrants have to pay a fixed cost F to launch a product (i and/or j), the relatively lower performance of a multiproduct position when switching costs are low should discourage new entrants from selecting this strategy. Thus, we propose Proposition 2.

Proposition 2. *New firms that enter the market when switching costs are low are less likely to pursue a multiproduct entry strategy than those that enter when switching costs are high.*

4. Empirical Setting

To study the effect of customer switching costs on firm scope, we analyze variations in relative performance and entry of mobile telecommunications firms. The issue of scope presents a causal identification challenge in that firms may choose their scope based on factors such as incumbency and resources; thus, the attractiveness of single- or multiproduct scope choices may be endogenous to these other factors. To address this issue, we constructed a matched sample of single- and multiproduct firms based on incumbency (year of launch) and compared their customer base and revenue before and after the advent of mobile number portability (MNP), a regulatory change that substantially reduced customer switching costs. Note that the analysis of Proposition 1 includes only firms that launched their networks before the introduction of MNP in each country. In contrast, in the analysis of Proposition 2, we compared new entrants' choice of scope in the full sample before and after MNP. In addition, we performed a wide variety of additional analyses to explore intermediate mechanisms, rule out alternative explanations, and examine the robustness of our findings.

4.1. Institutional Context

The mobile telecommunications industry provides the empirical context of the research. Focusing on this

industry allows us to easily characterize two main scope choices based on the services that firms offer to different customer segments. Based on the industry literature, we identify two types of services: prepaid (or no-frills) and postpaid (or contract) (Banker et al. 1998, Shi et al. 2016). These two services, at first glance, may appear merely to indicate different revenue models, but there are substantial differences in the key value propositions and customer segments targeted by each type (see the appendix for details on these services). Prepaid services are usually suitable for cost-conscious, younger subscribers, whereas postpaid services work better for heavy users and early adopters (Grajek and Kretschmer 2009, Eggers et al. 2020). The heterogeneous market segments across the two services require targeted promotions and marketing plans as well as technological and operational choices tailored to each segment.

Subsequently, we identify two types of firms based on the breadth of offerings. First, single-product firms that sell only one of the prepaid or postpaid services, and second, multiproduct firms that provide both prepaid and postpaid services and enable potential transfers between the two. TELUS Corporation chief executive officer (CEO) Darren Entwistle describes the offerings at his multiproduct firm as a strategy that allows TELUS to "grow and cultivate a prepaid base and harvest that base as it relates to pre[paid] to post[paid] migration" (TELUS Corporation 2018). Indeed, it is a strategy common among industry managers as they have stated: "it is their hope to rope in new users on prepaid and then cultivate them to be bigger spenders and eventually convert them to postpaid" (The Edge Financial Daily 2005). Serving both segments facilitates customer migration from one service to the other over time, giving customers the flexibility to change their services as their preferences evolve.

We expect that firms select the services they offer, and thus their scope, based on their characteristics as well as on customer needs. In this sense, scope choice is endogenous to the firm or market opportunities. To address this endogeneity, we draw on an exogenous policy change, mobile number portability (MNP), that allows customers to keep their numbers while switching service providers, thus reducing their switching costs. The main rationale for MNP implementation around the world is enhancing competition and general improvement of customer welfare. Traditionally, subscribers were hesitant to switch operators as they were required to give up their number when doing so. Thus, MNP represents an external change advantageous to our understanding of switching costs and firm scope: It affects customer switching costs but not a firm's choice of scope, at least in the short term.[5] Building on this exogenous change, we can estimate the variation in customer base and performance between single- and multiproduct firms in two different demand environments: high and low switching costs. Conveniently, the policy was implemented at different times in different countries, allowing us to remove the effect of other events such as economic shocks that are specific to a given time and country.[6] Besides, there is little evidence that firms can proactively influence the timing of the MNP implementation. Wei and Zhu (2018) confirm this exogeneity assumption by obtaining consistent findings in markets in which MNP introduction was mandated by a supranational organization (European Union) and other markets. In addition, qualitative evidence suggests factors such as country's political priorities or technological readiness were the main drivers of MNP's staggered implementation. These factors tend to be largely exogenous to firms' actions. Countries such as Ireland, for example, delayed the introduction of MNP due to the lack of an adequate technical solution. Similar delays happened in non-European countries such as Australia (Bühler et al. 2006).

Although MNP adoption generally increases competition, it did not tend to be adopted as part of a larger package of liberalization reforms that would confound the results of the analysis. In particular, we find no evidence that rates of entry by new operators increased after the adoption of MNP. Similarly, a recent study found no increase in rates of entry for mobile virtual network operators (which rent network capacity from other firms) after MNP (Riccardi et al. 2009). Thus, though MNP is expected to reduce switching costs and increase competition (Bühler et al. 2006), there is no evidence that other major structural or regulatory changes accompanied the policy. Further analysis of other regulatory changes can be found in the post hoc analysis (Section 6.2).

4.2. Data Source

Our data source for the firm- and country-level variables is the GSMA Intelligence database. The data includes 883 national mobile operators in a total of 197 countries tracked quarterly from 2000, quarter 1, to 2017, quarter 1. To construct our sample, we excluded firms located in countries that never implemented MNP, allowing us to include in our analysis only firms in relatively comparable countries, similar to Balachandran and Hernandez (2019). Hence, after excluding observations with missing values, our sample is comprised of 380 firms in 75 countries that implemented MNP during the time span of our study.

4.3. Measures

4.3.1. Outcome Variables. To study Proposition 1, we analyzed the customer base and revenue of single- and multiproduct firms before and after MNP.[7] We measured customer base as the total number of subscribers

in quarter t. Revenue was calculated through multiplying a firm's average revenue per user (ARPU) by its total number of subscribers in quarter t. To reduce the skewness of these outcome variables, we computed the natural logarithm of both, obtaining *Ln(Subscribers)* and *Ln(Revenue)*.

