Competition with Multinational Firms: Theory and Evidence

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Abstract

Do multinationals wield more market power than their domestic counterparts? The answer is yes, but with some important subtleties. We innovate within a canonical Ricardian model of endogenous markups and heterogeneous firms to provide analytical distributions of market shares and markups *when goods are imperfect substitutes* to provide structure for an empirical analysis. Using Hungarian firm-level data between 1993 and 2007, we find that (1) markups are higher for both greenfield and acquired foreign-owned firms than for domestic firms and (2) markups for greenfield foreign-owned firms are higher than for acquired firms. Our results show that differences in markups are not entirely explained by differences in market shares or export participation, and that the higher productivity and wages of foreign-owned firms also play an important organic role in determining markups.

JEL codes: F12; F13; F15; F23

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1 Introduction

Local production by multinational firms is twice as large as the volume of exports. Because they are such large players in the global marketplace for both goods and labor, the size of their profits is a subject of lively and constant discussion among a range of policymakers and pundits, debating the pros and cons of their investment and taxation. Exactly how big is the profit margin for the multinational enterprise (MNE)? Although this depends to a large degree on the ability of the firm to charge high markups over marginal cost, little is known about the extent of this market power for MNEs relative to their domestically owned counterparts. We innovate within a canonical Ricardian model of heterogeneous firms and strategic pricing *when goods are imperfect substitutes* to guide a firm-level empirical analysis of MNEs' pricing behavior. We find that multinational firms do, indeed have greater market power than domestically owned firms. However, the mode of investment is quite important, as much of this surplus is devoted to paying higher wages when branches are acquired rather than established as greenfield ventures.

The idea that MNE activity results in greater market power is not new. Path-breaking work by Hymer (1976), Knickerbocker (1973), Neary (2007), and Mràzòva & Neary (2013) conceptualize a world where the decision to invest overseas achieves higher markups or is principally driven by this motive in a strategic sense. Models of MNEs with heterogeneous firms (Helpman et al. (2004), Nocke & Yeaple (2007), Russ (2007), and Ramondo & Rappoport (2010)) characterize MNEs as being more efficient than the average domestically owned firm, giving them a higher market share as a result. However, they assume preferences that impose a constant markup, precluding an examination of market power. De Blas & Russ (2012) (hereafter DBR) derive a model of multinational activity with heterogeneity in labor productivity, combined with strategic pricing, but must assume that goods are perfect substitutes to do so, making market share either zero or one. So the literature can discuss market share in relation to MNEs when firms are heterogeneous, but has not yet linked market share or market concentration to their market power.

Studies of trade with endogenous markups and heterogeneous firms have made this link for exporters. Recent theoretical models depict high markups and market shares as arising from a technological edge. For instance, Bernard et al. (2003), Melitz & Ottaviano (2008), Atkeson & Burstein (2008), Rodriguez-Lopez (2013), and Edmond, Midrigan, and Xu (2012), as well as Garetto (2012) and De Blas & Russ (2010), all present models where domestically owned firms' markups at home and when exporting are increasing in the efficiency of the firm relative to its competitors. A number of studies indicate that multinationals are, on average, technologically more advanced than their domestic rivals (Temouri et al. (2008), and Alfaro and Chen (2013) provide new evidence and useful surveys). Thus, it is natural to conjecture that multinational firms might charge higher markups than domestically owned firms because they are more efficient. Their greater efficiency can derive from scale effects, from strategic takeovers of close rivals, or from better technology or management. We are agnostic as to what drives the efficiency, as long as it allows them to charge a lower price than competitors.

In this paper, we build on these models, developing a framework for an empirical analysis demonstrating that foreign-owned firms in Hungary do, in reality, appear to use a technological advantage to charge higher markups. In building the model underpinning the empirical analysis, we advance the current theory of heterogeneous firms and strategic pricing by presenting an analytical distribution for market share, which in the studies above either had to be numerically simulated or was degenerate. Since market share and markups are mapped one-to-one in these models, by implication our analytical expressions also govern the behavior of the distribution of markups.

Our empirical findings are quite new in the context of manufacturing firms. Perhaps due to the scarcity of firm-level data for which both balance sheet data and product-level prices are available, there is little empirical evidence on the markups charged by MNEs relative to domestically owned firms in the existing literature. A notable exception is Sembenelli & Siotis (2008), the only paper of which we are aware that analyzes the markups charged by target

firms before versus after a merger in the manufacturing sector. Using Spanish firm-level data, they find that following acquisition by a foreign firm, a domestic target increases its markup. The authors attribute this increase in markups to cost savings arising from improved efficiency after the merger. They characterize these cost savings as arising from the transfer of superior technology or managerial know-how. We study markups of foreign-owned firms formed both by mergers and by greenfield FDI.

