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The Effectiveness of Competition Policy and the Price-Cost Margin: Evidence from Panel Data

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Abstract. This paper presents robust panel data econometric evidence suggesting that more effective competition policy curtails the exercise of market power because countries in which competition policy is judged to be more effective are characterised by lower market price-cost margins, controlling for other factors, including market growth, import penetration and spare capacity. The measure of competition policy effectiveness incorporated into our analysis is the annual survey-based ratings of national competition authorities (NCAs) produced by Global Competition Review (GCR). Our findings imply a role for competition in enhancing economic competitiveness and that government should continue to support NCAs in enforcing competition policy.

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1. Introduction

In the economic assessment of competition cases, market power is associated with the ability to elevate price over cost and can be analysed by reference to the Lerner index or price-cost margin, defined as the difference between price and marginal cost relative to price (i.e. $\frac{p - c}{p}$, where p denotes price and c marginal cost). In the Cournot model of competition, where firms are quantity setters, each firm's price-cost margin is proportional to its market share while the market price-cost margin, given as the sum of the firms' individual price-cost margins weighted by their respective market shares, is proportional to the Herfindahl-Hirschman index of market concentration.¹ In the Bertrand model of competition, in which firms are price setters, the firm and market price-cost margins vary from 0 (homogeneous products) to some positive number (product differentiation), with margins increasing with the degree of product differentiation. Economic theory therefore predicts that market power will generally be higher the greater the level of concentration and the larger the degree of product differentiation in a relevant market, other things being equal. However, the exercise of market power in practice may depend on other considerations, including the condition of entry and consumer buying power and, as we explore further in this paper, the effectiveness of competition policy.²

Since the 1950s, a large amount of empirical economic research has been undertaken (on both sides of the Atlantic) aimed at understanding why the price-cost margin varies across markets. It is fair to say that there is no universal consensus on why different markets are characterised by different degrees of market power. The level of concentration or degree of product differentiation does not always predict the price-cost margin and economists have not

¹ The HHI is defined as the sum of the squares of the market shares of all firms in the relevant market and varies from close to 0 (perfect competition) to 10,000 (monopoly). The squaring of market shares means that firms with larger market shares are given greater weight in the HHI.

² It is, of course, possible that the firm and market price-cost margin will be negative.

always been agreed on whether higher profitability reflects economic efficiency or concerted practices.³ In the past ten years or so, economists have come to recognise the case-specific nature of market power, with much of the understanding gained through working on antitrust cases, in tandem with lawyers.

Only recently have economists begun to investigate the potential for national competition policy to influence the price-cost margin or the exercise of market power. The scope for competition policy to act in this way is seen to have macroeconomic as well as microeconomic or market-specific benefits: by identifying and removing unnecessary impediments to competition in individual markets, competition policy is viewed as a spur to improving productivity and innovation, which are central to enhancing overall economic competitiveness. Recent economic research in this regard has considered whether more effective competition policy (in terms of design, implementation and enforcement) may serve to curtail the exercise of market power and reduce the price-cost margin in individual markets (controlling for other factors).

This paper provides new evidence on this important issue by setting out an economic model accounting for why competition policy may matter in this regard and presenting econometric analysis suggesting that the effectiveness of competition policy has a statistically significant effect on the market price-cost margin. Before describing the nature of the paper in more detail, we first review the recent research.

Konings *et al.* (2001) studied price-cost margins in Belgium and the Netherlands during 1992-1997 and tentatively found that the change in competition policy in the former country in 1993 did not significantly affect price-cost margins, although margins were higher in the Netherlands during the period, which, according to the authors, had a less stringent competition policy at the time. The tentative nature of this finding stems from the fact that the change in competition policy in Belgium came in the context of a former system of price regulation, which, the authors speculate, may have already served to discipline firms in that country and thus may have limited the effect of the new competition policy introduced in 1993. Konings *et al.* also found that import competition does not lead to lower price-cost margins, in contrast to the earlier

³ See, for example, Schmalensee (1989) and Martin (1994).

studies by Levinsohn (1993), Harrison (1994), Grether (1996) and Djankov and Hoekman (2000), which suggest that import competition and trade liberalisation reduce price-cost margins. More recently, Kee and Hoekman (2007) suggest that while markets that have higher import exposure or larger numbers of domestic firms tend to be more competitive, the direct effect of competition law on competition is likely to be insignificant, even though competition law may have an indirect effect on domestic competition by promoting entry.

In contrast to the studies by Konings et al. (2001) and Kee and Hoekman (2007), which suggest a limited role for competition policy in terms of curbing market power (captured by the price-cost margin), a series of earlier papers suggests a role for competition policy in enhancing economic performance. These include Nickell (1996), Blundell *et al.* (1999) and Aghion *et al.* (2005a&b), which examine competition and innovation, and Aitken and Harrison (1999), Pavcnik (2002) and Javorcik (2004), which look at trade liberalisation and productivity. The study by Nicoletti and Scarpetta (2003) assumes that product market reforms affect the rate of total factor productivity convergence across countries and industries, and finds that the impact of reforms tends to be larger for countries further behind the frontier, suggesting that policy-makers in such countries have an incentive to implement product market reform. Griffith *et al.* (2006) associate the reforms carried out under the EU Single Market Programme with increased product market competition, as measured by lower average profitability and a subsequent increase in innovation intensity and productivity growth for manufacturing sectors in the countries considered.