To study Proposition 2, we examined the choice of scope by new entrants in the full sample before and after MNP. In this case, we constructed an outcome variable, *Multiproduct Entry*, which is a binary measure equal to 1 if a firm offers both prepaid and postpaid services, and equal to 0 if a firm offers only one of these services in its launch year. We obtained the variable based on the average share of a firm's services that were prepaid during the year it launched its networks, expressed as a percentage. Hence, we coded *Multiproduct Entry* as 1 if a firm's average prepaid share was any value greater than 0% and smaller than 100% in its launch year.

4.3.2. Explanatory Variables. Our key explanatory variable to test Proposition 1 and capture firm scope, *Multiproduct*, is a dichotomous measure equal to 1 if a firm offers both prepaid and the postpaid services before MNP, and 0 otherwise. We constructed this variable based on the average share of a firm's services that were prepaid in all quarters prior to MNP introduction. We coded *Multiproduct* as 1 if a firm's average prepaid share was greater than 0% and smaller than 100%. In contrast, we coded this variable 0 if a firm offered only prepaid (prepaid share = 100%) or postpaid (prepaid share = 0%) services before MNP. There were 141 single-product firms in the overall sample: 138 prepaid and three postpaid. This skew means that most single-product firms adopted the prepaid model.[8]

We also constructed the variable *PostMNP*, which is a binary measure equal to 1 for observations in the quarters after the policy was introduced in the focal country, and 0 for prior observations.

Our explanatory variable to test Proposition 2, *PostMNP Entry*, is a binary variable equal to 1 if a firm entered the market up to two years prior to or after the introduction of MNP, and 0 otherwise. The variable includes entry up to two years prior to the regulatory change since regulators typically announce implementation decisions well in advance, allowing entrants to anticipate regulatory changes. The results remain meaningfully consistent if this timing is changed to one year prior.

4.3.3. Control Variables. We controlled for a variety of country-level effects. To begin with, we used population penetration, coded as *Penetration*, to control for the stage of adoption of cellular services across countries in our study. We calculated this variable based on the total number of subscribers in a given country divided by population. To measure the degree of competition at the country level, we used the Herfindahl-Hirschman index, *HHI*, a commonly accepted measure of market concentration, represented on a scale of 0 (evenly distributed competition) to 10,000 (no competition). We also controlled for business cycles by adding gross domestic product, *GDP*, to the model. To account for the size of the market, we controlled for *Population* at the country level. By including both *Population* and *GDP* as controls, we effectively controlled for wealth effects (GDP per capita). Finally, we used firm-, quarter-, and year-fixed effects in our regressions.

5. Empirical Analysis, Methodology, and Findings

We divided our empirical analysis into two parts, Proposition 1 and Proposition 2, using two different specifications to test our predictions. We obtained a matched sample to test Proposition 1 and created a pooled, cross-sectional sample to test Proposition 2. The following subsections explain the processes involved in testing both propositions, along with the results obtained.

5.1. Proposition 1 Analysis: MNP and Relative Performance of Multiproduct Firms

5.1.1. Empirical Specification. To test Proposition 1, we used a difference-in-differences methodology with staggered treatment (Bertrand and Mullainathan 2003, Castellaneta et al. 2020) to regress the effect of being a multiproduct firm (in contrast to being a single-product firm) on performance before and after the introduction of MNP. This design compares the performance difference between single- and multiproduct firms in countries with MNP to the same difference in countries that have not yet adopted it. Given the staggered implementation of the policy, the composition of the group subject to the policy changes over time as more countries progressively introduce MNP.

Our identification strategy relied on the timing of the various policy changes not being systematically endogenous to firm activities. As previously discussed, this exogeneity assumption is likely valid since the main factors affecting MNP adoption timing are related to technical and political issues (Bühler et al. 2006). The regression model with the firm- and time-fixed effects is as follows:

$$\begin{aligned} Performance_{it} = {} & \beta_0 + \beta_1 PostMNP_{it} + \beta_2 Multiproduct_i \\ & + \beta_3 PostMNP_{it} \times Multiproduct_i \\ & + \bar{\theta} Controls_{it} + \alpha_i + \gamma_t + \varepsilon_{it}. \end{aligned}$$

In this model, i indexes the firm and t indexes time. The outcome variables that capture performance are measured as either $Ln(Subscribers_{it})$ or $Ln(Revenue_{it})$.

Table 1. Matched Sample Composition by Country, MNP Adoption Year, and Firm Scope

Country	MNP year	Single-product	Multiproduct	Total
1. Canada	2007	1	3	4
2. Georgia	2011	1	3	4
3. Ghana	2011	2	1	3
4. India	2011	4	4	8
5. Iran	2016	3	2	5
6. Ireland	2003	1	1	2
7. Kenya	2011	2	1	3
8. Nigeria	2013	2	6	8
9. Russia	2013	1	4	5
10. Tanzania	2017	4	3	7
11. USA	2003	3	1	4
Total		24	29	53

The coefficient β_1 measures the performance effect of MNP on firms after the regulatory change compared with before the change, irrespective of the firm type. The coefficient on β_2 captures the average effect of being a multiproduct firm on its performance irrespective of time. Finally, the main coefficient of interest, β_3, measures the change in performance of the multiproduct group relative to the single-product group after the policy adoption. In other words, this coefficient captures how the performance difference between multiproduct and single-product firms changes after the implementation of MNP. The term α_i is the firm-fixed effects, γ_t is the time-fixed effects, and ε_{it} is the error term.