Far more analyses of markups exist related to foreign direct investment in the financial sector. Available evidence suggests that (1) net interest margins, similar to the markup, increase after a merger, (2) foreign affiliates of banks with parents in rich countries charge higher markups than domestic banks in poor countries, and (3) foreign affiliates of banks with parents in less developed countries charge lower markups than domestic banks in rich countries. All of these stylized facts are consistent with the Ricardian approach to markups for nonfinancial firms in DBR and banks in De Blas & Russ (2013), so we use this modelling framework as a foundation for our empirical investigation of manufacturing firms in Hungary, generalizing it to allow goods to be imperfect substitutes.

Hungary in our sample period provides a rare opportunity to study the differences between domestic and foreign-owned firms, and especially, to compare firms which were earlier acquired by foreigners with greenfield multinational affiliates. The majority of privatization took place in the beginning of the 1990s creating many foreign-owned firms by 1993-94, when our analysis starts. Liberalization and growth also led to the entry of many greenfield foreign affiliates in the second half of the 1990s, which we can follow during our period.

The rest of the paper is organized as follows. In Section 2, we present a reduced-form version of the model in DBR and use it to derive an empirical approach to the analysis of firm-level data. In Section 3 we describe a comprehensive dataset with the balance sheets of more than 23,000 manufacturing firms operating in Hungary in the years 1993-2003. This panel dataset allows us to calculate firm-year-specific markups. In Section 4, we analyze the data using the empirical model derived in Section 2 and present the results, concluding in

Section 5 with a discussion of future questions and research.

2 Theoretical Framework

Suppose that final goods producers in the home country assemble a continuum of intermediate goods from each sector j given a technology with a constant elasticity of substitution, $\eta > 1$, and total output of the final good Y given by

$$Y = \left(\int_0^1 Y_j^{\frac{\eta-1}{\eta}} dj \right)^{\frac{\eta}{\eta-1}},$$

the corresponding aggregate price index being

$$P = \left(\int_0^1 P_j^{1-\eta} \right)^{\frac{1}{1-\eta}}.$$

Within each intermediate goods industry, there is a finite number of firms K, each of which produce their own variety. As in Atkeson & Burstein (2008), output within each intermediate goods industry j is governed by the elasticity of substitution between varieties $\rho > \eta$,

$$Y_j = \left(\sum_{k=1}^{K} q_{jk}^{\frac{\rho-1}{\rho}} dj \right)^{\frac{\rho}{\rho-1}}.$$

We assume that firms set prices to compete with each other in each sector, paying attention to how their own prices affect the industry price index in Bertrand competition, with the industry price index P_j given by

$$P_j = \left(\sum_{k=1}^{R} P_{jk}^{1-\rho} \right)^{\frac{1}{1-\rho}}.$$

Then, each supplier k of good j will charge a markup over marginal cost according to its market share s_{ijk},

$$M(s_{jk}) = \frac{\varepsilon(s_{jk})}{\varepsilon(s_{jk}) - 1} C_{jk},$$

where C_{jk} represents the marginal cost of a domestically owned firm k supplying good j, $\varepsilon(s_{jk}) = \eta s_{jk} + \rho(1 - s_{jk})$ is the price elasticity of substitution facing each firm, and s_{jk} is market share. Market share for each home firm k can be derived as a function of prices,[3]

$$s_{jk} = \frac{P_{jk}^{1-\rho}}{\sum_{k-1}^{R} P_{jk}^{1-\rho}} \tag{1}$$

Note that the larger the firm is in terms of industry market share, the closer its markup tends toward the Dixit & Stiglitz (1977) markup, $\frac{\eta}{\eta-1}$, governed by the elasticity of substitution between industries, as in Amiti, Itskhoki, and Konings (2012). As market share shrinks, a firms markup also shrinks toward the markup $\frac{\rho}{\rho-1}$, governed by the elasticity of substitution between varieties within an industry.

2.1 Technology and market share, and markups

Within this context, there is a monotonic relationship between market share and a firm's markup—ranking firms by market share is analogous to ranking them by their markups. In this general framework with heterogeneous firms and endogenous markups, it is difficult to pin down an analytical distribution for markups. However, we can present a way to obtain an analytical distribution for market share and thereby discern the behavior of the distribution of markups in the closed economy and in the presence of multinational producers.