The empirical assessment of the relationship between the effectiveness of competition policy and the market price-cost margin in this paper is carried out through econometric analysis of panel data comprising 19 markets in the same number of countries during 1999-2003. We incorporate a novel measure of the effectiveness of a country's competition policy using a data source that, to be the best of our knowledge, has not been used for this purpose until now. The measure in question is obtained from *Global Competition Review* ('GCR'), an international publication aimed at national competition authorities (NCAs), competition lawyers, economists, businesses and others with an interest in competition law and policy. Since 1999, GCR has published an annual independent survey-based assessment of NCAs – to the best of our knowledge, the most detailed and comprehensive of its kind in the world – which rates the institutions on a scale of 1 to 5 on the basis of a number of criteria, including cartel enforcement,

merger review, competition advocacy and economic expertise (reflecting the emphasis now put on economic analysis in the application of competition law and policy). Of particular interest in this paper is whether more effective competition policy, as captured by the GCR scores, is associated with lower market power, controlling for other factors believed to influence the market price-cost margin (including market growth, import penetration and spare capacity).

In contrast to Konings *et al.* (2001) and Kee and Hoekman (2007), our results suggest that more effective competition policy is associated with lower price-cost margins, which in turn points to a potentially important role for competition policy in curbing market power. Our findings, which are econometrically robust, should be of particular interest to NCAs, regulators and other professional practitioners in the burgeoning field of competition policy.

The structure of the paper is as follows. The next section outlines the hypotheses to be tested. Section 3 describes the data in more detail and Section 4 presents the empirical results. Finally, Section 0 concludes and suggests avenues for further research.

2. Economic Model and Hypothesis

This section sets out the principal economic hypothesis to be empirically assessed in this paper, namely that the more effective a country's competition policy, the lower will be the market price-cost margin on average, controlling for other economic factors believed to influence the price-cost margin, including the rate of market growth, import substitution and spare capacity.

The outline is based on a generalised oligopoly model in which firms are quantity setters and the analysis incorporates a 'coordination' parameter that allows us to identify a potential role for competition policy to affect firms' ability to coordinate their behaviour and thus the market price-cost margin.⁴

The market comprises N firms each producing a homogeneous product the demand for which is given by the inverse demand function $P = P(Q)$, where P is price and Q is market

⁴ The model is based on the oligopoly formulations due to Cowling and Waterson (1976) and Clarke and Davies (1982). The predictions of the model also apply to the case where firms are price setters and to product differentiation.

output. In particular, $Q = \sum_{i=1}^N q_i$, where q_i is the output of the i^{th} firm in the market. The market

price elasticity of demand is given by $e = -\frac{dQ}{dP} \frac{P}{Q}$ and measures the percentage change in

demand for the product to any given percentage change in the price of the product.⁵ Costs of firm i vary positively with its level of output (i.e. $c_i(q_i)$) and each firm chooses its output level simultaneously by maximising its profit.

The profit function of firm i is given as the difference between the firm's revenue and costs, namely:

$$(1) \quad \pi_i = P(Q)q_i - c_i(q_i)$$

Under Cournot behaviour, each firm maximises its profits under the belief that its competitors will not react to any change in the firm's own output level. Formally, this conjecture

is represented as $\frac{dQ_{-i}}{dq_i} = 0$, where Q_{-i} is the output level of firm i 's rivals in aggregate. This

belief is generally known as the 'zero conjectural variation' condition, where the derivative

$\frac{dQ_{-i}}{dq_i}$ is the 'conjectural variation' parameter of firm i .⁶ Under the Cournot or zero conjectural

variation condition, the first-order condition for firm i 's profit maximisation is:

$$(2) \quad P + q_i \frac{dP}{dQ} - MC_i = 0$$

In this equation, MC_i is the firm's marginal cost (given as the derivative of $c_i(q_i)$ with respect to q_i). Upon re-arranging, we obtain the expression for firm i 's price-cost margin (l_i) as follows:

$$(3) \quad l_i = \frac{P - MC_i}{P} = \frac{s_i}{e}$$

⁵ Where $e > 1$, demand is 'elastic' and $e < 1$ demand is inelastic. As shown below, the model predicts that the price-cost margin will be higher the lower the elasticity of demand (i.e. the less responsive users are to changes in the price of the good, which may reflect switching costs or brand loyalty).

⁶ Similarly, in Bertrand competition, where firms are price setters, there is a zero conjectural variation parameter in prices.

In this expression, s_i is firm i 's market share (i.e. $\frac{q_i}{Q}$ with $0 < s_i \leq 1$). According to (3), in Cournot equilibrium, each firm's price-cost margin varies directly with its share of the relevant market (s_i) and inversely with the market price elasticity of demand (e). In simple terms, a firm's price-cost margin under such circumstances will be higher when its market share is larger or when customers are less sensitive to changes in price (e.g. due to search costs or brand loyalty). (Note also in equation (3) that where the firms are all of the same size, each firm's price-cost margin is given as $\frac{1}{Ne}$ and that under monopoly ($N = 1$) the price-cost margin is $\frac{1}{e}$, the largest possible value the price-cost margin can take.)⁷

To obtain the market price-cost margin (L), we weight each firm's individual price-cost margin by its market share and sum over all N firms in the market. This yields the expression:

$$(4) \quad L = \sum_{i=1}^N l_i s_i = \frac{HHI}{e}$$

According to (4), the market price-cost margin will be higher the greater the degree of concentration in the market (given by the HHI) or the less sensitive customers are to changes in price (i.e. the lower the value of e).