5.1.2. Matched Sample. In each market, we observed early incumbents, which were the first to launch a mobile network in a country, and other operators that entered the market in later years. Incumbents can have different characteristics from other firms in the sample (Mitchell 1991), and such differences might provide alternative explanations for Proposition 1.[9] To address any potential concerns, we relied on a subsample of matched firms that are similar in the year they launched their networks, coded as *Launch Year*. Using a Caliper matching approach, we identified at least one single-product and one multiproduct firm with similar years of launch before MNP. Countries without a pair of single- and multiproduct firms with similar launch years were excluded. This matching process gave us a subsample of firms that existed in each market before MNP and excluded those that launched after MNP. Table 1 shows the composition of the matched sample based on country, MNP adoption year, and choice of firm scope. The matched sample includes 53 firms—24 single-product and 29 multiproduct—in a total of 11 countries. Among the single-product firms, 23 are purely prepaid and one is entirely postpaid.[10]

Table 2 reports the comparison of single-product and multiproduct firms based on selected variables. Table 3 provides a breakdown of the entry year for all the matched firms. Based on these two tables, we can conclude that single- and multiproduct firms are comparable in terms of year of launching their networks. However, multiproduct firms are slightly larger than single-product firms in terms of number of subscribers and revenues. This finding is expected, given that multiproduct firms target a larger customer base (both segments).

Table 4 reports descriptive statistics for all the variables involved in the analysis of Proposition 1. Table 5 represents the correlation table of our matched sample. The largest correlations are between the two outcome variables—subscribers and revenue—which were expected to be correlated, and the negative correlation between population and market concentration.

Our matched sample represents an excellent experimental setting to test our theory but raises some questions of generalizability. To corroborate our results and extend their validity, in the post hoc analysis section we extended our analysis to all firms in the sample, with largely similar results.

5.1.3. Results. Figure 1 uses a graph of *Ln(Subscribers)* for single-product and multiproduct firms in the

Table 2. Comparison of Selected Variables for Firms in Matched Sample

Variables	Single-product (1)	Multiproduct (2)	Difference (1) – (2)
Launch Year	2002.68	2002.58	0.10
	(4.55)	(3.68)	
Ln(Subscribers)	13.19	13.79	–0.55***
	(2.55)	(2.92)	
Ln(Revenue)	15.66	16.97	–1.31***
	(2.49)	(2.30)	
ARPU	14.26	15.08	–0.81
	(15.56)	(18.04)	

Notes. This table reports the mean and standard deviation (in parenthesis) of selected variables separately for single- and multiproduct firms. The last column reports the difference in the means between the two groups of firms.

***$p < 0.01$.

Table 3. Composition of Firms in Matched Sample Based on Launch Year and Firm Scope

Year	Single-product	Year	Multiproduct
1994	1	1996	1
1995	1	1997	1
1999	1	1999	1
2000	2	2000	3
2001	3	2001	5
2002	2	2002	1
2005	1	2003	3
2006	1	2005	1
2007	1	2006	4
2008	3	2007	1
2009	2	2008	2
2010	2	2009	3
2011	1	2010	1
2012	1	2012	1
2013	1	2013	1
2014	1		
Total	24	Total	29

matched sample before and after MNP to provide a visual representation of the results. The figure shows that after the introduction of the policy, the number of subscribers using the services of multiproduct firms remains quite steady, whereas this number increases substantially for single-product firms. The pattern is similar if we use *Ln(Revenue)* to illustrate the results (see online appendix Figure A1). As anticipated in Proposition 1, single-product firms increase their customer base at the expense of multiproduct firms following MNP introduction.

A more formal test of Proposition 1 is provided in Tables 6 and 7 using *Ln(Subscribers)* and *Ln(Revenue)* as the outcome variables, respectively. The regressions report ordinary least squares (OLS) estimates with different specifications for unobserved variation between firms (fixed and random effects) and error clustering both at the firm and country level. In Table 6, the controls have effects in the directions we expected. Subscribers rise with the size of the country (population), penetration levels, and concentration. For higher GDP, however, individual firms have fewer subscribers, suggesting an increase in the number of competitors in countries with greater income (controlling for population and penetration, hence mostly capturing a small wealth effect). In Table 7, however, the controls generally do not have significant effects on firm revenue, effects sometimes even switching directions across specifications.[11]

In both tables, the interaction term between *PostMNP* and *Multiproduct* across all models is negative and significant. In Table 6, Model 1 shows that in the post MNP period, single-product firms experience a 46% increase in their subscriber base whereas multiproduct firms see their customer base shrink by 23%. Note that these coefficients, in contrast to Figure 1, show the net effect of MNP on customer base after controlling for the time effects. Thus, this analysis shows an actual drop in customer base of multiproduct firms whereas the graph of raw subscribers including time trends shows just slower growth after MNP. Models 2 and 3 both include the control variables; Model 2 refers to error clustering at the firm level whereas Model 3 uses error clustering at the country level. Results of random effects specification are reported in Models 4 and 5 with error clustering at the firm and country level, respectively.

Table 7 presents similar results when firm revenue is used as the outcome variable. After controlling for time-fixed effects, all models display a large and significant revenue drop (around 40%) for multiproduct firms. Following the structure of Table 6, Models 2 and 3 introduce the control variables and error clustering at the firm and country level, respectively. Models 4 and 5 show the results with a random effects specification and error clustering at the firm and country level. Taken together, these results lend support to Proposition 1. The introduction of MNP and the subsequent reduction in customer switching costs negatively affect the customer base and revenues of multiproduct firms.