We start with the observation that many studies in trade treat the distribution of firm size as resembling a power law and take this as our aim for a closed-economy distribution. To arrive at that point, we begin with the conjecture that intermediate goods prices are

[3]See Kucheryavyy (2012) for a full discussion of pricing behavior within this preference structure when firms are heterogeneous under both Bertrand and Cournot competition.

distributed inverse Weibull (Fréchet) within each category of intermediate goods. If P_{jk} is distributed Fréchet with a technology parameter T^{-1}, a wage w, and dispersion parameter λ, then under the further assumption that the dispersion parameter is equal to $\rho - 1$ we have[4]

$$P_{jk}^{1-\rho} \sim \text{Exponential}\left(Tw^{-1}\right) \sim \text{Gamma}\left(Tw^{-1}, 1\right). \tag{2}$$

The sum of $K-1$ exponential distributions, the weighted sum of the prices of all firms in the industry is distributed Gamma($(K-1)Tw^{-1}$,1). Thus, the market share of home firms in a closed economy is distributed according to a Beta distribution,

$$s_{jk}^{\text{CLOSED}} = \frac{P_{jk}^{1-\rho}}{\sum_{k=1}^{K} P_{jk}^{1-\rho}} \sim \text{Beta}\left(Tw^{-1}, (K-1)Tw^{-1}\right). \tag{3}$$

The power law is a special case of the Beta distribution, when $(K-1)Tw^{-1} = 1$. Otherwise, the Beta distribution is less fat-tailed than the power law. The average market share for a firm in an industry j in this case is given by

$$E\left[s_{jk}^{\text{CLOSED}}\right] = \frac{Tw^{-1}}{Tw^{-1} + (K-1)Tw^{-1}} = \frac{1}{K}, \tag{4}$$

which is decreasing in K. The distribution gives us the attractive property that the expected market share of any firm is decreasing in the number of rival firms, K. Thus, the average *markup* is also decreasing in the number of rivals.

If multinationals are present, they may set prices based on a distribution of costs that reflects a greater average efficiency than is available among firms in the host country. We embody the superior technology accessible to multinationals operating in the host country within the parameter $T^* > T$. In this case, the market share of a particular firm is no longer

[4]The following expression comes about because any exponential distribution is also a Weibull distribution, therefore the inverse of any exponential distribution is inverse Weibull (Fréchet). An exponential distribution is also a special case of a Gamma distribution.

distributed Beta, but rather Dirichlet (see Frigyik et al. (2010) (p.13) for proof):

$$s_{jk} = \frac{P_{jk}^{1-\rho}}{\sum_{k=1}^{K} (P_{jk})^{1-\rho} + \sum_{k^*=1}^{K^{MNE}} \left(P_{jk^*}^{MNE}\right)^{1-\rho}} \sim \text{Dirichlet}\left(\gamma_1, ..., \gamma_K, \gamma_1^*, ...\gamma_{K^{MNE}}^*\right), \tag{5}$$

where $\gamma_k = Tw^{-1}$ for all $k \in \{1, ..K\}$ and $\gamma_k^* = T^*w^{-1}$ for all $k^* \in \{1, ..K^{MNE}\}$. Given this Dirichlet distribution, calculating the expected market share of any domestically owned firm k in the home country is straightforward:

$$E\left[s_{jk}\right] = \frac{Tw^{-1}}{KTw^{-1} + K^{MNE}T^*w^{-1}} = \frac{1}{K + K^{MNE}\left(\frac{T^*}{T}\right)} \tag{6}$$

Though it is less fat-tailed than a power law distribution, the Dirichlet distribution can reflect very high concentration, depending on the underlying technological parameters. For our purposes, it is useful to shed light on the behavior of markups. Because our theory implies that markups are increasing in market share, we can use the distribution to analyze the expected market share of multinational firms relative to domestic firms in the host country. We can see that greenfield FDI, by increasing K^{MNE}, would decrease the total market share of home firms in the home country.[5]

Similarly, one can see that the market share of the average multinational is increasing in any technological advantage that the parent country has relative to the host (home) country,

$$E\left[s_{jk^*}\right] = \frac{T^*w^{-1}}{KTw^{\theta} + K^{MNE}T^*w^{-1}} = \frac{1}{K\left(\frac{T}{T^*}\right) + K^{MNE}}. \tag{7}$$

The expected market share of an individual foreign-owned firm $E\left[s_{jk^*}\right]$ is clearly highest in countries with low technology T.

