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THE IMPACT OF STATE AND FOREIGN OWNERSHIP ON POST-TRANSITION INDUSTRIAL CONCENTRATION: THE CASE OF POLISH MANUFACTURING

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Abstract

This paper reports an analysis of the determinants of the *level* and *changes* in Polish industrial concentration in the early post-transition era. The empirical evidence is based on a panel of 144 Polish manufacturing industries over the period 1989-1993. The results suggest that both state and foreign ownership have a significant impact on industry concentration and this relationship is U-shaped. Minimum efficient scale is found to be the only other factor to impact on industry concentration.

Key words: Post-transition; Foreign Direct Investment; State ownership; industry concentration

JEL Classification: D40, L11, F23

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Abstract

This paper reports an analysis of the determinants of the *level* and *changes* in Polish industrial concentration in the early post-transition era. The empirical evidence is based on a panel of 144 Polish manufacturing industries over the period 1989-1993. The results suggest that both state and foreign ownership have a significant impact on industry concentration and this relationship is U-shaped. Minimum efficient scale is found to be the only other factor to impact on industry concentration.

1. Introduction

Evidence on the determinants of the *level* and *changes* of industry concentration has tended to focus on developed economies (e.g. Levy, 1985; Battacharya and Bloch, 2000; Symeonidis, 2000; Ratnayake, 1999; Driffield, 2001). There is limited evidence on developing economies (e.g. Blomstrom, 1986; Chou, 1986), however, there is a paucity of evidence on the determinants of industry structure in post-transition economies. The major competitive shock as a consequence of transition from a centrally planned to a mixed economy with capitalist enterprise is a 'natural experiment' that offers an exceptional opportunity to examine the impact of such shocks on economic activity.[1]

On 1 January 1990 a variety of economic reforms were introduced in Poland with the intention of increasing competition between firms. The major changes were: first, economic activity and prices were deregulated to provide entrepreneurial incentives; second, the process of privatising state owned enterprises started; third, foreign ownership became more prevalent. Such economic policies were designed to de-monopolise production because they lowered the entry barriers faced by state, cooperative and private firms (Slay, 1995; Ghemawat and Kennedy, 1999). Consequently, they are expected to lead to a decline in industrial concentration.

This paper seeks to contribute to the literature on industry concentration in three ways. First, it extends Ghemawat and Kennedy's (1999) work by examining the determinants of the level and changes in concentration using a panel data set covering the early years

[1] The macro and micro economic reforms conducted in Poland from 1990 after the demise of the Communist regime are discussed in Slay (1995) and Ghemawat and Kennedy (1999).

post-transition. Second, it addresses important features of early transition such as the diminishing role of the state sector and increased foreign presence by examining the impact of state and foreign ownership on industry concentration. Finally, we seek to determine the effect of industry profitability on industry concentration in a post-transition economy.

The paper is organised in the following way. Section 2 presents the model construction and discusses the theoretical motivations behind the inclusion of variables in the model. The models to be estimated are also presented in this section. The data are described in section 3. The results are presented in section 4 and conclusions are drawn in section 5.

2. Model specification

2.1 Model construction

The empirical approach taken in this study involves estimating a steady-state equilibrium model in order to examine determinants of the *levels* of industrial concentration and estimating a model of the determinants of *changes* of industrial concentration. Note that these are reduced form models. The basic model illustrating the factors that affect industrial concentration in industry i (i = 1, 2, ..., N) in year t (t = 1, 2, ..., T) is expressed as:

$$HI_{it} = f(\boldsymbol{X}_{it}, \boldsymbol{S}_{it}, \boldsymbol{G}_{it}, \boldsymbol{F}_{it}) \qquad (1)$$

where HI is the Herfindahl Index, $\boldsymbol{X}$ is a vector of industry technological barriers to entry; $\boldsymbol{S}$ is a vector of strategic barriers to entry; $\boldsymbol{G}$ is a vector of government policy related variables, and $\boldsymbol{F}$ is a vector of variables representing international influences.

The technological barriers to entry ($\boldsymbol{X}_{it}$) include:

$$\mathbf{X}_{it} = \left(MES_{it}, CAPR_{it}, SIZE_{it}\right) \tag{2}$$

where *MES* is minimum efficient scale, *CAPR* is the capital requirement, and *SIZE* is the industry or market size. *MES* is the lowest quantity of output required to minimise average costs and so, for a given market size, is hypothesised to have a positive effect on industrial concentration. *CAPR* is hypothesised to have a positive effect on industrial concentration because it measures capital requirements and economies of scale in raising capital (Levy, 1985). Larger *SIZE* is hypothesised to have a negative impact on industrial concentration because a larger market can support more firms.