What is interesting about (4) is that it establishes a positive relationship between market power (given by L , the market price-cost margin) and concentration (given by HHI) *even when firms act non-cooperatively* (as is the case in Cournot equilibrium). Therefore, (4) establishes a lower level for the price-cost margin when firms compete *à la* Cournot. If the firms were able to coordinate their behaviour in some way, they would increase their price-cost margins and earn even higher profits compared with the non-cooperative equilibrium.

To expand on this principle, and consequently identify the potential role for competition policy in conditioning the market price-cost margin (L), we may generalise the above model by considering a 'conjectural elasticity' parameter that allows for coordinated as well as competitive

⁷ On the other hand, under perfect competition, $N \rightarrow \infty$ and the price-cost margin approaches zero.

behaviour in the relevant market. The conjectural elasticity parameter of firm i (which we denote by α_i) is given as:

$$(5) \quad \alpha_i = \frac{dQ_{-i}}{dq_i} \cdot \frac{q_i}{Q_{-i}}$$

Upon re-arrangement:

$$(6) \quad \frac{dQ_{-i}}{Q_{-i}} = \alpha_i \left(\frac{dq_i}{q_i} \right)$$

What (6) says is that firm i conjectures that its rivals will proportionately match $\left(\frac{dQ_{-i}}{Q_{-i}} \right)$ a given proportionate change in its own output $\left(\frac{dq_i}{q_i} \right)$ either fully ($\alpha_i = 1$), partially ($\alpha_i > 0$) or not at all ($\alpha_i = 0$). The latter case is equivalent to the zero conjectural variation of the Cournot model. Full coordination (tacit or overt) is captured as $\alpha_i = 1$ and partial coordination as $0 < \alpha_i < 1$.

With the inclusion of the coordination parameter, α_i , the price-cost margin of firm i (l_i) now becomes:

$$(7) \quad l_i = \frac{s_i(1 - \alpha_i)}{e} + \frac{\alpha_i}{e}$$

From (7), the market price-cost margin may be derived in a similar way as previously (i.e. by weighting each firm's individual price-cost margin by its market share and summing over all N firms *and* now assuming $\alpha_i = \alpha$ for all i). This yields the following generalised expression for the market price-cost margin when firms compete in quantities:

$$(8) \quad L = \sum_{i=1}^N l_i s_i = \frac{(1 - \alpha)HHI}{e} + \frac{\alpha}{e}$$

Comparing (8) with (4), the extended model nests the Cournot model as a special case. In particular, where firms behave according to Cournot ($\alpha = 0$), (8) coincides with (4) (i.e. $L = \frac{HHI}{e}$). Where there is full coordination of firm behaviour (tacitly or overtly), $\alpha = 1$ and

(8) coincides with the monopoly price-cost margin noted earlier (i.e. $L = \frac{1}{e}$). Where there is partial coordination among firms ($0 < \alpha < 1$), (8) says that L is a weighted average of the full coordination/collusive outcome and the non-coordination outcome, with the former given greater weight the closer the conjectural elasticity parameter (α) is to unity. In other words, the closer α is to unity, the higher the market price-cost margin.

Of interest, therefore, are the factors that might influence the value of α and thus the ability of firms to coordinate their behaviour and increase their profits (whether they compete *via* quantity or price). Possible market-specific factors may include the condition of entry (with the value of α tending towards unity where sunk costs and/or regulatory barriers to entry are high), the number of firms in the market (fewer firms making coordinated behaviour more likely), the extent of size differences among firms (lower size inequalities aiding coordinated behaviour) and idiosyncratic features of the market (e.g. the strength of trade organisations within the market). However, there tend to be methodological problems in terms of identifying these possible influences for the purpose of econometric analysis, not least in large-scale panel datasets, such as here.

On the other hand, a possible factor that we can identify here is the effectiveness of national competition policy, specifically the effectiveness of the work of NCAs. It is reasonable to posit that well-designed and consistently enforced competition policy (across antitrust, dominance and merger review) inputs into more efficient outcomes in markets and generally heightens the profile of competition policy, making it less likely that breaches of competition law will occur. In terms of the economic model outlined above, more effective competition policy would serve to reduce the value of the coordination parameter (α) towards 0 and reduce the price-cost margin. However, it is also important to account for other identifiable influences on the price-cost margin, such as market growth, import penetration and spare capacity. In particular, even in competitive markets, it is possible for the price-cost margin to be high due to rapid demand growth (or cost control). Import penetration means an expansion of the relevant market and this factor may decrease the level of market concentration and, other things being equal, the price-cost margin. A relevant market characterised by spare capacity means that

barriers to expansion will tend to be lower, meaning less capability of firms exercising unilateral or coordinated market power and therefore lower price-cost margins, *ceteris paribus*.

