Danilo Samà

Essays on Economic Analysis
of Competition Law: Theory and Practice

«*Mie care, la felicità consiste nel poter dire la verità senza far mai soffrire nessuno*».

Federico Fellini

General Introduction

The present work is the result of a scientific research in the field of the economic analysis of competition law developed through academic experiences at the Erasmus Rotterdam University in the Netherlands, the Ghent University in Belgium, the University of Hamburg in Germany and the Toulouse School of Economics in France, as well as through professional experiences at the Antitrust Department of Pavia & Ansaldo and the Directorate-General for Competition (DG COMP) of the European Commission.

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Rome, May 1st 2014

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The Antitrust Treatment of Loyalty Discounts and Rebates in the EU Competition Law: in Search of an Economic Approach and a Theory of Consumer Harm [*]

Danilo Samà

Abstract

In the paper, the fundamental question is under what conditions loyalty discounts and rebates adopted by a dominant firm cause anti-competitive effects. Fidelity schemes, although extremely frequent in the market, if applied by a dominant firm, are likely to be judged as illegal per se, as demonstrated by the EU case-law delivered so far and the severe scrutiny reserved by the national competition authorities. As a result, the paper first provides an analytical overview of loyalty structures, focusing in particular on retroactive rebates, and elaborates on important economic implications, such as the lock-in and the suction effect. The work then discusses the novelties introduced by the Guidance Paper on the Application of Art. 102 of the TFEU, which calls for an effects-based analysis of exclusionary abuses. Therefore, after an in-depth evaluation of the as-efficient competitor test, the new approach of the European Commission towards loyalty discounts and rebates is discussed in details with reference to a controversial antitrust case recently examined at EU level (*Tomra*). The paper finally proposes a systematic economic framework for analysing the effects, and therefore the legality, of fidelity schemes, in the light of a consistent theory of consumer harm.

Keywords: Fidelity Discounts, Loyalty Rebates, Abuse of Dominant Position, As-Efficient Competitor Test, Consumer Harm, Exclusive Dealing, Foreclosure, Monopolization, Non-linear Pricing, Predation, Tomra.

JEL Classification: K21; L12; L42

≪Where did we come from? Where are we going? Is there possibility of a group discount?≫

Woody Allen

1 The Definition of Loyalty Discounts and Rebates

In general terms, loyalty discounts and rebates may be defined as a reduction in the list price of a relevant product which a seller or supplier offers to a buyer or distributor as an explicit or implicit reward in exchange for a relationship of substantial exclusivity. As a result, the key difference respect to the standard form of price discounting is that a loyalty scheme is structured, on one side, to provide significant benefits to the customer in case it maintains or raises its purchasing expenditure towards a particular supplier, and, on the other side, to impose heavy penalties on the customer in case it switches its purchasing expenditure towards a rival supplier. In fact, since in common practice the supplier does not grant the price premium to the customer if it moves even only a limited part of its purchasing requirements to another competitor, the two types of loyalty structures may entail an effect similar to an exclusive dealing, which, as it is known, forces the customer to purchase the entire or a significant part of its total supply from a specific supplier.

Nevertheless, as demonstrated by the fact that these practices are extremely frequent in the market, loyalty discounts and rebates are normally not problematic. If competitors are able to compete on equal terms against rivals and if customers are able to respond actively to the incentives proposed, loyalty schemes are unlikely to be anti-competitive and instead may represent pro-competitive instruments in support of price competition, which in turn may increase the total level of social welfare. On the contrary, in the presence of a dominant firm, loyalty structures may cause crucial problems from a competition policy perspective. Within this context, the present work is therefore intended to develop a critical and extensive economic analysis of the issue, in the light of the latest guidelines on abuse of dominant position published by the European Commission and the most recent EU case-law in regard.

Although in common language a distinction between the concepts of discount and rebate appears often absent, the main characteristic shared is that the granting of both is conditional on the achievement of a certain amount of purchases within a given reference period. The main difference is that for the former the premium is applied directly to the list price and for the latter the premium is awarded indirectly in a rebate cheque. However, even if in the presence of a dominant undertaking it is not sufficient to examine the form of the discount or rebate in order to carry out a correct evaluation of its loyalty effect from an antitrust standpoint[1] (as it will be demonstrated in the next section), as a preliminary matter, it is necessary to consider how the structure of a generic discount or rebate may change in terms of three primary features[2].