Strategic barriers to entry are defined as:

$$\boldsymbol{S}_{it} = (INTANG_{it}, PCM_{it}) \tag{3}$$

where *INTANG* is intangible assets and *PCM* is price-cost margins.[2] *INTANG* are non-physical assets and include: goodwill, trademarks, patents, copyrights, and R&D. Firms might obtain competitive advantage over their rivals by differentiating their product from those of their rivals by: (i) offering a higher quality service to customers which enhances customers experience of consuming the product, (ii) investing in R&D in order to innovate products, (iii) protecting such product innovations via patent and copyrights in order to prevent rivals from replication. The costs of product differentiation arising from

[2] Sutton (1991) argues that research and development (R&D) and advertising expenditures are endogenous sunk costs that serve as strategic barriers to entry, which consequently lead to higher concentration. Sutton suggests using R&D and advertising intensity to distinguish between industries when estimating concentration models rather than estimating a model for all industries. Unfortunately, R&D and advertising data are unavailable and so we do not adopt the approach suggested by Sutton.

the development and marketing of brands increase the disadvantage to small firms (Bhattacharya and Bloch, 2000). Consequently, such costs act as a deterrent to entry and lead to increased industry concentration.

Intangible assets may also serve to reduce production costs and may help incumbent firms obtain and sustain competitive advantage via a cost advantage. For instance, firms might obtain and sustain cost advantage over their rivals by investing in R&D for the purpose of process innovation. Thus, investment in R&D might indicate the possibility of producing at a lower average cost in the future. Therefore, if intangible assets are difficult to replicate or are too costly to replicate the intangible assets might serve as a deterrent and barrier to entry to potential entrants.

There are two competing arguments for the effect *PCM* is expected to have on industrial concentration. First, there might be a positive relationship between *PCM* and industry concentration because industries with high price-cost margins have an incentive to maintain them by keeping potential entrants out (Co, 2001). Second, *PCM* has a negative effect on industry concentration because high price-cost margins are likely to be attractive to potential entrants and lead to a decline in industry concentration when new entrants actually enter such markets (Evans et al. 1993). Conversely, low price-cost margins are unattractive to potential entrants, which might lead to an increase in industry concentration. Indeed, Geroski (1995) argues that profitability is an important determinant of the rate of entry into an industry with higher profitability leading to higher rates of entry.

Government industrial policy and involvement in industrial production is defined as:

$$G_{it} = STATE_{it} \tag{4}$$

where *STATE* is the variable capturing government influence on industrial concentration. Government policy in relation to the structure and competitive nature of an industry can be exerted in a variety ways. Here, five ways are identified. First, the government can introduce antitrust legislation that prevents monopoly power *per se* (Ratnayake, 1999). Second, antitrust legislation might not prevent monopoly but prevent (or outlaw) the abuse of monopoly power e.g. by preventing predatory pricing. Third, government can introduce private enterprise via a privatisation programme. Fourth, the government can determine import tariffs and quotas, which affects the extent foreign based firms can compete against domestically based firms. Fifth, government can own firms and can impact on the structure and competitive practices of an industry by choosing output quantity and prices for firms it owns.

This paper focuses on state involvement in production as described by the fifth point above. There are two alternative predictions for the effect of state ownership of firms on industry concentration. First, Chou (1986) suggests, in relation to Taiwan, that state-owned enterprises are large-scale and have low export intensity due to their domestic orientation. Given that pre-transition Polish state-owned firms would have been large scale and domestically focused (either by design or because they were producing relatively low quality products that struggled to obtain significant market share outside of Poland), *STATE* will have a positive impact on industrial concentration.

Slay (1995) outlines an alternative argument that predicts *STATE* will have a negative effect on industry concentration. The 1989 Enterprise and Activity Act in Poland authorised managers to sell stock in their firms as part of the privatisation process. This legislation, however, allowed managers to create bogus firms that functioned as repositories for the liabilities of parent firms. The creation of such firms creates more firms that will lead to a decline in the Herfindahl Index. The decline in the Herfindahl Index reported in Table 2 is suggestive of increased competition, however, such new firms will have links to the state firms that created them and such links are not conducive to increased competition.

