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Efficiency vs. market-power effects in the mobile-voice industry

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Abstract

This paper suggests a new procedure for separating the market-power effect from the efficiency effect when cost data are not available. We examine a panel of data on 177 mobile-voice operators in 45 countries from 1999:1 to 2004:2 and find that a 1% increase in the market share of an operator increases its price-cost margin by 0.58-0.66%, but only a small share of this increase is due to a market-power effect.

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1. Introduction

A seminal paper by Bain (1951) is the starting point of a large body of literature looking at the impact of different measures of industry concentration on profitability. Pioneer examples are provided by Cowling (1976), Cowling and Waterson (1976), Geroski (1981), Dickson (1982), Clarke and Davies (1982), and Geroski (1982) among others.

A related field of research concerns with the attempt of separating the so-called market-power effect from the so-called efficiency effect (see Demsetz 1973). The market-power effect is based on the argument that higher concentration leads to higher prices because competition decreases as concentration increases (higher concentration makes price coordination among industry members easier), while the efficiency effect is related to the argument that higher concentration leads to lower marginal costs because of economies of scale.

In a recent article, Dickson (2005) briefly reviews the literature of the 1980s, stressing that the major contributions, generally related to the American manufacturing sector, are either inconclusive (see for instance Allen 1983, Chappell and Cottle 1985, and Martin 1988) or contradictory (see for instance Peltzman 1977, and Kelton and Weiss 1989) or controversial (see for instance Smirlock *et al.* 1984, Shepherd 1986, and Martin 2002). We basically share this view.

In the 1990s, the literature seems characterized by a generalized attempt of using the tools of the NEIO[1] approach (see Iwata 1974, Appelbaum 1982, and Bresnahan 1982) for answering the old SCPP[2] question of the separation between efficiency and market-power effects. Examples are provided by Rosenbaum (1994) and Azzam (1997). However, an issue with the estimation of NEIO models (structural supply-demand models) is that they require the availability of data, namely cost data, which are rarely available, thus providing a reason why most studies are related to very specific US industries (such as cement, beef-packing, and so on).

In the 2000s, most of the research effort looks mainly oriented towards the refinement of the methods of the 1990s, although several contributions present some innovative and path-breaking ideas. This paper focuses on one of these contributions. In particular, it focuses on the above-mentioned article by Dickson (2005) who suggests a new procedure for identifying and weighting market-power and efficiency effects, using data on the American manufacturing sector. The whole estimation exercise is performed using a fixed-effects estimator (and the ordinary-least-squares estimator as a benchmark). The author explores industry-level panel data from 1963 to 1992 and his procedure has three steps.

In step-1, he estimates a standard price-cost margin regression and measures the positive effect of concentration on profitability, using a number of control variables (ratio of real industry capital stock to real output, annual growth rate of real industry output, and year effects).

Then, in step-2, he estimates a price regression using the same explanatory variables of the price-cost margin regression estimated in step-1 plus an additional one: a proxy of the marginal cost. From the latter regression, the author obtains an estimate of the positive effect of concentration on price, holding the marginal cost constant. In this way, he obtains a direct measure of the market-power effect.

[1] NEIO stands for New Empirical Industrial Organization.

[2] SCPP stands for Structure-Conduct-Performance-Paradigm.

Finally, in step-3, the author estimates his price regression without controlling for the marginal cost (i.e. he uses the same explanatory variables of step-1) and finds that concentration negatively affects price, thus providing indirect evidence of the efficiency effect. The explanation is simple: an increase in concentration, without holding the marginal cost constant, increases the price-cost margin (step-1) but reduces the price level (step-3). Hence, the coexistence of these two results must be explained by a reduction in the level of the marginal cost which more-than-counterbalances the reduction in the price level. Particularly, the efficiency effect is found to be bigger than the market-power effect (the latter is estimated in step-2).