Obviously, home and foreign market shares within industries negatively covary. The degree to which they covary depends on their relative technologies and number of domestic

[5]Takeovers would have a similar but more muted effect, as it may leave the total number of firms intact, but increase the technology available to merged firms, leaving the remaining domestic firms at a disadvantage.

vs. foreign-owned firms. The expected market share of foreign-owned multinational firms across industries in the home country, $s*_j$, is[6]

$$E\left[s_j^*\right] = \frac{K^{MNE}T^*w^{-1}}{KTw^{-1} + K^{MNE}T^*w^{-1}}, \tag{8}$$

What is more, using our Dirichlet distribution, we can derive the covariance of the market shares of any particular home firm with the foreign firm market share is also negative with a magnitude that depends on their relative technology,

$$Cov\left(s_{jk}, s_j^*\right) = \frac{-(Tw^{-1})K^{MNE}(T^*w^{-1})}{\left(KTw^{-1} + K^{MNE}T^*w^{-1}\right)^2\left(KTw^{-1} + K^{MNE}T^*w^{-1}\right) + 1} \tag{9}$$

The market shares and therefore markups of existing home firms covary negatively with the degree of foreign presence.

2.2 Empirical Predictions

Our theoretical framework yields two key predictions:

1. The markups of foreign-owned firms will be higher on average than those of home firms in a country with lower technological efficiency.

2. The markups of home firms are decreasing in the total market share of foreign-owned firms in the same industry.

3 Data and Empirical Approach

We use a panel of firm-level dataset collected by the Hungarian Tax Authority, which contains information on Hungarian firms between 1986 and 2011, but in our main empirical analysis we restrict the sample to the period between 1995 and 2007 in order to focus on years after

[6]See Frigyik et al. (2010) for a proof of this aggregation property of the Dirichlet distribution.

the early phases of transition as well as the crisis beginning in 2008. The sample consists of all double-bookkeeping enterprises. The data includes balance sheet and income statements, including sales, exports, material costs, different accounting measures of capital, the number of employees, 4-digit industry identifier and the county of the center of the firm. The data was extensively cleaned, with a careful attention to harmonizing industry codes across years and filling in missing observations. Because markup estimates tend to be noisy for small firms, we only include firms with at least 20 employees in our sample. We also restrict our attention to manufacturing firms because productivity and markup estimates are more reliable in such industries.

A key variable in our investigation is the ownership status of each firm. The dataset includes information on the foreign ownership share in each year. Hence, we classify firms as foreign-owned when the foreign equity share is at least 10%.[7] As our theoretical framework suggests important differences between greenfield and acquired firms, we classify foreign owned firms into three sub-categories. First, we can observe whether a firm was aquired by foreigners after 1986, and we call such enterprises *acquired*. The second group is that of *greenfield* firms which were founded after 1986, and were already foreign at that first year. In our sample all firms were state-owned in 1986, hence we can classify each of them as domestic, privatized or greenfield.

The number of firms in each category is shown in Table 1. The overwhelming majority of privatization in manufacturing firms took place before 1995, hence the number of acquired firms did not change much in our sample period. On the other hand, many domestic and greenfield firms entered during the dynamic, export-led growth period between 1995 and 2001, followed by a small amount of attrition after 2001.

We use the method proposed by De Loecker & Warzynski (2012) to estimate both TFP and markups from the balance sheet data. In this section only, the symbol θ is used according to the notation in that study. This method relies on the Ackerberg et al. (2006)

[7] Changing this threshold to 25 or 50% does not affect our results.

Table 1: Sample size

Year	Domestic	Acquired	Greenfield	Total
1995	1,399	399	311	2,109
1996	1,558	418	376	2,352
1997	1,702	464	439	2,605
1998	1,970	489	496	2,955
1999	2,122	503	513	3,138
2000	2,271	505	580	3,356
2001	2,482	512	635	3,629
2002	2,512	498	676	3,686
2003	2,456	432	671	3,559
2004	2,380	400	660	3,440
2005	2,356	370	661	3,387
2006	2,286	342	661	3,289
2007	2,224	330	653	3,207

procedure when estimating productivity and estimates markups from the relationship between the change input usage and output growth. This approach is based on conditions derived from cost minimization, and does not rely on any specific market structure. An important assumption of the method is that the firm is able to vary the input in question freely.