5.1.4. Relative Performance of Firms Before MNP. The previous analysis demonstrates that a reduction in

Table 4. Descriptive Statistics of Matched Sample

Variable	Level of analysis	Observations firm-quarter	Mean	Standard deviation	Min	Max
Launch Year	Firm	1,849	2002.63	4.08	1994	2014
Ln(Subscribers)	Firm	1,849	13.52	2.78	5.35	18.56
Ln(Revenue)	Firm	1,282	16.37	2.48	4.85	22.48
ARPU	Firm	1,282	14.71	16.94	0.12	87.18
Multiproduct	Firm	1,849	0.58	0.49	0.00	1.00
PostMNP	Country	1,849	0.34	0.47	0.00	1.00
HHI	Country	1,849	3,289.53	1,647.05	1,033	9,994
GDP (Bn)	Country	1,849	1,651.38	3,542.10	3.76	15,700.01
Population (M)	Country	1,849	259.98	403.71	3.83	1,303.17
Penetration	Country	1,849	0.60	0.41	0.00	1.66

Table 5. Matrix of Correlations of Matched Sample (N = 1,282)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) *Ln(Subscribers)*								
(2) *Ln(Revenue)*	0.83							
(3) *ARPU*	−0.09	0.41						
(4) *Multiproduct*	0.22	0.27	0.02					
(5) *PostMNP*	0.28	0.28	0.21	−0.08				
(6) *HHI*	−0.39	−0.37	−0.16	−0.14	−0.24			
(7) *GDP*	0.27	0.51	0.60	−0.13	0.37	−0.37		
(8) *Population*	0.18	0.02	−0.13	0.24	0.09	−0.61	0.07	
(9) *Penetration*	0.27	0.20	0	−0.02	0.54	−0.12	0.19	−0.20

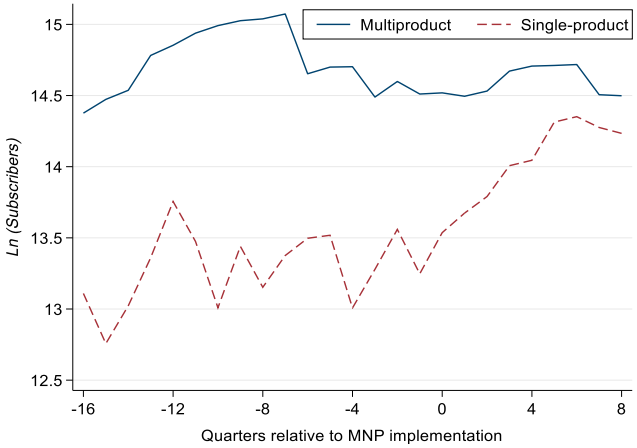
switching costs has a stronger negative effect on multiproduct firms than single-product ones and leads to a performance convergence between the two groups. The related question is to understand what happens in the market in the absence of MNP. To answer this question, Figure 2 provides a visual representation of *Ln(Subscribers)* for single- and multiproduct firms over time before MNP implementation. To avoid any anticipation effect (the policy was usually publicized prior to the implementation date), we excluded from the analysis the two years preceding the MNP introduction. As expected, the figure shows that in the absence of MNP, the performance difference between the two groups of firms stays the same at best or diverges over time, with multiproduct firms overperforming single-product ones. This pattern is similar if we use *Ln(Revenue)* to illustrate the prepolicy performance trend (see online appendix Figure A2).

5.2. Proposition 2 Analysis: MNP and Scope Choice of Entrants

5.2.1. Empirical Specification. To test Proposition 2, we used limited dependent variable specifications, including OLS, logit, and probit regression models, to estimate the effect of MNP on the scope choice of firms in the year of entry. In the overall sample of MNP-adopting countries between 2000 and 2017, we observed 168 new entries: 82 before and 86 after the policy change. In the regressions we controlled for entry year-fixed effects, γ_t. The regression model is as follows:

$$Multiproduct\ Entry_i = \beta_0 + \beta_1 PostMNP\ Entry_i + \bar{\theta} Controls_i + \gamma_t + \varepsilon_i.$$

Figure 1. (Color online) Evolution of Firm Subscribers Before and After MNP



5.2.2. Results. Table 8 represents the breakdown of entrants' choice of scope by launch year prior to and after MNP, revealing that multiproduct entry decreased after MNP introduction. Before MNP, 82% of new entrants adopted a multiproduct entry strategy, whereas after MNP, this share dropped to 70%.

Table 9 presents the results of our OLS, probit, and logit regressions to test Proposition 2. The only two controls that have an effect in this analysis are *Penetration* and *GDP*: the likelihood of multiproduct entry rises with the penetration of mobile services and falls with GDP. In terms of the main variable of interest, *PostMNP Entry*, the results show that firms entering after MNP are more likely to be single-product players than those entering before MNP. These results are largely invariant to the underlying error distribution (OLS, logit, and probit).[12] Models 1 and 2 in Table 9 show that in the post MNP period, a multiproduct entry is 10 to 20 percentage points less likely than in the pre-MNP period. Importantly, our results remain consistent even when controlling for launch year (Models 3, 4, and 5 in Table 9). Consistent with Proposition 2, a multiproduct entry strategy becomes less attractive when switching costs are low than when these costs are high.

6. Post Hoc Analysis

We used a series of follow-up analyses to provide additional evidence of the suggested mechanism, rule out alternative explanations, and verify the robustness of our primary results.

Table 6. Analysis of Firm Subscribers Following MNP (Proposition 1, Matched Sample)