Drawing together the analysis presented, we formulate the following hypothesis to be empirically assessed in this paper:

Hypothesis: *More effective competition policy lessens the ability of firms in any given market to coordinate their behaviour and, as a result, the market price-cost margin will be lower, whilst controlling for other factors believed to influence the price-cost margin.*

In terms of our *a priori* expectations, we posit that the market price-cost margin will be lower:

- The more effective is national competition policy (i.e. the higher a country's GCR rating);
- The faster the growth of the market;
- The lower the degree of import penetration (as found in the previous studies cited above); and
- The more capacity constrained are firms (especially those outside any coordinating group).

3. Data

Our main sources of data are the OECD STAN database, which contains a range of structural indicators at the level of industry sector and country, and the annual GCR surveys described earlier. The latest year covered by the OECD STAN database is 2003 and that determined the end-date of our observation period. Likewise, the earliest year covered by GCR is 1999 and that governed the start of our observation period (1999-2003).

Our econometric analysis is based on two data samples: Sample A and Sample B. The respective structures of the sample A and B panel datasets, in terms of the number of countries and years covered, are given in Tables A1 and Table A2 in the Appendix.

Sample A comprises 938 observations and is used to estimate the first of two specifications of our econometric model comprising all explanatory variables. As an added

check on the robustness of the results from Sample A, we also considered a parsimonious econometric specification consisting of those explanatory variables found to be statistically significant in the first specification. Accordingly, we were able to increase the size of the sample in the parsimonious specification (2,027 observations).⁸

The remaining dimension of our sample is the industry sector. For each country in each sample, we include data on nineteen sectors. The OECD STAN dataset provides a range of (sometimes overlapping) levels of sectoral aggregation. We have used the most disaggregated level available, on the grounds that it constitutes the grouping of firms that most closely corresponds to the concept of an ‘antitrust market’ (i.e. defined according to the SSNIP or hypothetical monopolist test). (However, these sectors are still relatively aggregated (i.e. two-digit NACE).) The list of sectors included is shown in Table A3 in the Appendix.

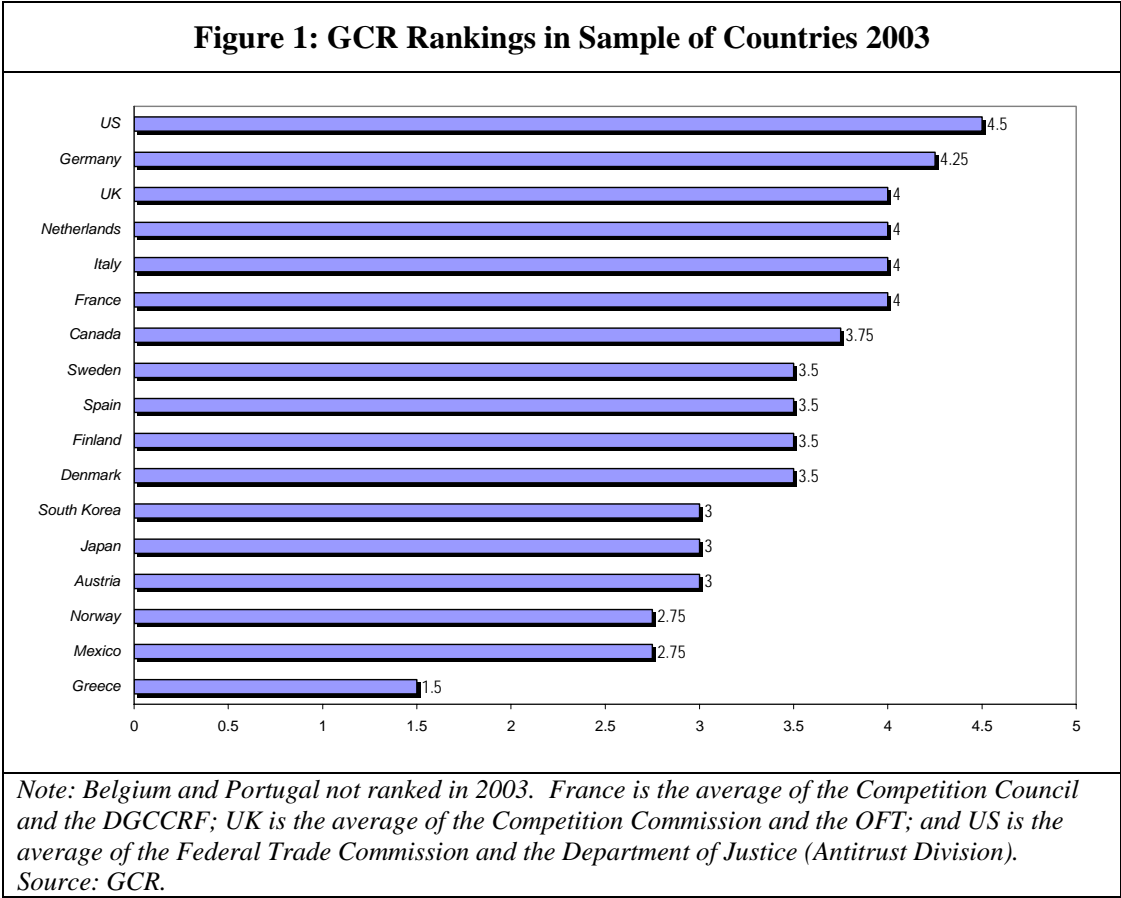
Variable descriptions and summary statistics for the two samples are provided in Table 1 and Table 2. In Sample A, the range of the market price-cost margin variable (*PCM*) is -0.375 to 0.542 and the *GCR* variable assumes the full range of values (1-5). The same is true of sample B, where the larger sample size accommodates even greater variation in the data. The market growth variable is *D_PROD*, the spare capacity variable is *OUTGAP* and the import penetration variable is *IMPPEN*. Other factors controlled for are employment growth (*D_EMP*) and the change in the GDP deflator (*D_GDPDF*), which accounts for the annual change in prices during the period.