The DLW methodology enables one to estimate the markup different ways, using different information. One possibility is to use a value added production function and identify the markup from the behavior of labor. The second possibility is to estimate a gross output production function, which provides opportunity to estimate markups from both material and labor inputs. Because of this richer choice set provided by the gross output production function, we opt for using the second. The gross output production function is:

$$\text{revenue}_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_{ll} l_i t^2 + \beta_{kk} k_{it}^2 + \beta_{mm} m_{it}^2 + \beta_{lk} l_{it} k_{it} + \beta_{lm} l_{it} m_{it} + \beta_{km} k_{it} m_{it} + \omega_{it} + \epsilon_{it} \tag{10}$$

where i denotes firms and t indexes years, revenue_{it} is gross output, l_{it} is the number of employees, k_{it} is tangible assets and m_{it} is material costs (all in logs). The variable ω_{it} is

the productivity shock observable by the firm in the beginning of the period while ϵ_{it} is an idiosyncratic productivity shock and/or measurement error. We estimate this translog production function by 2-digit industries.

The gross output function provides an opportunity to estimate markups both from the behavior of materials and labor. One can argue that materials usage is more flexible than labor, hence it may be preferable to use materials to estimate cost efficiency and the corresponding markup. The formulae for the markups identified from labor (μ_{it}^L) and material use (μ_{it}^M), respectively, are:

$$\mu_{it}^L = \frac{\theta_{it}^L}{\alpha_{it}^L} \text{ and } \mu_{it}^M = \frac{\theta_{it}^M}{\alpha_{it}^M}, \tag{11}$$

where θ_{it}^L is the output elasticity for labor, $\theta_{it}^L = \hat{\beta}_l + 2\hat{\beta}_{ll} l_{it} + \hat{\beta}_{lk} k_{it} + \hat{\beta}_{lm} m_{it}$, while α_{it}^L is the share of labor costs in value added (corrected with the idiosyncratic shock).

The output elasticities are quite similar for all firms within each industry, hence the bulk of identification comes from variation in input spending shares. This, however, seems to be problematic, because there is likely be substitution between labor and materials, which is not taken into account in these measures. Also, the degree of substitutability can be strongly related to ownership and firm size, hence can distort estimates.[8] Another issue which may be important in a transitional economy is that firms can pay less taxes if their employers are not employed by them formally, but provide receipts as an entrepreneur, even if they were in fact employed by the firm. The motivation for this is tax evasion, and bypassing minimal wage and other labor legislation. In such a case the wage of the worker in question would show up as a materials cost (purchased services) rather than as wage. This practice was used mainly by smaller/domestic firms, and is likely to have become less frequent over time.

In fact empirically the two markups measures based on only labor vs. only materials are negatively correlated, showing that this substitution between labor and materials dominates the positive correlation coming from the underlying market power. In order to increase the

[8] A relationship between substitutability and size or ownership could arise for two reasons. First, larger/foreign firms are more likely to integrate earlier stages of production, hence substitute materials for labor. Second, MNE affiliates may import easily in-house, which may lead to larger material consumption.

robustness of the estimates by reducing noise from this substitution, we simply calculate a geometric average of the two markups and also report results with different estimated markups as robustness checks. Hence, the average markup measure used in our main regressions is:

$$\mu_{it}^{AV} = \sqrt{\frac{\theta_{it}^{M}\theta_{it}^{L}}{\alpha_{it}^{M}\alpha_{it}^{L}}} \tag{12}$$

Note that this method provides one markup estimate for each firm-year combination. The estimated markup is a weighted average of the markups in each of the firm's markets, hence (without additional assumptions) we cannot estimate separately the markups for the domestic and foreign market. In our main specification, we model this estimated markup with variables describing ownership, competition and other conditions. The estimated equation is:

$$\mu_{it}^{AV} = \sum_{f \in \{\text{M\&A, G}\}} \alpha_f * I_{it}^{f} + \beta * X_{it} + \delta_{jt} + \zeta_{it} \tag{13}$$

where i indexes firms and t years. The variable μ_{it} is the estimated markup, X_{it} is the vector of explanatory variables, δ_{jt} is (4-digit) industry-year fixed effects and ζ_{it} is the idiosyncratic error. We cluster the estimates by firm. Our most important explanatory variable is the set of dummies indicating foreign ownership, as discussed above.