The international influences that impact on industrial concentration are defined as:

$$\boldsymbol{F}_{it} = FOREIGN_{it} \tag{5}$$

There are a variety of international influences that can impact on industrial concentration. These include imports, exports and Foreign Direct Investment (FDI). Government policy will impact on all the international influences via tariffs, subsidies, quantity controls and legislation on the foreign ownership of domestically located plants. Unfortunately, we do not have data on imports and exports nor on the factors through which government can impact on international influence of industrial concentration. It should be noted, however, that trade liberalisation policies in Poland were reversed during 1991 with tariffs increasing and quotas being introduced (Slay, 1995). This would have the effect of reducing import competition. Foreign firms might try to circumvent the increase in tariffs and the introduction of quotas by setting up new plants or purchasing firms in Poland.

FDI, therefore, would be the main mechanism through which foreign competition manifests itself. Thus, in this study, the impact of international influences on industrial concentration focuses on FDI.

The effect of FDI on industrial concentration is theoretically ambiguous. FDI increases competition because Multinational Enterprises (MNEs) are better placed than domestic firms to overcome barriers to entry in the host country (Driffield, 2001). This is due to special advantages that include superior production techniques, imperfections in input markets that allow established firms to purchase at lower prices (Teece, 1985) and the specialised knowledge associated with new products, processes and proprietary technology (Caves, 1996). Incoming MNEs also have advantages due to the possession of specialised assets that include specialised technical knowledge, brand name and organisational capabilities (Conyon *et al*., 2002). Thus, FDI through the role of MNEs tends to reduce the level of industry concentration in host country industries (Caves, 1996)

In contrast, FDI could increase concentration because inefficient small firms exit or merge in the face of competition from foreign firms that have advantages compared to their domestic counterparts for the reasons outlined above. Blomstrom (1986) suggests that, if an underdeveloped country is the host country, the MNEs that invest in it possess advanced technology that is suited to serving a market much bigger than that of the host country. In addition, foreign-owned firms technological advantage might put them in a position to steal market share from their rivals by producing at lower cost than domestically owned firms (Aitken and Harrison, 1999). Thus, FDI will increase industry concentration by driving local firms out of business (Blomstrom, 1986).

2.2 Estimating equation

Following the above discussion the long-run equilibrium model of industry concentration is expressed as:

$$HI_{it} = \beta_0 + \beta_1\ CAPR_{it} + \beta_2\ SIZE_{it} + \beta_3\ INTANG_{it} + \beta_4\ PCM_{it} + \beta_5\ MES_{it} + \beta_6\ STATE_{it} + \beta_7\ STATE_{it}^2 + \beta_8\ FOREIGN_{it} + \beta_9\ FOREIGN_{it}^2 + \theta_i + \theta_t + \varepsilon_{it} \quad (6)$$

where θ_i captures unobserved industry-specific factors, θ_t captures macroeconomic factors common to all industries over time, ε_{it} is an error term, and the remaining terms are defined earlier. Quadratic terms are included for the *STATE* and *FOREIGN* variables in order to examine whether their impact on industry concentration is non-linear. The β's are estimated using a two-step generalised method of moments instrumental variables estimator (GMM-IV) with *INTANG* and *PCM* treated as endogenous. One period lags of these two variables are used as instruments. Investment in intangible assets is determined by firms' managers for strategic purposes e.g. to create brand awareness that potential entrants cannot replicate without high levels of investment. Thus, intangible assets are used as a strategic barrier to entry by incumbent firms c.f. say, *MES* that is exogenously determined by prevailing technological conditions. *PCM* is treated as endogenous because firms choose the prices at which they sell their outputs. In addition, the structure of an industry feeds back into prices i.e. the structure of an industry affects firms conduct and their price-cost margins. This is the reverse of the arguments explored in Evans *et al*.

(1993) who examine the effect of industry structure on prices. The instruments employed are a one period lag of *INTANG* and *PCM*.