	(1)	(2)	(3)	(4)	(5)
Variables	*Ln(Subscribers)*	*Ln(Subscribers)*	*Ln(Subscribers)*	*Ln(Subscribers)*	*Ln(Subscribers)*
PostMNP	0.460*	0.617***	0.617**	0.578***	0.578**
	(0.261)	(0.193)	(0.237)	(0.201)	(0.245)
Multiproduct				0.545	0.545
				(1.113)	(1.111)
PostMNP × Multiproduct	−0.693*	−1.142***	−1.142***	−1.001***	−1.001***
	(0.375)	(0.290)	(0.213)	(0.289)	(0.190)
HHI		0.000228*	0.000228	0.000234*	0.000234*
		(0.000123)	(0.000135)	(0.000121)	(0.000142)
GDP		−500.8***	−500.8***	−410.2***	−410.2***
		(82.77)	(76.84)	(72.96)	(66.97)
Population		0.0125***	0.0125***	0.00751***	0.00751***
		(0.00335)	(0.00220)	(0.00168)	(0.00117)
Penetration		1.361**	1.361*	1.381**	1.381*
		(0.570)	(0.747)	(0.556)	(0.738)
Constant	10.03***	6.330***	6.330***	6.356***	6.356***
	(0.639)	(0.970)	(0.521)	(1.149)	(1.472)
Observations	1,849	1,849	1,849	1,849	1,849
R^2	0.690	0.750	0.750		
Number of IDs	53	53	53	53	53
Firm fixed effects	Yes	Yes	Yes	—	—
Firm random effects	—	—	—	Yes	Yes
Year and quarter fixed effects	Yes	Yes	Yes	Yes	Yes

Notes. Robust standard errors are in parentheses. The results in Models 1, 2, and 4 come from error clustering at the firm level, whereas Models 3 and 5 refer to error clustering at the country level.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

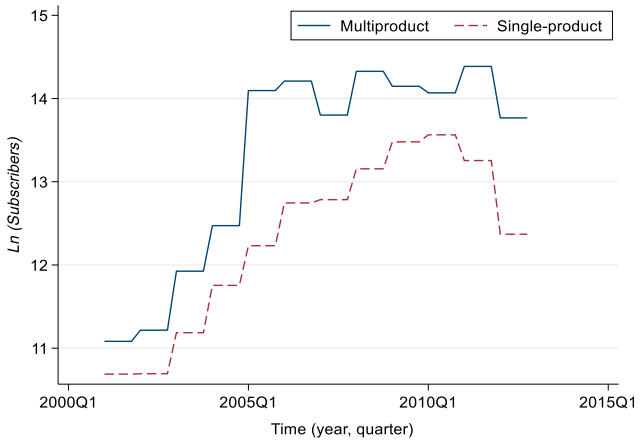
6.1. Additional Evidence: Internal Switching Rate of Multiproduct Firms

According to our theory, multiproduct firms thrive when switching costs are high because they offer customers the potential to shift to different products as their preferences evolve. When switching costs fall, changing products within the same firm is no longer as useful or important for customers since they can now easily switch between firms instead of changing product types within firms. Hence, we expect fewer customers switching between prepaid and postpaid services within multiproduct firms after MNP. To capture such an internal switching rate, we used the fraction of a firm's combined postpaid and prepaid churn rates that is not explained by the firm's total churn rate. We built on this equation to construct a multiproduct firm's internal switching rate:

$$\begin{aligned} &\textit{Internal switching rate}_{it} \\ &\quad = \textit{Prepaid churn rate}_{it} \times \textit{Prepaid share}_{it} \\ &\qquad + \textit{Postpaid churn rate}_{it} \times \textit{Postpaid share}_{it} \\ &\qquad - \textit{Churn rate}_{it} \end{aligned}$$

Online Appendix A provides a detailed explanation of this equation. The $\textit{Internal switching rate}_{it}$ is a variable between 0 and 1 (mean = 0.00048; standard deviation (S.D.) = 0.002), capturing the share of customers moving from prepaid to postpaid or vice versa within a multiproduct firm in a given quarter. Data points to construct this variable (a firm's prepaid churn

Figure 2. (Color online) Prepolicy Firm Subscribers Trend



Notes. Graph shows *Ln(Subscribers)* for single- and multiproduct firms over time only in countries that have yet to implement the policy.

Table 7. Analysis of Firm Revenue Following MNP (Proposition 1, Matched Sample)

	(1)	(2)	(3)	(4)	(5)
Variables	*Ln(Revenue)*	*Ln(Revenue)*	*Ln(Revenue)*	*Ln(Revenue)*	*Ln(Revenue)*
PostMNP	0.414	0.409	0.409	0.305	0.305
	(0.277)	(0.281)	(0.335)	(0.310)	(0.372)
Multiproduct				1.832**	1.832***
				(0.805)	(0.665)
PostMNP × Multiproduct	–0.808**	–1.135***	–1.135***	–0.767**	–0.767***
	(0.386)	(0.359)	(0.323)	(0.384)	(0.282)
HHI		0.000169	0.000169	4.53e-05	4.53e-05
		(0.000181)	(0.000167)	(0.000152)	(0.000168)
GDP		–107.8	–107.8	193.7***	193.7***
		(107.9)	(84.86)	(39.19)	(23.46)
Population		0.00834	0.00834***	0.000229	0.000229
		(0.00495)	(0.00169)	(0.000979)	(0.000468)
Penetration		0.852*	0.852*	0.624	0.624
		(0.463)	(0.411)	(0.508)	(0.432)
Constant	13.83***	10.59***	10.59***	12.13***	12.13***
	(0.552)	(1.726)	(0.512)	(1.127)	(1.213)
Observations	1,282	1,282	1,282	1,282	1,282
R^2	0.545	0.584	0.584		
Number of IDs	31	31	31	31	31
Firm fixed effects	Yes	Yes	Yes	—	—
Firm random effects	—	—	—	Yes	Yes
Year and quarter fixed effects	Yes	Yes	Yes	Yes	Yes

Notes. Robust standard errors are in parentheses. The results in Models 1, 2, and 4 come from error clustering at the firm level, whereas Models 3 and 5 refer to error clustering at the country level.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

rate, postpaid churn rate, and total churn rate) are unfortunately available for only a handful of firms in our matched sample. We therefore conducted our analysis using the full sample. The regression to test our prediction is:

$$Internal\,switching\,rate_{it} = \beta_0 + \beta_1 PostMNP_{it} + \bar{\theta} Controls_{it} + \varepsilon_{it}.$$

Table 10 reports the results of our OLS regressions analyzing multiproduct firms' internal switching rate following MNP. The results provide additional support for the theoretical framework outlined in the paper: After MNP, the ratio of subscribers moving from prepaid to postpaid services (and vice versa) within multiproduct firms drops by almost 40%, suggesting that customers are more likely to switch between firms rather than within them when switching costs fall.