One set of controls describes market structure. First, we calculate domestic market share of the firm in the 2-digit industry by using Eurostat data on production, imports and exports. Second, as competition in export markets may differ from domestic competition, we also include variables representing the proportion of exports relative to the sales of the firm. Note that this variable may also control for product quality to the extent that firms producing higher quality goods are more likely to export.

In some specifications, we also control for productivity and relative wage level, as these variables may be related to foreign ownership. The TFP estimate comes from the De Loecker & Warzynski (2012) process. We also control for the size of the firm by creating sales quintiles within each 2-digit industries.

Note also that our identification of the key variables comes mainly from cross-sectional variation. Due to the fact that there are very few changes in firm ownership, it is not possible to include firm fixed effects or use a matching estimator.

4 Results

Table 2 presents averages of key variables. First, there are large differences in terms of employment. Acquired firms are much larger than domestic firms, and their average size is more or less constant during the sample period. The average size of domestic firms was declining before 2001, which is mainly explained by the large number of new entrants in this dynamic period. The size of greenfield firms is between the domestic and privatized firms on average. These firms were growing quickly, nearly catching up with acquired firms by the second half of the 2000s.

The size of markups is economically meaningful, between 30 and 60 percent. There are large differences across different kinds of firms: the average markup of foreign firms is larger than that of domestic firms in each year. With time, the difference between domestic firms and foreign affiliates was declining, showing evidence for some degree of convergence. The relationship between the markups of acquired and greenfield firms is not clear cut: greenfield markups tend to be larger at the beginning of the period but have lower markups after 2000.

Finally, in line with earlier results (Brown et al. (2006)), foreign firms are significantly more productive than domestic firms. In contrast to markups, however, we do not see convergence between the average TFP of domestic and foreign-owned firms. Rather, we see increasingly higher markups among each new cohort of domestic firms, suggesting a catch-up effect between exiting foreign and new domestic firms.

Table 2: Descriptive statistics

Year	Employees			Markup			TFP		
	Dom.	Acqu.	Greenf.	Dom.	Acqu.	Greenf.	Dom.	Acqu.	Greenf.
1995	159.10	272.15	177.49	1.32	1.61	1.68	2.39	2.71	2.74
1996	142.40	271.10	171.51	1.37	1.61	1.65	2.36	2.67	2.67
1997	133.79	270.85	186.93	1.39	1.59	1.58	2.34	2.65	2.60
1998	117.47	275.26	198.45	1.39	1.58	1.58	2.35	2.65	2.58
1999	107.29	278.77	218.01	1.40	1.60	1.61	2.34	2.71	2.60
2000	101.47	257.09	220.69	1.43	1.59	1.56	2.32	2.65	2.52
2001	94.79	243.10	240.03	1.42	1.59	1.54	2.36	2.68	2.53
2002	91.10	227.31	228.72	1.38	1.59	1.51	2.37	2.68	2.55
2003	86.56	233.37	230.26	1.41	1.61	1.53	2.36	2.63	2.54
2004	83.37	241.27	231.26	1.40	1.57	1.52	2.34	2.61	2.52
2005	80.85	277.28	238.87	1.42	1.56	1.50	2.33	2.54	2.48
2006	80.94	289.51	247.61	1.41	1.63	1.53	2.32	2.60	2.48
2007	78.32	283.62	253.28	1.39	1.55	1.49	2.30	2.53	2.44

4.1 Baseline results

Table 3 shows our baseline results. Column (1) shows the differences across firms when only controling for industry-year fixed effects. Greenfield firms have the highest markups: the point estimate is suggests that their premium is close to 20% relative to domestic firms. Acquired firms' markups are between domestic and greenfield firms, with a 8.7% point premium.

In order to understand better the sources of markup premia of foreign firms, in column (2) we control for the market share and export status of firms. Market share is important in the more general but less tractable version of our model where goods within an industry are not perfect substitutes, or $\rho < \infty$. In this general version of the model, cost efficiencies across firms are fully captured by their market share, so controlling for market share should reduce or eliminate any difference in the relative markups charged by foreign versus domestic firms. In line with our expectations market share is positively related to markups, but export status is insignificant. More importantly the estimates of the acquired and greenfield dummies does not change when with the inclusion of these controls.