⁸ Sample B comprises three more countries than Sample A, namely South Korea, Mexico and Norway.

| Table 1: Variable Descriptions, Sources and Summary Statistics for Sample A | | | | | | | |
|--|--|----------------------------|-------------|---------------|------------|------------|------------|
| Variable | Description | Source | Mean | St Dev | Min | Max | Obs |
| <i>PCM</i> | Price-cost margin; for each country/market = (production - labour compensation - cost of intermediate inputs)/production | Analysis of OECD STAN data | 0.136 | 0.0909 | -0.375 | 0.542 | 938 |
| <i>GCR</i> | Index of competition effectiveness for each country (increasing on a scale of 1-5) | Global Competition Review | 3.36 | 0.795 | 1 | 5 | 938 |
| <i>D_PROD</i> | Annual % change in country/market production | Analysis of OECD STAN data | 0.0392 | 0.132 | -0.799 | 0.945 | 938 |
| <i>D_EMP</i> | Annual % change in country/market employment | Analysis of OECD STAN data | 0.201 | 1.44 | -3.04 | 3.33 | 938 |
| <i>D_GDPDF</i> | Annual % change in GDP deflator for each country * 100 | OECD | 1.95 | 1.45 | -1.71 | 5.22 | 938 |
| <i>OUTGAP</i> | Output gap for each country/market | OECD | -0.0109 | 0.0638 | -0.524 | 0.357 | 938 |
| <i>IMPPEN</i> | Import penetration for each country/market = imports/(production - exports + imports) | Analysis of OECD STAN data | 0.490 | 1.0496 | -26.0 | 9.91 | 938 |

| Table 2: Variable Descriptions, Sources and Summary Statistics for Sample B | | | | | | | |
|--|--|----------------------------|-------------|---------------|------------|------------|------------|
| Variable | Description | Source | Mean | St Dev | Min | Max | Obs |
| <i>PCM</i> | Price-cost margin; for each country/market = (production - labour compensation - cost of intermediate inputs)/production | Analysis of OECD STAN data | 0.198 | 0.162 | -0.375 | 0.926 | 2,027 |
| <i>GCR</i> | Index of competition enforcement quality for each country (increasing on a scale of 1-5) | Global Competition Review | 3.28 | 0.843 | 1 | 5 | 2,027 |
| <i>D_PROD</i> | Annual % change in country/market production | Analysis of OECD STAN data | 0.0497 | 0.124 | -0.799 | 1.73 | 2,027 |

The 2003 GCR ratings of 17 of the 19 countries considered in our analysis are illustrated in Figure 1 (neither Belgium nor Portugal were ranked in 2003). Competition policy was judged to have been most effective in the US, the birthplace of antitrust. Within Europe, the competition regimes in Germany, the UK, the Netherlands, Italy and France were all assessed as strong (GCR rating of 4 or more). At the other end of the scale, respondents to GCR’s survey considered Greece to have the least effective competition regime (the rating of which fell to 1.5 in 2003 from 2.5 in 2000).



Although not part of the sample in this paper, it is interesting to note the GCR ratings for the same countries in 2006 (the latest year covered by GCR). These are shown in Table 3. There is a strong correlation between the rankings in 2003 and 2006, with the leading countries being the US, the UK and Germany. The latest GCR rankings describe as “elite” the top performing institutions, namely the UK Competition Commission and the US Federal Trade

Commission, and the European Commission (DG Competition), all of which received the maximum rating of 5 and which climbed on the previous year.

| Table 3: GCR Rankings in Sample of Countries 2003 and 2006 | | |
|---|-------------------|-------------------|
| Country | GCR (2003) | GCR (2006) |
| US | 4.5 | 4.75 |
| UK | 4 | 4.5 |
| Germany | 4.25 | 4 |
| France | 4 | 3.75 |
| Japan | 3 | 3.5 |
| South Korea | 3 | 3.5 |
| Denmark | 3.5 | 3.5 |
| Finland | 3.5 | 3.5 |
| Canada | 3.75 | 3.5 |
| Italy | 4 | 3.5 |
| Netherlands | 4 | 3.5 |
| Norway | 2.75 | 3 |
| Austria | 3 | 3 |
| Spain | 3.5 | 3 |
| Sweden | 3.5 | 3 |
| Mexico | 2.75 | 2.5 |
| Greece | 1.5 | 2 |

Note and source: see Figure 1.