There is an implicit assumption in equation (6) that adjustment to the long-run equilibrium level of concentration is instantaneous and that industrial concentration in Poland is at its equilibrium level. Industry concentration, however, may not be in equilibrium due to changing market conditions. Moreover, adjustment in concentration to changing market conditions is not instantaneous because there are costs for incumbent firms and potential entrants in responding (Levy, 1985). Indeed, the consequences of transition are likely to lead to changes in market conditions that might take a period of adjustment e.g. from the moment that legislation allows foreign investors to set up operations in Poland there will be a period of adjustment during which investors will raise finance, build plants, acquire machinery, hire labour, and develop production facilities that are operating at optimal level. Thus, there will be an initial increase in industry concentration followed by a decline as other firms in the industry and new entrants respond accordingly to the new market conditions as a consequence of transition. There are also adjustments to changes in technology. If firms receive information at different times as to how to attain the lowest possible production cost there will be an initial period of high concentration (Klepper and Graddy, 1990). Consequently, high concentration may be a disequilibrium phenomenon that is eliminated by competition.

Given that market structure might be in disequilibrium, the concentration ratio lagged one period is included in the set of regressors in Equation (6) in order to capture the persistence in industrial concentration over the sample period. Its inclusion also serves to assist in the removal of first order serial correlation. In addition, as determinants of the changes in concentration are of concern the model is expressed in first-differences, which has the effect of removing industry-specific effects. The model of the determinants of changes in industry concentration is therefore specified as:

$$\Delta HI_{it} = \beta_0 + \lambda \, \Delta HI_{it-1} + \beta_1 \, \Delta \, CAPR_{it} + \beta_2 \, \Delta \, SIZE_{it} + \beta_3 \, \Delta INTANG_{it} + \beta_4 \, \Delta PCM_{it} + \beta_5 \, \Delta \, MES_{it} + \beta_6 \, \Delta \, STATE_{it} + \beta_7 \, \Delta \, STATE_{it}^2 + \beta_8 \, \Delta \, FOREIGN_{it} + \beta_9 \, \Delta FOREIGN_{it}^2 + \theta_t + \varepsilon_{it} \quad (7)$$

where Δ is the first difference operator (i.e. $\Delta X_{it} = X_{it} - X_{it-1}$), where λ is a parameter to be estimated and represents the rate of adjustment to deviations from the industry concentration long-run equilibrium and the remaining terms have been previously defined. The modelling framework adopted here is similar to that employed by Ratnayake (1999). Other studies (e.g. Battacharya and Bloch, 2000; Driffield, 2001) consider determinants that affect the speed of adjustment to equilibrium industry concentration, we do not adopt this approach.

The lagged dependent variable, *INTANG* and *PCM* are treated as endogenous to the model. The motivations for treating *INTANG* and *PCM* are outlined for the equilibrium model. First-differencing leads to the lagged dependent variable in equation (7) being correlated with the error term and is therefore a potential source of bias. These problems are overcome by estimating equation (7) using the first-differenced generalised method of moments estimator (GMM-DIF) proposed by Arellano and Bond (1991). This involves instrumenting the lagged dependent variable, *INTANG* and *PCM*, which are in first-differenced form, using the additional instruments of the lags of the levels of these variables. Lagged levels of the dependent variable from t-2 back and of *INTANG* and *PCM* from t-1 back are employed. Crucially, consistent estimation using this technique requires the absence of serial correlation in the error term. No evidence of second-order serial correlation in the first-differenced error term indicates this.

3. Data

All industry characteristics used in this paper are calculated from a database containing data for Polish manufacturing firms over the 1989-1993 period. This database is constructed from the financial reports that all firms employing 5 or more workers are legally obliged to submit annually to the Polish Central Statistical Office (GUS). The coverage of the database is very high, with the firms included representing around 90% of the aggregate manufacturing output. Each firm is classified as belonging to a 3-digit SIC industry.[3] We aggregate individual firm-level data for a given industry in order to get concentration indices as well as various industry level-characteristics. As a result, we are able to carry out an analysis at a more disaggregated level and include more explanatory variables than can be found in officially released statistics.

Although, in principle, GUS defines 170 industries, sometimes there are no firms classified under the heading of a particular industry in a given year. The appearance and disappearance of some industries might be related to the restructuring of the economy.

[3] According to the Polish classification system used by 1993, the manufacturing sector is divided into 24 two-digit branches, and further into 170 three-digit industries. The codes used are slightly different from the published SIC codes but for the majority of industries it is possible to find a match on the basis of the description of the product of a given industry.