This paper builds on Dickson (2005) but suggests a different procedure for separating market-power and efficiency effects. Indeed, rather than measuring the market-power effect directly by estimating a price regression that holds the marginal cost constant, we measure the efficiency effect directly by estimating a price-cost margin regression that holds the price level constant. Particularly, we look at the impact of the market share of a firm on its price-cost margin (a practice in use since Gale 1972, and Kwoka 1979), and contribute to the existing literature in several ways. First, we explore firm-level panel data rather than industry-level data. Second, we focus on the international mobile-voice industry rather than standard US sectors or industries. Third, our procedure can be used even if cost data are not available. Fourth, we find evidence reinforcing the conclusion of Dickson (2005) and Azzam (1997) that the efficiency effect dominates the market-power effect.

2. Empirical approach

This paper examines a panel of data on 177 mobile-voice operators in 45 countries over the period from 1999:1 to 2004:2. The data are provided by Merrill Lynch and extracted from the Global Wireless Matrix in its version of September 29th, 2004. Sample statistics are reported in Table I. Further details on the sample are provided by Andini and Cabral (forthcoming).

Market share, ebitda margin[3] and price level represent the three main variables of the empirical analysis in this paper. The market share of the operator i in country j at time t is measured as the number of subscribers of the operator i in country j at time t divided by the total number of subscribers in country j at time t. The ebitda margin is used as proxy of the price-cost margin although we partly agree with the criticisms associated with the use of accounting measures as indicators of economic profitability (see Fisher and McGowan 1983, and Fisher 1987). Its calculation is based on the total operator's revenues from sales of both goods and services. It is worth stressing that voice traffic represents, on average, around 80% of total operator's revenues. The price level is given by total revenues per minute of call, measured in euros (using quarterly exchange rates).

Basically, we compare estimation results from the following two empirical models:

$$\ln \text{ebitda}_{ijyq} = \alpha_0 + \alpha_i + \alpha_j + \alpha_y + \alpha_q + \alpha_1 \ln s_{ijyq} + \xi_{ijyq} \quad (1)$$

$$\ln \text{ebitda}_{ijyq} = \beta_0 + \beta_i + \beta_j + \beta_y + \beta_q + \beta_1 \ln s_{ijyq} + \beta_2 \ln p_{ijyq} + \zeta_{ijyq} \quad (2)$$

Note that we control for firm (i), country (j), year (y) and quarter effects (q).

[3] Earnings before interests, taxation, depreciation, and amortization, divided by operating revenues.

This paper focuses on the estimation of the effect of the market share on the ebitda margin, with and without a control for the price level. Putting it differently, the paper focuses on the coefficients α_1 and β_1. The coefficient α_1 gives the total impact of the market share on the price-cost margin, including both the efficiency effect and the market-power effect. The coefficient β_1, instead, gives the total impact of the market share on the price-cost margin, holding the price level constant. Hence, the latter coefficient provides a direct measurement of the total efficiency effect. Then, by subtracting the estimate of β_1 from the estimate of α_1, we get an indirect measurement of the market-power effect.

Note that we only use vectors of specific effects as control variables in model (1), plus the price level in model (2). This choice can be justified on two grounds. First, on the theoretical ground, the first-order condition of a simple profit-maximization problem provides an equation where the price-cost margin of a firm in a given country at a given time (the so-called Lerner index) only depends on the market share of the firm, its conjecture about competitors' behaviour (we do control for firms' unobserved heterogeneity), and the market-demand elasticity in a given country at a given time (we do control for country, year and quarter effects). Second, on the empirical ground, the insertion of additional price-cost margin regressors to models (1) and (2) implies the risk of adding market-share-dependent covariates to these models and therefore the risk of poorly estimating the total effect of the market share on the price-cost margin because a share of this effect is captured by the market-share-dependent covariates. In addition, the explained variability of the price-cost margin in both models is relatively high, compared for instance to Dickson (2005).

Further, note that the reason behind the choice of a logarithmic specification concerns with an easier interpretation of results, which are nevertheless robust to a model specification in levels.