4. Econometric Results

Initial testing, using an OLS (ordinary least squares) fixed-effects estimator, indicated the presence of heteroscedasticity, so the estimates employ robust standard errors.⁹ In addition, we corrected for possible Moulton bias by allowing for standard errors clustered at the country level.¹⁰

Both the OLS and OLS Moulton-bias corrected estimates for sample A (938 observations) are reported in Table 4. Both show a well-determined econometric model, with 92% of the variation in the price-cost margin being accounted for by differences across the

⁹ We used a modified Wald test for groupwise heteroscedasticity (Greene, 2000, p. 598). The result was unequivocal: $\chi^2(247) = 1.0e07$ ($p = 0.000$).

¹⁰ This problem may arise when some explanatory variables are at a higher level of aggregation than the dependent variable. See Moulton (1990). Here, the GCR and GDP deflator variables pertain to the level of the country in the data, while the other variables pertain to the level of market within each country.

countries. In each case, the coefficient on the *GCR* variable is significantly negative, providing empirical support for our hypothesis that more effective competition policy is associated with lower market price-cost margins, controlling for other influences on the price-cost margin. The other variables that are statistically significant are *D_PROD* (positive coefficient) and *OUTGAP* (negative coefficient). The latter implies that greater spare capacity is associated with lower profitability, other things being equal, which conforms to our belief that spare capacity is likely to operate as a mitigating factor on the exercise of unilateral market power and would make coordinated behaviour less likely. The former also confirms our expectation: in this case that the price-cost margin is higher in more rapidly growing markets, *ceteris paribus*. The import penetration variable (*IMPPEN*) is not statistically significant and the same is true of the other two variables (*D_GDPDF* and *D_EMP*).

| Table 4: Price-Cost Margin Panel Data Regression Results –OLS Fixed-Effects with and without Standard Errors Clustered by Country (Sample A) | | | | |
|--|--------------------------|-----------------------|---|-----------------------|
| Variables and Summary Statistics | OLS Fixed-Effects | | OLS Fixed-Effects with Errors Clustered by Country (Moulton Bias Correction) | |
| <i>Dep. Variable</i> | <i>PCM_{it}</i> | | <i>PCM_{it}</i> | |
| | Coef. | <i>Robust t-stat.</i> | Coef. | <i>Robust t-stat.</i> |
| <i>Constant</i> | 0.148 | 22.3*** | 0.148 | 17.3*** |
| <i>GCR_{it}</i> | -0.00489 | -2.23** | -0.00489 | -1.78* |
| <i>D_PROD_{it}</i> | 0.0612 | 4.38*** | 0.0612 | 5.24*** |
| <i>OUTGAP_{it}</i> | -0.00222 | -2.54** | -0.00222 | -2.02* |
| <i>D_GDPDF_{it}</i> | 0.00121 | 0.90 | 0.00121 | 0.94 |
| <i>D_EMP_{it}</i> | 0.0265 | 0.60 | 0.0265 | 0.69 |
| <i>IMPPEN_{it}</i> | 0.0000212 | 0.13 | 0.0000212 | 0.22 |
| Sample | 247 country-sectors | | 247 country-sectors | |
| Observations | 938 | | 938 | |
| Adj. R ² | 0.922 | | 0.922 | |
| Min. periods | 1 | | 1 | |
| Avg. periods | 3.8 | | 3.8 | |
| Max. periods | 5 | | 5 | |
| F(6,685) | 6.00 [0.000] | | | |
| F(6,15) | | | 18.6 [0.000] | |
| Fraction of variance due to u_i | 0.923 | | 0.923 | |
| <i>Note: t-statistics are robust, based on the Huber/White/sandwich estimator of variance; *, ** and *** denote significant at the 10%, 5% and 1% level respectively. Numbers in brackets are p-values. Data sources: see Table 1 above.</i> | | | | |

We next considered a parsimonious model with fewer explanatory variables (using sample B, 2,027 observations). Our ‘best’ model in this regard is shown in Table 5 below, where as before we report both the standard FE and Moulton bias-corrected FE results. These show a very well-determined model (97-98% of the variation in the price-cost margin is explained, much of it by fixed effects) with the *GCR* variable having an even stronger influence on market profitability (the market growth variable, *D_PROD*, continues to be statistically significant but the spare capacity variable, *OUTGAP*, is no longer statistically significant). As before, import penetration is not significant.¹¹

¹¹ The spare capacity and import penetration variables were dropped in reaching the best model reported in Table 5.

| Table 5: Price-Cost Margin Panel Data Regression Results – Parsimonious Models Estimated using OLS Fixed-Effects with and without Standard Errors Clustered by Country (Sample B) | | | | |
|--|--------------------------|-----------------------|---|-----------------------|
| Variables and Summary Statistics | OLS Fixed-Effects | | OLS Fixed-Effects with Errors Clustered by Country (Moulton Bias Correction) | |
| <i>Dep. variable</i> | <i>PCM_{it}</i> | | <i>PCM_{it}</i> | |
| | Coef. | <i>Robust t-stat.</i> | Coef. | <i>Robust t-stat.</i> |
| <i>Constant</i> | 0.214 | 46.91*** | 0.214 | 36.42*** |
| <i>GCR_{it}</i> | -0.00534 | -4.24*** | -0.00534 | -3.14*** |
| <i>D_PROD_{it}</i> | 0.0323 | 1.86* | 0.0323 | 2.78** |
| <i>OUTGAP_{it}</i> | | | | |
| <i>D_GDPDF_{it}</i> | | | | |
| <i>D_EMP_{it}</i> | | | | |
| <i>IMPPEN_{it}</i> | | | | |
| Sample | 592 country-sectors | | 592 country-sectors | |
| Observations | 2,027 | | 2,027 | |
| Adj. R ² | 0.974 | | 0.982 | |
| Min. periods | 1 | | 1 | |
| Avg. periods | 3.4 | | 3.4 | |
| Max. periods | 5 | | 5 | |
| F(2,1433) | 17.2 [0.000] | | | |
| F(2,18) | | | 16.9 [0.000] | |
| Fraction of variance due to u_i | 0.975 | | 0.975 | |
| <i>Note: t-statistics are robust, based on the Huber/White/sandwich estimator of variance; *, ** and *** denote significant at the 10%, 5% and 1% level respectively. Numbers in brackets are p-values. Data sources: see Table 2 above.</i> | | | | |