Table 3: Baseline results

Dependent variable: Individual firm markup				
	(1)	(2)	(3)	(4)
Acquired	0.087***	0.077***	0.050***	0.035**
	(0.016)	(0.016)	(0.016)	(0.015)
Greenfield	0.198***	0.193***	0.151***	0.119***
	(0.022)	(0.022)	(0.023)	(0.019)
Market share		0.324***	0.167***	0.439***
		(0.044)	(0.047)	(0.044)
Size: 2nd q.			0.046***	
			(0.013)	
Size: 3rd q.			0.118***	
			(0.018)	
Size: 4rd q.			0.140***	
			(0.017)	
Size: 5th q.			0.185***	
			(0.025)	
Exporter		0.008		
		(0.014)		
TFP				0.439***
				(0.020)
Observations	40,712	40,712	40,712	33,262
R-squared	0.496	0.500	0.506	0.607

All specifications contain industry-year fixed effects.

In column (3) and (4) we include size dummies and TFP, respectively. In line with our theoretical framework these variables are strongly positively related to markups. As expected, their inclusion leads to lower estimated foreign premia. The two variables still remain significant, however, reflecting that foreign firms have higher markups then similarly productive domestic firms. Importantly, the markups of greenfield firms still remain significantly higher than that of acquired firms.

Table 4: Robustness checks: Markup behavior when using different measures of costs

Dependent variable: Individual firm markup						
VARIABLES	(1) Translog labor and materials	(2) Translog labor and materials	(3) Translog labor only	(4) Translog labor only	(5) Cobb-Doug. labor and materials	(6) Cobb-Doug. labor and materials
Acquired	0.077***	0.035**	0.024	0.014	0.094***	0.051***
	(0.016)	(0.015)	(0.059)	(0.061)	(0.019)	(0.017)
Greenfield	0.193***	0.119***	0.330***	0.299***	0.224***	0.147***
	(0.022)	(0.019)	(0.092)	(0.088)	(0.023)	(0.020)
Market share	0.324***	0.439***	2.022***	2.126***	0.329***	0.449***
	(0.044)	(0.044)	(0.205)	(0.221)	(0.045)	(0.047)
Exporter	0.008		0.057		-0.000	
	(0.014)		(0.047)		(0.015)	
TFP		0.439***		0.375***		0.425***
		(0.020)		(0.081)		(0.025)
Observations	40,712	33,262	40,712	33,262	40,712	33,262
R-squared	0.500	0.607	0.535	0.566	0.236	0.353

All specifications contain industry-year fixed effects.

4.2 Robustness

Table 4 presents our baseline results with other markup measures. Columns (1) and (2) repeat our baseline results from Table 3. Columns (3) and (4) show results when the markup is identified from only the labor variable. In columns (5) and (6) we estimate a Cobb-Douglas production function instead of the translog in our baseline model. The results seem to be robust to these different measures.

Table 4 shows additional robustness checks. In columns (1) and (2) we split the sample for two subperiods: 1995-2000 and 2001-2007, respectively. This sample split suggests that foreign premia were significant in both periods; also, greenfiled firms charged higher markups in both periods than acquired firms. The premia, however, are smaller in the later period, in line with the descriptive statistics.

An important question is whether our results are driven by composition effects or within-

firm changes in markups. To focus on firms which were present in the sample for a long term, in column (3) we restrict the sample to firms with at least 10 observations. While the much smaller sample size leads to less precise estimates, the point estimates are very similar to our baseline results. The acquired firm premium becomes insignificant, but the greenfield dummy remains highly significant.

In column (4) we exclude firms with less than 50 employees. One motivation for this is that balance sheet data by smaller firms may be less reliable, hence markup estimates for these firms may be more noisy. This restriction, however, does not change the qualitative results. [9]

Two important differences between domestic and foreign firms are the higher wages payed by foreign firms and the different tax concessions provided by the government for foreign firms. To check the importance of wage differences, we calculate 5 quantile dummies reflecting the average wage payed by the firm relative to the industry average. To control for the differences in tax rates, we calculate the effective tax rate for each firm by dividing the corporate tax bill with before tax earnings. The estimates show that firms that pay higher wages have lower markups. The effect of the effective tax rate is insignificant. Importantly, including these variables does not change significantly the estimates of the ownership dummies.

Finally, in column (6) we control for import penetration at the industry-year level to capture another dimension of competition. While higher export share is negatively related to markups, including this variable does not change our main results.