For example, when there is a single firm belonging to a particular industry and this firm changes the product mix to the extent that it falls under the heading of a different industry, we might see some industries disappearing. In particular, in the period under consideration there were only 152 industries where there was at least one firm operating in all the years. We also dropped some industries with missing data on one of the variables used in estimation. Finally, we excluded the industries for which the Herfindahl Index takes the value of one for the majority of observations[4]. A model of the determinants of concentration has nothing to explain for such industries. Moreover, these industries often exhibit massive changes in the Herfindahl Index, which are unlikely to occur for economic reasons and might be an outcome of reorganisation. In the end, our estimations are based on 144 industries, using the data for 1989 till 1993. After 1993 the classification system changed, making it difficult to extend the analysis in a consistent way.

[Insert Table 1 about here]

Descriptive statistics (mean and standard deviation) of the variables employed in the econometric analysis can be found in Table 1. Variable construction is described in the Data Appendix. Except for measures of *STATE* and *FOREIGN*, construction of the variables is not noteworthy as procedures are used that are typical to a study of this kind.

[4] These industries are not named because GUS regards the information as commercially sensitive.

At this juncture a comment on the construction of the *STATE* and *FOREIGN* variables is made because they are key variables to this study.

Chou (1986) uses a dummy variable for industries where the percentage output of state-owned firms is above industry average. In this study *STATE* is measured in two ways using continuous variables. First, the proportion of output in an industry that is produced by firms owned and/or controlled by the state (*STATE_SHARE*). Second, the proportion of firms operating in any given sector that is owned by the state (*STATE_NUM*). Due to the paucity of data it is not possible to include further variables that capture the government's effect on industrial concentration. The two measures of *STATE*, however, do proxy the government's intent to control manufacturing production and to this extent they reflect what the government believes are strategically important industries. Moreover, if the government has imposed legislation that favours state-owned firms this is likely to lead to a positive impact on industrial concentration.

Two measures of FDI are employed in this study. The first measure, following Blomstrom (1986), Ratnayake (1999), and Driffield (2001), is the share of foreign owned firms industrial output in Poland (*FOREIGN_SHARE*) and it is used as a proxy for the influence of FDI on host country industry concentration. The second measure, following Chou (1986), is the ratio of the number of foreign-owned firms to the total number of firms in the sector (*FOREIGN_NUM*).

Before proceeding to the results of the econometric analysis the trends in market concentration are examined. A frequency distribution, mean, median, and standard deviation of the Herfindahl index over the sample period are presented in Table 2. The figures in Table 2 indicate that there are generally low levels of market concentration over the sample period. In addition, there is evidence of a decline in market concentration.

[Insert Table 2 about here]

4. Results

The results of GMM-IV estimation of equation (6), the *levels* equation, are presented in Table 3. In Table 3, F-tests of the time and industry effects indicate that they are not significant at the 10% level in the models reported in columns (1) and (2). Thus, the reported results are estimates of Equation (6) but excluding the industry and time effects. In contrast, F-tests indicate that the explanatory variables are significant at the 1% level. The t-statistics are derived from standard errors that are robust to general forms of heteroscedasticity and correlation within industries. As the standard errors of two-step GMM estimators suffer from finite sample downward bias, they are 'corrected' using a procedure proposed by Windmeijer (2000). In both columns (1) and (2), t-statistics indicate that *MES* is significant at the 1% while the *STATE* variables are significant at the 5% level. Thus, there is evidence consistent with *MES* being a barrier to entry.

[Insert Table 3 about here]

Both the linear and quadratic terms are significant for both *STATE* measures, which indicates that state ownership has a U-shaped relationship with industrial concentration. The turning point for this relationship is estimated using the 'delta method' (Oehlert, 1992) and is reported in Table 5. The turning point for *STATE_SHARE* is estimated to be 0.68 (i.e. when state-owned firms output accounts for 68% of industry output) and is significant at the 1% level. It is reported in Table 1 that mean *STATE_SHARE* is 0.83, which is higher than the turning point. Thus, for the mean industry, state-owned firms share of industry output has a positive effect on industry concentration. The estimated turning point for *STATE_NUM* is 0.52 (i.e. when 52% of firms are state-owned), which is significant at the 1% level. Mean *STATE_NUM*, reported in Table 1, is 0.70. This is higher than the turning point and suggests that for the mean industry the proportion of firms owned by the state has a positive effect on industry concentration. Note that the turning point for *FOREIGN_SHARE* is found to be significant at the 1% level, however, column (1) indicates that *FOREIGN_SHARE* has no statistically significant effect on industry concentration.