Our panel data models effectively assume that the coefficients on *GCR* and the other determinants of the price-cost margin are the same across markets. However, it is intuitively possible that this might not be so; for example, some markets are more prone to antitrust action for a range of reasons. We therefore also estimated separate market-level (panel data) regression models using the full set of explanatory variables identified in our analysis. The resulting *GCR* coefficients are shown in Table 6 below. The results show that the *GCR* variable generally has a negative on the price-cost margin and that several markets have large and statistically significant *GCR* coefficients – radio, television and communication equipment, electrical machinery and apparatus nec, basic metals, motor vehicles, trailers and semi-trailers and textiles. According to

our analysis, it is in these particular markets that the effectiveness of competition policy appears to have had an especially large influence on profitability across the countries in our sample (sample A).

| Table 6: Coefficient on GCR Variable in Market-Level PCM Regressions – estimated using OLS with Standard Errors Clustered by Country | | |
|---|---|-----------------------|
| Market | <i>In descending order by level of significance</i> | |
| | Coef. | Robust t-stat. |
| Radio, television and communication equipment | -0.0476 | -4.59*** |
| Electrical machinery and apparatus nec | -0.0335 | -3.61*** |
| Basic metals | -0.0202 | -3.04*** |
| Motor vehicles, trailers and semi-trailers | -0.0230 | -2.99*** |
| Textiles | -0.0183 | -2.97** |
| Food products and beverages | -0.0125 | -1.76 |
| Coke, refined petroleum products and nuclear fuel | -0.0248 | -1.54 |
| Wearing apparel, dressing and dyeing of fur | -0.0201 | -1.52 |
| Medical, precision and optical instruments, watches and clocks | -0.0274 | -1.35 |
| Paper and paper products | -0.0136 | -1.29 |
| Office, accounting and computing machinery | 0.0380 | 1.17 |
| Other transport equipment | -0.0313 | -1.05 |
| Publishing, printing and reproduction of recorded media | 0.0108 | 0.52 |
| Rubber and plastics products | -0.00263 | -0.36 |
| Electricity, gas, steam and hot water supply | -0.00831 | -0.26 |
| Chemicals and chemical products | 0.00291 | 0.25 |
| Other business activities | -0.00705 | -0.17 |
| Fabricated metal products, except machinery and equipment | 0.00139 | 0.14 |
| Tobacco products | -0.00386 | -0.11 |

*Note: t-statistics are robust, based on the Huber/White/sandwich estimator of variance; *, ** and *** denote significant at the 10%, 5% and 1% level respectively. Numbers in brackets are p-values. Data sources: see Table 1 above.*

5. Conclusions

Recent years have witnessed an increased focus on competition policy as a key instrument of economic policymaking. In emerging economies, such as the former Soviet Bloc countries of Eastern Europe (many of which are now members of the EU), competition policy is identified as central to promoting a fair and effective enterprise economy and of fundamental importance to attracting mobile foreign direct investment. In this regard, it is interesting to note China's recently-introduced competition laws. In other countries, competition policy has also become an important weapon against inflation – notably in the Eurozone economies, which no longer have the option of using domestic monetary policy to control prices. The increased emphasis on competition policy across the world has seen national competition authorities (NCAs) working towards adopting international best practices in the design, implementation and enforcement of competition policy (including concerted practices, dominance abuse and merger control) – a development that has been aided by international networks of competition practitioners.

Nevertheless, differences in the effectiveness of national competition policy and NCAs across countries remain (due to a variety of factors). Applying panel data analysis to a unique source of data – the survey-based annual ratings of NCAs provided by *Global Competition Review* – this paper has found that more effective competition policy is likely to have an important effect in curbing the exercise of market power in markets, which serves to reinforce the emphasis on competition policy as an instrument of economic policy.

While we have measured an overall effect of competition institutions on market outcomes, there is scope for future work to identify the main channels through which these institutions have their effects. Presumably much of the benefit arises from prevention and deterrence of anti-competitive concerted practices (particularly cartels), but there are also likely to be contributions from other antitrust activities such as control of market power, competition advocacy and market studies, which can sometimes lead to improvements in competition in markets through voluntary and/or imposed remedies.