6.2. Alternative Explanations

We now rule out several alternative explanations pertaining to Proposition 1 findings. All regression models were run using the matched sample and their primary specification is the one used in Table 6, Model 2, unless otherwise specified.

6.2.1. Firm Size. One alternative explanation of our results is that discriminatory pricing strategies may give larger firms an advantage when faced with MNP and reduced switching costs (Shi et al. 2006). A size effect (Wei and Zhu 2018) is minimized by our matched sample but could still be present given the small size difference between single- and multiproduct firms (see Table 2). We ruled out this explanation by introducing *Market share* interaction with *PostMNP* to the model. *Market share* (mean = 0.12; S.D. = 0.16) is a time-invariant variable[13] constructed based on the firm's average market share in quarters before MNP. Model 1 in online appendix Table I shows that the *Market share* interaction with *PostMNP* does not affect our primary results.

6.2.2. Entry Barriers. Variations in entry barriers for national operators before and after MNP could provide a possible explanation for our findings. We address this concern through three different checks. First, the descriptive statistics of market entry in our sample (see Table 8) show that the number of firms does not increase significantly after the adoption of MNP. This allows us to rule out the possibility that reduced barriers to entry for new national mobile operators cause the observed differential performance outcome.

Table 8. Composition of Entrants' Choice of Scope Before and After MNP (Whole Sample)

PreMNP Entry			*PostMNP Entry*		
Launch year	Single-product	Multiproduct	Launch year	Single-product	Multiproduct
2000	1	11	2001	1	1
2001	4	10	2002	1	1
2002	1	7	2003	0	1
2003	1	12	2004	0	3
2004	0	3	2005	1	8
2005	1	4	2006	1	1
2006	0	3	2007	2	9
2007	0	9	2008	1	5
2008	3	5	2009	5	7
2009	1	3	2010	5	6
2012	1	1	2011	1	2
2014	1	0	2012	0	3
Total	14	68	2013	1	2
		82	2014	3	4
			2015	0	3
			2016	3	3
			Total	25	61
					86

Second, the *HHI* variable in the regression models controls for market concentration. Finally, as an additional test, we controlled for *Total Firms* (mean = 8.22; S.D. = 4.33), calculated as the total number of operating firms (in the full sample) in each country in each quarter. This variable effectively controls for the entry and exit rates in national markets in a given quarter. The results reported in online appendix Table I, Model 2, remain consistent with our primary findings.

6.2.3. Other Regulatory Changes Around the Timing of MNP Implementation. MNP is one of several policies that governments introduce to increase competition in the telecommunications market. Another reform coinciding with MNP implementation might therefore account for our findings. Measures that might be correlated with MNP timing include the regulation of the interconnection charge and the liberalization of the regulatory framework for new entrants. The first regulation refers to the obligation of dominant

Table 9. Analysis of Scope Choice of Entrants (Proposition 2, Whole Sample)

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	Probit	Logit
Variables	*Multiproduct Entry*	*Multiproduct Entry*	*Multiproduct Entry*	*Multiproduct Entry*	*Multiproduct Entry*
PostMNP Entry	–0.120*	–0.230***	–0.214**	–1.045***	–1.642**
	(0.0646)	(0.0879)	(0.0876)	(0.392)	(0.699)
HHI		–9.17e-06	–3.10e-05*	–0.000158*	–0.000309*
		(1.97e-05)	(1.78e-05)	(8.36e-05)	(0.000163)
GDP		–5.29e-05	–8.38e-05**	–0.000326***	–0.000595**
		(3.45e-05)	(3.40e-05)	(0.000121)	(0.000242)
Population		–0.000211	–7.93e-05	–9.67e-05	–0.000200
		(0.000152)	(0.000129)	(0.000440)	(0.000740)
Penetration		0.190*	0.532***	2.661***	4.528***
		(0.0987)	(0.112)	(0.586)	(1.108)
Constant	0.829***	0.852***	1.047***	2.207**	4.338*
	(0.0418)	(0.117)	(0.149)	(1.010)	(2.467)
Observations	168	157	157	151	151
R^2	0.020	0.096	0.266		
Launch year fixed effects	—	—	Yes	Yes	Yes

Note. Robust standard errors are in parentheses. Due to missing values, the number of observations drops after including control variables.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Table 10. Additional Evidence: Internal Switching Rate of Multiproduct Firms (Whole Sample)

Variables	(1) *Internal switching rate*	(2) *Internal switching rate*	(3) *Internal switching rate*	(4) *Internal switching rate*
PostMNP	–0.000629**	–0.000541*	–0.000628**	–0.000541**
	(0.000296)	(0.000306)	(0.000305)	(0.000224)
HHI		2.91e-07	1.11e-07	2.91e-07
		(3.95e-07)	(1.32e-07)	(3.44e-07)
GDP		–9.28e-08	1.03e-07	–9.28e-08
		(1.63e-07)	(9.33e-08)	(1.41e-07)
Population		2.70e-06	–2.85e-07	2.70e-06
		(3.46e-06)	(4.02e-07)	(4.38e-06)
Penetration		–0.000836	–0.000188	–0.000836
		(0.000898)	(0.000418)	(0.000827)
Constant	0.00154*	0.000512	0.000847	0.000512
	(0.000792)	(0.00156)	(0.00101)	(0.00130)
Observations	1,872	1,872	1,872	1,872
R^2	0.032	0.034		0.034
Number of IDs	72	72	72	72
Firm fixed effects	Yes	Yes	—	Yes
Firm random effects	—	—	Yes	—
Year and quarter fixed effects	Yes	Yes	Yes	Yes

Notes. Robust standard errors are in parentheses. Models 1–3 are reported using error clustering at firm level; Model 4 is reported error clustering at the country level.