The results of models examining the determinants of *changes* in industry concentration are presented in Table 4. Two-step GMM-DIF estimates are reported. The Windmeijer (2000) 'correction' is applied to the standard errors in order to adjust for finite sample downward bias. Tests of first-order serial correlation in the first-differenced residuals indicate that the null hypothesis of no first-order serial correlation cannot be rejected at the 6% and 5% significance levels for estimates reported in columns (1) and (2), respectively. In both models reported in Table 4 there is no statistically significant evidence of second-order serial correlation. F-tests indicate that the time dummies are not statistically significant for both models, therefore, reported models exclude time dummies. F-tests also indicate that the explanatory variables are significant at the 1% level for both models. The null hypothesis of instrument validity is not rejected by the Hansen tests of over-identifying restrictions reported in columns (1) and (2).

[Insert Table 4 about here]

[Insert Table 5 about here]

Coefficient estimates presented in columns (1) and (2) of Table 4 indicate the first-differences of the lagged dependent variable, *MES, STATE_SHARE*, and *FOREIGN_SHARE* are statistically significant. The remaining variables are not statistically significant at the 10% level. The lagged dependent variable is significant at the 1% level. This suggests that there is persistence in industrial concentration in Poland over the sample period. *MES* is significant at the 1% level and positive signs on the coefficient estimates in columns (1) and (2) indicate that it is a positive determinant of changes in the industrial concentration, which is consistent with *MES* being a barrier to entry.

In column (1) it can be seen that the linear and quadratic *STATE_SHARE* terms are both significant at the 5% level, which indicates there is a U-shaped relationship between

STATE_SHARE and *HI*. The turning point for this relationship is estimated and reported in Table 5. The turning point for the *STATE_SHARE-HI* relationship is estimated to be 0.69 and is significant at the 1% level. The t-statistics for the linear and quadratic *FOREIGN_SHARE* variables are significant at the 5% level and indicate a U-shaped relationship between *FOREIGN_SHARE* and *HI*. The estimated turning point, reported in Table 5, is 0.26 and it is significant at the 1% level. Note that neither the *STATE_NUM* and *FOREIGN_NUM* variables have a statistically significant impact on industry concentration.

5. Conclusions

In 1990 Poland embarked on a transition from a centrally planned economy to a mixed economy, which involved reducing the role of state-owned firms in the economy. Such deregulation consequently allowed an increased role for privately owned firms and increased competition between firms. The general decline in industry concentration over the 1989-1993 sample period is indicative of increased competition and implies that policies to reduce industry concentration are succeeding.

We find evidence of a U-shaped relationship between state ownership and industry concentration. Thus, there is an optimal state-ownership that minimises industry concentration. This indicates that state-ownership could have a positive effect on industry concentration. Chou (1986) suggests this could be due to state-owned firms being large-scale and having low export intensity due to their domestic orientation. Additionally, this suggests that privatisation policies that involve managers of state-owned firms divesting assets, selling stock and consequently reducing state ownership in the economy will be successful in reducing industry concentration. This will lead to a more competitive business environment as long as managers of state-owned firms are not creating new firms as repositories for the liabilities of state firms as suggested by Slay (1995). As there is a negative aspect to the relationship between state-ownership and industry concentration, completely eliminating state-ownership of firms will lead to higher industry concentration. This suggests that the state can provide competition to privately-owned firms, which the private sector is unable to provide by itself.

There is also evidence of a U-shaped relationship between foreign ownership (as measured by foreign-owned firms share of industry output) and industry concentration. This suggests that there is an optimal foreign ownership that minimises industry concentration. The evidence is consistent with the view that FDI leads to increased competition for domestic firms because MNEs are able to overcome barriers to entry with superior technology and proprietary assets, and that FDI leads to a reduction in industry concentration because it forces inefficient firms out of business. The effect that dominates depends on the extent of the change in the share of output controlled by foreign firms. From the Polish government's perspective the results suggest that there is a case for discouraging large positive changes in the share of output of foreign-owned firms. Note that foreign ownership appears to have no statistically significant impact on the level of industry concentration.

Data Appendix

Definition of variables

HI – the Hirschman-Herfindahl concentration index (equal to the sum of squared market shares of all the firms in the industry), where the share of each firm is expressed in terms of sales.

MES – minimum efficient scale as the average size of enterprise contained in the 50th percentile of industry sales. It is expressed as a proportion by dividing through by industry sales.