The time dimension of competition policy also remains to be explored. Putting appropriate institutions in place may have some immediate effects, but it is also likely that changing the behaviour of firms requires a process of education, which may take time. For example, competition compliance programmes within undertakings or competition advocacy

activities by regulators may affect behaviour in gradual, but wide-ranging, ways. With the advent of competition policy across the world, small and medium enterprises (SMEs) as well as larger businesses are becoming increasingly aware of what can and cannot be done under national competition rules and there appears to be much greater respect for complying with competition principles (on average). If such educational effects are important, there are likely to be lags between changes in institutional quality and market outcomes.

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Tables for Appendix: Additional Information

| Table A1: Number of Observations per Country and Year (Sample A) | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| <i>Country</i> | 1999 | 2000 | 2001 | 2002 | 2003 |
| 1. Austria | - | 19 | 19 | 19 | 19 |
| 2. Belgium | 17 | - | - | - | - |
| 3. Canada | 14 | 14 | 14 | - | - |
| 4. Denmark | 19 | 19 | 19 | 19 | 19 |
| 5. Finland | - | 19 | 19 | 19 | 19 |
| 6. France | 19 | 19 | 19 | 19 | - |
| 7. Germany | 19 | 19 | 18 | 18 | - |
| 8. Greece | - | 19 | 19 | 19 | 19 |
| 9. Italy | 16 | 16 | 16 | 16 | 3 |
| 10. Japan | - | 13 | 13 | 13 | 13 |
| 11. Netherlands | 16 | 16 | 16 | 12 | 8 |
| 12. Portugal | 3 | 3 | 3 | - | - |
| 13. Spain | - | 19 | 17 | 17 | - |
| 14. Sweden | 14 | 14 | 14 | 14 | - |
| 15. United Kingdom | 3 | 3 | 3 | 3 | 3 |
| 16. United States | 18 | 18 | 18 | 16 | 16 |

| Table A2: Number of Observations per Country and Year (Sample B) | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| <i>Country</i> | 1999 | 2000 | 2001 | 2002 | 2003 |
| 1. Austria | - | 37 | 37 | 37 | 37 |
| 2. Belgium | 37 | - | - | - | - |
| 3. Canada | 24 | 24 | 24 | - | - |
| 4. Denmark | 37 | 37 | 37 | 37 | 37 |
| 5. Finland | - | 37 | 37 | 37 | 37 |
| 6. France | 37 | 37 | 37 | 37 | - |
| 7. Germany | 37 | 37 | 35 | 35 | - |
| 8. Greece | - | 37 | 37 | 37 | 37 |
| 9. Italy | 27 | 27 | 27 | 27 | 3 |
| 10. Japan | - | 14 | 14 | 14 | 14 |
| 11. South Korea | - | - | - | 22 | 22 |
| 12. Mexico | - | - | 21 | 12 | 12 |
| 13. Netherlands | 33 | 33 | 33 | 29 | 23 |
| 14. Norway | - | - | - | 33 | 6 |
| 15. Portugal | 37 | 21 | 21 | - | - |
| 16. Spain | - | 37 | 19 | 19 | - |
| 17. Sweden | 22 | 22 | 22 | 22 | - |
| 18. United Kingdom | 37 | 37 | 37 | 37 | 35 |
| 19. United States | 26 | 26 | 26 | 24 | 24 |

| Table A3: Sectors included in Analysis | | |
|---|--|-------------|
| | Sector description | NACE |
| 1 | Radio, television and communication equipment | 32 |
| 2 | Electrical machinery and apparatus, nec | 31 |
| 3 | Basic metals | 27 |
| 4 | Motor vehicles, trailers and semi-trailers | 34 |
| 5 | Textiles | 17 |
| 6 | Food products and beverages | 15 |
| 7 | Coke, refined petroleum products and nuclear fuel | 23 |
| 8 | Wearing apparel, dressing and dyeing of fur | 18 |
| 9 | Medical, precision and optical instruments, watches and clocks | 33 |
| 10 | Paper and paper products | 21 |
| 11 | Office, accounting and computing machinery | 30 |
| 12 | Other transport equipment | 35 |
| 13 | Publishing, printing and reproduction of recorded media | 22 |
| 14 | Rubber and plastics products | 25 |
| 15 | Electricity, gas, steam and hot water supply | 40 |
| 16 | Chemicals and chemical products | 24 |
| 17 | Other business activities | 74 |
| 18 | Fabricated metal products, except machinery and equipment | 28 |
| 19 | Tobacco products | 16 |

| Year | Number | Title/Author(s) ESRI Authors/Co-authors Italicised |
|-------------|---------------|---|
| 2007 | 208 | Tax Structure and Female Labour Market Participation: Evidence from Ireland <i>Tim Callan, A. Van Soest, J.R. Walsh</i> |
| | 207 | Distributional Effects of Public Education Transfers in Seven European Countries <i>Tim Callan, Tim Smeeding and Panos Tsakloglou</i> |
| | 206 | The Earnings of Immigrants in Ireland: Results from the 2005 EU Survey of Income and Living Conditions <i>Alan Barrett and Yvonne McCarthy</i> |
| | 205 | Convergence of Consumption Patterns During Macroeconomic Transition: A Model of Demand in Ireland and the OECD <i>Sean Lyons, Karen Mayor and Richard S.J. Tol</i> |
| | 204 | The Adoption of ICT: Firm-Level Evidence from Irish Manufacturing Industries <i>Stefanie Haller and Iulia Traistaru-Siedschlag</i> |
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