4.3 Markups of entering firms

In this subsection we use a simple framework to (1) test our second empirical predition– that domestic markups are negatively correlated with the market share of multinationals, and (2) check whether the presence of multinational firms is associated with a catch-up effect in the selection process of entering domestic firms. In order to do this, we have calculated 3

[9]This is also true when we also restrict the productivity and markups estimation to this subsample of firms

Table 5: Robustness checks: Different samples and specifications

Dependent variable: Individual firm markup						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	1995-2000	2001-2007	balanced	emp>50	tax wage	impt. comp.
Acquired	0.094***	0.066***	0.086	0.079***	0.096***	0.076***
	(0.019)	(0.019)	(0.093)	(0.020)	(0.017)	(0.016)
Greenfield	0.248***	0.157***	0.250***	0.214***	0.215***	0.192***
	(0.027)	(0.024)	(0.092)	(0.027)	(0.023)	(0.022)
Market share	0.202***	0.419***	0.249	0.322***	0.388***	0.326***
	(0.050)	(0.053)	(0.243)	(0.054)	(0.046)	(0.044)
Exporter	-0.005	0.017	0.035	-0.006	0.037**	0.007
	(0.017)	(0.016)	(0.068)	(0.019)	(0.014)	(0.014)
Wage: 2nd q.					-0.134***	
					(0.017)	
Wage: 3rd q.					-0.180***	
					(0.020)	
Wage: 4rd q.					-0.196***	
					(0.022)	
Wage: 5th q.					-0.149***	
					(0.025)	
Tax rate					0.001	
					(0.001)	
Imp. Penetration						-0.849***
						(0.162)
Observations	16,515	24,197	3,120	21,379	37,442	40,712
R-squared	0.465	0.522	0.707	0.566	0.513	0.501

All specifications contain industry-year fixed effects.

variables for each (4-digit) industry-year:

1. s_j^*: share of foreign firms in industry employment
2. Entrant premium: difference between median markup of domestic entrants and incumbent domestic firms
3. Foreign premium: difference between median markup of foreign firms and incumbent domestic firms

One can run a regression at the industry level:

$$\text{Entrant premium}_{jt} = \beta s^*_{j,t-1} + \gamma Foreign\, premium_{j,t-1} + \eta_j + \xi_t + \epsilon_{st} \tag{14}$$

where j denotes sectors, t years, η_j is sector fixed effects while ξ_t is year fixed effects. Explanatory variables are lagged to reduce simultaneity.

Table 6 shows the results from this exercise. Foreign presence is in fact negatively related to the premium of new entrants, as predicted by Eq. 9, but the larger is the premium of foreign firms, the larger is the difference between new entrants and incumbent domestic firms. For productivity, the horizontal measure is insignificant, and foreign (productivity) is positive but only significant with 2-digit industry dummies.

5 Conclusion

We used a structural model of endogenous markups and heterogeneous firms to derive predictions about the differences in markups of domestic and foreign-owned firms to show that important differences are expected between domestic firms on the one hand, and acquired and greenfield foreign-owned firms on the other.

This model motivates our analysis of Hungarian firm-level data. We show that markups for foreign firms are higher in general that for domestic firms, especially greenfield firms.

Table 6: Influence of multinationals' market share on domestic firms' markups

Dependent variable: Entrant premium (Domestic entrant markup - Domestic incumbent markup)						
	(1)	(2)	(3)	(4)	(5)	(6)
$s^*_{j,t-1}$	-0.224**		-0.197**	-0.458**		-0.207
	(0.0914)		(0.0950)	(0.207)		(0.231)
Lagged foreign markup		0.225***	0.224***		0.208***	0.202***
		(0.0545)	(0.0544)		(0.0751)	(0.0754)
Observations	1,019	909	909	1,019	909	909
R-squared	0.040	0.060	0.065	0.248	0.220	0.220

All specifications contain industry and year fixed effects.

The markup premium is partly, but not entirely, explained by the differences in market share between the different firms. Importantly, greenfield foreign firms seem to be able to charge higher markups than domestic firms with similar market shares, but that the markup premium for firms acquired through cross-border M&A is eroded somewhat by higher labor costs in line with previous work on rent-sharing between workers and multinational firms. New cohorts of domestic firms achieve progressively higher markups than past cohorts, suggesting a dynamic catch-up effect with foreign firms that happens through entry rather than only upgrading by existing firms.

In future research, we propose to merge the data to expand the sample to 2008 using data where we will be able to control for the type of worker, accounting for compositional differences in the labor force within domestic and foreign firms. We also hope to investigate whether tax considerations could drive the difference in reported profit margins; however, the different behavior of markups and labor costs across modes of entry and the sensitivity of markup behavior to measures of market share suggest that tax variables are not a primary factor explaining our results.

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