CAPR - The industry entry capital requirements calculated as *MES* multiplied by the capital stock-sales ratio.

SIZE – market size measured by industry sales (in millions of Polish zloty) and deflated by the 1988 price index [5].

INTANG – the ratio of intangible assets (such as patents, goodwill, brand name) to total assets.

PCM - price-cost margin is defined as (sales-cost)/sales, where cost includes all costs such as intermediate inputs and energy, not just wage bill.

[5] The price index available is at a level more aggregated than the 3-digit classification we used throughout.

STATE_NUM – the ratio of state-owned firms to the total number of firms in a given industry.

STATE_SHARE – the ratio of output produced by state-owned firms to total industry output.

FOREIGN_NUM – the ratio of foreign-owned firms to the total number of firms in a given industry.

FOREIGN_SHARE – the ratio of output produced by foreign-owned firms to total industry output.

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Table 1 - Descriptive Statistics

Variable	Description	Mean	Standard Deviation
HI	Herfindahl Index	0.17	0.18
CAPR	Capital requirement	0.15	0.28
SIZE	Market size (millions of Zloty)	160834.90	238937.40
INTANG	Intangible assets / Fixed assets	0.97	1.53
PCM	Price-cost margin	0.17	0.16
MES	Minimum efficient scale	0.22	0.22
STATE_SHARE	State-owned firms share of output	0.83	0.26
STATE_NUM	Proportion of firms state-owned	0.70	0.32
FOREIGN_SHARE	Foreign-owned firms share of output	0.02	0.05
FOREIGN_NUM	Proportion of firms foreign-owned	0.03	0.05

Notes: (1) Variables are expressed as ratios or are weighted unless units of measurement are also expressed. (2) More complete definitions can be found in the Data Appendix.

Table 2 - Frequency Distribution of Herfindahl Indexes Over Time

Herfindahl Index	Number of 3-Digit Industries				
	1989	1990	1991	1992	1993
0-0.1	60	60	70	80	79
0.11-0.2	35	39	38	33	31
0.21-0.3	20	18	15	13	13
0.31-0.4	9	7	8	7	12
0.41-0.5	8	9	1	4	1
0.51-0.6	3	1	4	4	6
0.61-0.7	4	3	3	2	0
0.71-0.8	1	4	3	0	1
0.81-0.9	4	1	2	1	1
0.91-1	0	2	0	0	0
Median	0.12	0.12	0.10	0.08	0.09
Mean	0.20	0.19	0.17	0.14	0.15
Standard deviation	0.19	0.20	0.19	0.15	0.15

Table 3 - Determinants of the Level of Industrial Concentration

Independent variables	Dependent variable: HI_{it}			
	(1)		(2)	
	Coefficient	t-statistic	Coefficient	t-statistic
Constant	9.49E-3	0.94	2.37E-3	0.29
$CAPR_{it}$	0.01	0.72	8.49E-3	0.56
$SIZE_{it}$	-1.97E-9	-0.19	3.78E-9	-0.40
$INTANG_{it}$	-4.02E-3	-1.12	-3.14E-3	-0.87
PCM_{it}	5.00E-3	0.22	-2.99E-3	-0.13
MES_{it}	0.79***	31.21	0.79***	31.71
$STATE\_SHARE_{it}$	-0.05**	-2.36		
$STATE\_SHARE_{it}^{2}$	0.04**	1.96		
$FOREIGN\_SHARE_{it}$	0.06	1.07		
$FOREIGN\_SHARE_{it}^{2}$	-0.15	-0.98		
$STATE\_NUM_{it}$			-0.04**	-2.21
$STATE\_NUM_{it}^{2}$			0.04**	2.35
$FOREIGN\_NUM_{it}$			0.03	0.44
$FOREIGN\_NUM_{it}^{2}$			-0.07	-0.41
Regressors	278.05 (0.00)		309.70 (0.00)	
Industry	1.39 (0.24)		0.04 (0.83)	
Time	0.36 (0.78)		0.43 (0.74)	
Industry and Time dummies included	No		No	
Observations	576		576	
Sample Period	1990-1993		1990-1993	

Notes: (i) Heteroscedasticity and within correlation robust t-statistics are reported in parentheses. (ii) ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. (iii) $INTANG_{it}$ and PCM_{it} are treated as endogenous and one period lags of these variables are used as instruments. Models estimated by two-step GMM, the Windmeijer (2000) correction is applied to the standard errors. (iv) *Regressors* is an F-test statistic of the joint significance of the explanatory variables (excluding industry dummies and constant) with the probability value reported in parentheses. (v) *Industry* is an F-test statistic of the industry effects with the probability value in parentheses. (vi) *Time* is an F-test statistic of the joint significance of the time dummies with probability value reported in parentheses. Reported models exclude time effects.