*$p < 0.1$; **$p < 0.05$.

carriers to interconnect with other carriers' networks with no discriminatory conditions. Considering that this policy targets dominant players, our matching procedure ensures that all the firms in our sample are symmetrically affected. The second measure refers to the introduction of policies that require established firms to collaborate with smaller entrants that offer mobile services but do not own network infrastructure and spectrum: mobile virtual network operators (MVNOs). Recent empirical findings have shown that the introduction of MNP had no significant effect on, and was even negatively correlated with, MVNO entry (Riccardi et al. 2009).

Yet MVNOs' operations in a market could be a reason for the sluggish performance of established operators. MVNOs do not make heavy investments in infrastructure and lack many of the network features that might support differentiation, hence they tend to compete on price. Established players, especially those that target multiple segments, might be more vulnerable to price competition. To address such concerns and provide a better picture of the industry's evolution, we collected supplementary data on the entry of MVNOs through the GSMA Intelligence database. We constructed three additional variables to control for the effect of MVNOs' entry: *Total MVNOs* (mean = 3.84; S.D. = 11.90), which captures the cumulative number of MVNO entries up to quarter *t* in each country; *Multiproduct MVNOs* (mean = 0.64; S.D. = 1.44), which reflects the cumulative number of MVNO entries by operators that offer both prepaid and postpaid services up to quarter *t* in each country; and *Single-product MVNOs* (mean = 1.5; S.D. = 3.75), which accounts for the cumulative number of MVNO entries by operators that offer only one service up to quarter *t* in each country.[14] Results reported in online appendix Table I, Models 3–5, are consistent with our initial findings; the performance difference between single- and multiproduct firms shrinks following MNP, even after controlling for MVNO entries.

6.2.4. Single-Product Firms' Aggressive Pricing. An alternative explanation for our findings might be that single-product firms become more aggressive with promotions and price cuts after MNP implementation. From this perspective, these firms benefit because they are low-cost, not because they are single-product. The concern here is the adoption of an aggressive price strategy by single-product firms (in particular prepaid firms) after MNP. We ruled out this alternative explanation by comparing the pricing choices of firms in our matched sample after MNP, finding no difference between single- and multiproduct groups. Online appendix Table I, Model 6, displays the results of OLS regressions using *Ln(ARPU)* (mean = 1.88; S.D. = 1.39) as an outcome variable. Note that the sample size drops from 53 to 31 firms due to the lack of data on prices for some firms. The results reveal that single-product firms do not respond to MNP introduction by decreasing their prices more than multiproduct firms.

6.3. Robustness Analysis

6.3.1. Full Sample Replication. Our main results for Proposition 1 are based on a matched sample that narrows our focus to a subset of markets where we can match single- and multiproduct firms based on similar launch years. A top concern is that these results, although carefully identified, might not generalize to the broader sample. Therefore, we extended our results from the matched subsample to the overall sample. Online appendix Table II, Model 1 reports the results and confirms consistency with our primary findings.

6.3.2. Alternative Measurement for *Multiproduct*. We replicated our findings after adopting a quantile-based, relative definition of single- and multiproduct firms, which provided a more balanced split between prepaid and postpaid firms. In this way, we classified single-product firms as those located at the top and bottom 10% of the prepaid distribution before MNP, with multi-product firms located in between these values. The analysis of performance difference between single- and multiproduct firms in online appendix Table II, Model 2, reveals similar results to our previous findings.

6.3.3. Changing Firm Scope and *Multiproduct* Classification. The relative stability of single- and multiproduct configurations is an important condition to observe the performance effect described in Proposition 1. As discussed, we assume that changing firm scope (from multiproduct to single-product and vice versa) is a slow and costly process. A simple comparison of the share of single- and multiproduct firms before and after MNP confirms our assumption: this share is stable over time. Nevertheless, it is notable that multiproduct firms competing in markets with many pure prepaid players tend to increase their postpaid share after MNP. Although this process did not push these firms to become entirely postpaid nor to change their scope in the time span of our study, it certainly highlights a tendency toward an increased specialization for established firms (consistent with Proposition 2 findings for entrants). The results of this analysis are available upon request.

7. Conclusion

Until recently, strategic explanations of scope choices were dominated by supply-side notions of "related" diversification and shared resources. In contrast, the demand-side literature emerged from the idea that an excessive focus inside the firm will sacrifice opportunities for understanding strategy that come from the customer side. Contributing to this growing demand-side literature, our study offers evidence that customer switching costs play an important role in shaping the relative advantage and market presence of multiproduct firms.

Even within the demand-side literature, the approach of this study contrasts with existing papers. The focus of demand-side studies has been on customer-side synergies (Priem 2007, Schmidt et al. 2016, Mawdsley and Somaya 2018) or customer heterogeneity (Adner et al. 2016). Relying on demand-side synergies, for example, has been shown to support competitive advantage for multiproduct firms (Ye et al. 2012). The attractiveness of scope choices is also suggested to depend on heterogeneity in customer preferences (Adner et al. 2016). In contrast, we develop an earlier insight from the economic literature to show that switching costs increase the incentives for multi-product positions, effectively internalizing the market to offer product selection without the cost of switching between suppliers.

For the literature on switching costs, this study highlights that this type of friction will affect markets beyond reducing competition or increasing pricing power. Strategy scholars and regulators should keep in mind that policies that reduce—or increase—switching costs will shape an industry's future evolution and dynamics; as new competitors enter, they will conform to the new market characteristics. Thus, policies that affect switching costs will also shape the product offerings that are presented to consumers and firms' incentives to invest in different business models. When switching costs fall, companies will invest more in specialization and differentiation. This stands in contrast to the high switching cost setting in which firms will maintain more complex activity systems to support multiproduct positions. This multi-product approach could lead to the costly adaptations that have been documented in more general industry players (Natividad and Rawley 2015).