Finally, let us discuss the estimation techniques. Since both market share and price are endogenous regressors due to simultaneity with price-cost margin[4], we use both the instrumental-variable-random-effects estimator (IVRE) and the instrumental-variable-fixed-effects estimator (IVFE). As instruments, we use both the lagged value of the price level and the lagged value of the market share for model (2), while only the lagged value of the market share for model (1). Note that the values of market share and price at time $t-1$ are likely to affect the values of market share and price at time t but unlikely to be affected by the value of the price-cost margin at time t. As a benchmark, we also provide estimation results based on the standard estimators of random-effects (RE) and fixed-effects (FE).

3. Results

Since the first-stage regression results, presented in Table II, strongly support the choice of the instrumental variables[5], we focus on the second-stage results.

As shown in Table III, the total impact of the market share on the price-cost margin in model (1), including both the efficiency effect and the market-power effect, varies from

[4] The value of the price-cost margin at time t is likely to affect the values of both market share and price at time t.

[5] Note that the models (1) and (2) are just-identified.

0.58 to 0.66. However, when holding the price level constant, the impact of the market share on profitability in model (2), measuring the efficiency effect, ranges between 0.52 and 0.63. Hence, depending on the estimation technique, the market-power effect goes from 0.03 to 0.08. These results are summarized in Table IV.

In sum, our evidence is consistent with the findings of Dickson (2005) and Azzam (1997). The market-power effect is dominated by the efficiency effect. If the market share of a mobile-voice operator increases by 1% then its price-cost margin is likely to increase by 0.58-0.66% but only a small share of this increase is due to a market-power effect. The latter is estimated between 4.55% and 13.33%.

To conclude, this paper suggests a new procedure for separating the market-power effect from the efficiency effect when cost data are not available. We examine a panel of data on 177 mobile-voice operators in 45 countries from 1999:1 to 2004:2 and find that the market share of an operator increases its price-cost margin mainly through efficiency gains.

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Table I. Summary sample statistics

	Obs.	Mean	St.Dev.	Min/Max
Ebitda	2292	0.33	0.13	0.01/0.77
Market share	3203	0.29	0.17	0.01/0.95
Price	2009	0.20	0.10	0.02/1.14

Table II. First-stage results

		IVRE			IVFE		
		(1)	(2)		(1)	(2)	
	Endogenous* variables	Log. of market share	Log. of market share	Log. of price	Log. of market share	Log. of market share	Log. of price
Instrumental variables							
Lagged** log. of market share		0.93 [0.000]	0.93 [0.000]	–0.03 [0.008]	0.85 [0.000]	0.87 [0.000]	–0.07 [0.000]
Lagged** log. of price			0.02 [0.000]	0.86 [0.000]		0.01 [0.045]	0.85 [0.000]
F-test of joint significance			[0.000]			[0.000]	[0.000]

P-values in square brackets

* The endogenous variables are the dependent variables of the first-stage regressions
** Previous quarter value

Table III. Second-stage results (dependent variable: log. of ebitda)

	RE		FE		IVRE		IVFE	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Log. of market share	0.60 [0.000]	0.52 [0.000]	0.59 [0.000]	0.53 [0.000]	0.58 [0.000]	0.55 [0.000]	0.66 [0.000]	0.63 [0.000]
Log. of price		0.12 [0.005]		0.12 [0.007]		0.09 [0.072]		0.10 [0.049]
R-squared	0.42	0.41	0.28	0.26	0.42	0.40	0.19	0.18
Obs.	2291	1780	2291	1780	2194	1689	2192	1687

P-values in square brackets

Table IV. Efficiency vs. market-power effects

	RE	FE	IVRE	IVFE
Total effect ($\hat{\alpha}_1$)	0.60	0.59	0.58	0.66
Efficiency effect ($\hat{\beta}_1$)	0.52	0.53	0.55	0.63
Market-power effect ($\hat{\alpha}_1 - \hat{\beta}_1$)	0.08	0.06	0.03	0.03
Efficiency share	86.67%	89.83%	94.83%	95.45%
Market-power share	13.33%	10.17%	5.17%	4.55%