Table 4 - Determinants of Changes in Industrial Concentration

Independent variables	*Dependent variable:* ΔHI_{it}			
	(1)		(2)	
	Coefficient	t-statistic	Coefficient	t-statistic
ΔHI_{it-1}	0.14***	2.96	0.12***	2.59
$\Delta CAPR_{it}$	-0.01	-0.54	-0.01	-0.72
$\Delta SIZE_{it}$	7.16E-9	0.24	1.48E-8	0.42
$\Delta INTANG_{it}$	-7.89E-4	-0.86	-3.84E-4	-0.58
ΔPCM_{it}	-0.03	-1.32	-0.04	-1.36
ΔMES_{it}	0.73***	22.95	0.75***	19.01
$\Delta STATE\_SHARE_{it}$	-0.07**	-2.27		
$\Delta STATE\_SHARE^2_{it}$	0.04**	1.98		
$\Delta FOREIGN\_SHARE_{it}$	-0.12**	-2.49		
$\Delta FOREIGN\_SHARE^2_{it}$	0.23**	2.34		
$\Delta STATE\_NUM_{it}$			0.01	0.20
$\Delta STATE\_NUM^2_{it}$			4.58E-3	0.21
$\Delta FOREIGN\_NUM_{it}$			0.01	0.10
$\Delta FOREIGN\_NUM^2_{it}$			-0.09	-0.45
Serial1	-1.90 (0.06)		-1.96 (0.05)	
Serial2	0.25 (0.81)		0.40 (0.69)	
Regressors	157.51 (0.00)		73.65 (0.00)	
Hansen	19.12 (0.58)		20.69 (0.48)	
Time	0.90 (0.44)		1.22 (0.31)	
Time dummies included	No		No	
Observations	432		432	
Sample Period	1991-1993		1991-1993	

Notes: (i) Heteroscedasticity robust t-statistics are reported in parentheses (ii) ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively. (iii) $\Delta HI_{it-1,}$ $\Delta INTANG_{it}$ and ΔCPM_{it} are treated as endogenous. Lags of HI_{it}, from t-2 back and $INTANG_{it}$ and PCM_{it} from t-1 back are used as instruments. Models are estimated by GMM using the Arellano and Bond (1991) technique, two-step estimates are reported. The Windmeijer (2000) finite sample correction to the two-step variance-covariance matrix is used. (iv) *Serial1* and *Serial2* are tests for first and second-order serial correlation in the first differenced residuals, distributed N(0, 1) under the null of no serial correlation. (v) *Regressors* is an F-test statistic of the joint significance of the explanatory variables (excluding time dummies and constant) with the probability value reported in parentheses. (vi) *Hansen* is a test of over-identifying restrictions distributed as chi-squared with as many degrees of freedom as there are over-identifying restrictions. The null hypothesis is of instrument validity with the probability value in parentheses. (vii) *Time* is an F-test statistic of the joint significance of the time dummies with probability value reported in parentheses.

Table 5 – Estimates of Turning Points for *STATE* and *FOREIGN* Variables

Column, Table	Variable	Coefficient	t-statistic	95% Confidence Interval	
				Lower Bound	Upper Bound
1, 3	*STATE_SHARE*	0.68***	3.97	0.34	1.02
1, 3	*FOREIGN_SHARE*	0.21**	2.30	0.03	0.38
2, 3	*STATE_NUM*	0.52***	4.67	0.30	0.74
2, 3	*FOREIGN_ NUM*	0.20	1.34	-0.10	0.50
1, 4	*STATE_SHARE*	0.69***	5.80	0.46	0.93
1, 4	*FOREIGN_SHARE*	0.26***	6.27	0.18	0.34
2, 4	*STATE_NUM*	-0.69	-0.10	-13.69	12.31
2, 4	*FOREIGN_ NUM*	0.03	0.12	-0.48	0.54

Notes: (i) Estimates obtained using the 'Delta method' (Oehlert, 1992). (ii) ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.