Since switching costs are widespread in social media and digital platforms, our theory can shed light on their broad and growing product offerings. In China, for example, WeChat has become an inseparable part of life: people use it to message friends, buy groceries, hail a ride, and even book a doctor's appointment. This "super app" integrates many services that in other countries are provided separately. Consistent with the mechanism in this study, the growth of super apps has been accelerated by government policies aimed at connecting the digital identity of people with such apps and hence substantially increasing switching costs. WeChat, for example, is being used as a virtual ID for social security by the Chinese government (Wildau 2017). By exploring the link between switching costs and firm scope, this study can inform the debate on the nature and potential solutions to market power in digital platforms (Gans 2018).

It is important, however, to acknowledge the limitations of the study. In order to define firm scope and identify a change in switching costs, the analysis

focused narrowly on one industry, which naturally raises the question of whether the findings will generalize to other industries. The dynamics of our model depend on customers who cannot fully predict their future product preferences as they gain experience with the product. We argue that these characteristics are prevalent in modern digital and service markets, but this is an empirical question that merits further study. In addition, the operationalization of firm scope by its offerings is specific to our setting and might be difficult to replicate in other contexts. Finally, we do not observe costs directly, hence we cannot assess the eventual profit implications of varying market conditions on different firms; we instead focus on growth and revenues as important intermediate outcomes for these companies.

By establishing the relationship between a notable form of market friction—customer switching costs—and firm scope, this paper joins the emerging literature on the role of demand-side market frictions in creating conditions and opportunities for different strategies (Mahoney and Qian 2013). Models of value creation and capture (Chatain and Zemsky 2007, 2011) have suggested that a drop in market frictions will be associated with reduced heterogeneity of strategic positions, and the findings of this study are consistent with that proposition. In particular, this study shows that the relative advantages of multiproduct and single-product firms can depend on market frictions such as switching costs. This opens the door to further studies exploring how market frictions might be key contingencies for other important competitive positions, such as cost leadership and differentiation.

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Appendix. Comparison of Two Main Service Types in the Telecommunications Industry

Characteristics	Prepaid	Postpaid
Revenue models	In-advance payments. A specific and bracket-based model in which customers pay before using the service. Firms hope to benefit from recurring purchases.	At the end. Charging customers at the end of the period based on their consumption. There is no limitation on the number of text messages or minutes of the call.
Value propositions	Basic plans. Core service with additional services as add-ons are offered to customers.	Sophisticated plans. Advanced features for customers (e.g., bundling, device leasing, unlimited data plans).
Customer profiles	Cost-conscious/youth. Short (one) time users and subscribers with a limited budget.	Families and professionals, heavy users, and early adopters.
Software (billing systems)	Advanced (real-time monitoring). Plan stops once subscriber's services are exhausted.	Less sophisticated. Only to keep track of subscribers' consumption.
Distribution points	Diversified. Network of retailers, online through third-parties, and carrier itself.	Centralized. Carrier-owned stores, website, and app.

Endnotes

[1] Our one-stop shopping model is similar to the type that has been found to explain generalists in retail (Messinger and Narasimhan 1997, Rhodes and Zhou 2019). However, unlike retail models, which focus on shopping time and search costs, our model relies on product differentiation within defined market segments and customer switching costs as the main market friction (Klemperer 1995, Burnham et al. 2003).

[2] A more complex model with price competition can derive propositions similar to the ones derived here.

[3] For simplicity, we assume zero switching costs when customers select a different product from their initial multiproduct provider. In reality, the customer of a multiproduct firm might experience a switching cost, but one that is negligible in comparison with that of switching between firms.

[4] Notice that in t_2, the market share is equivalent. Considering the model symmetry, the same amount of customers will switch from single-product firm i to single-product firm j as from single-product firm j to single-product firm i in t_2. In equilibrium, no customer will switch from the multiproduct firm to single-product firms.

[5] Consistent with prior research, we assume that firms cannot change their scope in short windows of time following the policy implementation. We find support for this assumption in our empirical analysis.

[6] First introduced in Singapore in 1997, it took approximately six years to implement MNP in Europe, beginning with the United Kingdom and the Netherlands in 1999. Countries such as Spain (2000); Sweden and Denmark (both 2001); and Belgium, Italy, Germany, and Portugal (all 2002) followed quickly (Bühler et al. 2006).

[7] As explained, Proposition 1 analysis consists of firms that are launched before MNP introduction.

[8] In post hoc analysis (Section 6.3), we grouped firms by quintiles of prepaid share and classified the extremes as single-product even though they still had a mix of services. The direction and size of the effect of MNP on the two groups of firms remained similar.

[9] For instance, multiproduct firms that entered the market earlier will tend to be more experienced and connected in the local market and society. The age and resource differences might account for the differential impact of MNP on these firms rather than the multiproduct choice of scope they selected.

[10] This is consistent with the prepaid share in the overall sample. An entirely postpaid firm is quite rare, and the few available ones launched their networks recently (see endnote [8] for a quintile-based measure of firm scope).

[11] Note that in Table 7 the sample size drops from 53 to 31 firms due to the lack of price data for some firms.

[12] The results remain similar when the *PostMNP Entry* is changed to include one year in anticipation of the policy change (see Section 4.3.2).

[13] We follow the common practice to include a measure of market share that is fixed at the time the regressor of interest (*PostMNP*) is determined (Angrist and Pischke 2008). Nevertheless, results are consistent if we use lagged time-vary market share as a control and are available upon request.

[14] These variables only account for the number of entries by MVNOs and do not take exits into account.

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