Firstly, according to the type of threshold, it is possible to distinguish between fidelity and target discounts and rebates. In the first case, the threshold set by the supplier that the customer must achieve is defined by a percentage of growth in the customer's purchasing expenditure calculated in comparison with a past period (i.e growth discounts or rebates), by a percentage of the customer's purchasing requirements (i.e. market share discounts or rebates) or by an exclusivity obligation (i.e. exclusive discounts or rebates). In the second case, the threshold set by the supplier that the customer must reach is defined by an individualized or standardized volume of units (i.e. quantity discounts or rebates). Nonetheless, in the common experience, the threshold is typically set such as to correspond to the entire or significant part of the customer's demand. This is the case, in addition to the fidelity discounts and rebates, also for the target category, or at least for the individualized variant, which generates more problems from a competition law point of view (as it will be shown in the next section). Thus, the two loyalty schemes tend to produce substantially the same economic effects.

Secondly, according to the scope of application, it is possible to distinguish between incremental discounts and rebates, which are applied forward-looking, i.e. only on the additional units purchased above the threshold (also known as prospective discounts or rebates), and retroactive discounts and rebates, which are applied

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[1]For the traditional assessment of loyalty discounts and rebates in the EU case-law: O'Donoghue, R., Padilla, A.R. (2006), *The Law and Economics of Article 82 EC*, Hart Publishing, Oxford, United Kingdom and Portland, United States, pp. 374-406.

[2]Ahlborn, C., Bailey, D. (2006), *Discounts, Rebates and Selective Pricing by Dominant Firms: A Trans-Atlantic Comparison*, in Marsden, P. (eds.), *Handbook of Research in Trans-Atlantic Antitrust*, Edward Elgar, Cheltenham, United Kingdom and Northampton, United States, p. 197.

backward-looking, i.e. not only on the additional units purchased above the threshold, but also on the previous ones (also known as all-unit, back to one, roll-back discounts or rebates).

Thirdly, according to the scope of products, it is possible to distinguish between single item discounts and rebates, which are applied to the units of a single product purchased (also known as single product discounts or rebates), and bundled discounts and rebates, which are applied to the units of a range of products purchased (multi-product discounts or rebates).

As regards its methodological setting, the current economic assessment is primarily focused on the discounting practice with the form of a single-product retroactive rebate for three principal reasons. Firstly, it constitutes one of the most frequent agreement adopted in commercial transactions. If employed by a dominant firm, it is likely to be deemed as illegal per se, as demonstrated by the EU case law delivered so far and the severe scrutiny reserved by the national competition authorities. Secondly, it represents a topic that remains relatively unexplored, as proved by the limited number of academic papers that has been published in the light of the new effects-based approach promoted by the Commission and the controversial cases recently examined at EU level. Thirdly, the present work does not significantly alter the conclusions that may be drawn for the other less relevant types of loyalty discounts and rebates.

2 The Economic Analysis of Loyalty Discounts and Rebates

A rebate may be defined as retroactive if, as mentioned in the previous section, the customer obtains the discount on all the quantities purchased, after having reached a certain amount of purchases within a given reference period. As a result, the discount is applied retroactively to all the previous purchases made by the customer and not exclusively to the purchases realized above the threshold, as in case of incremental rebates. Hence, the purchasing target corresponds to the quantity of units that, if it is purchased by the customer before the expiry of the reference period, triggers retroactively the discount on all the previous purchases. In most cases, the main advantage of using a retroactive rebate rather than an incremental rebate, which in turn justifies its higher frequency, is that the former allows to adopt a price

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discrimination scheme more easily than the latter. Through this price discrimination, large customers pay a lower price while small customers pay a higher price, as a recompense of the different level of loyalty shown, which in turn allows the firm to benefit from economies of scale.

However, in case of retroactive rebates, since the discount affects retroactively the total amount of units purchased in the reference period, the customer is subject to a so-called "lock-in effect" in the form of a switching cost. In fact, if the customer chooses to switch its supplier source, it risks not to reach the threshold, losing the discount otherwise determined on all the previous purchases. Given that the supplier is generally able to define an individualised rather than standardised purchasing target that reflects the buyer's total requirements, the customer would be less likely to switch to other suppliers, since it would be more complex for it to cross the threshold within the reference period[3].

In addition to the loyalty-enhancing effect, retroactive rebates raise a further problem, i.e. the so-called "suction effect", arising in proximity of the purchasing target. In fact, once the customer has reached an amount of purchases very close to the threshold, a slight increase in the quantity of units purchased would be enough to trigger retroactively the discount on all the previous purchases. Thus, the incremental price, which a customer must implicitly correspond for the marginal units necessary to achieve the threshold, may be inferior to the discounted and list price (cf. Formula 1)[4]. Furthermore, given the non linear and retroactive nature of the rebate, the total expenditure borne by the customer faces a discontinuity in correspondence of the threshold. In fact, if the purchasing target is reached, the total expenditure may decrease to a level lower than the one prior to the achievement of the threshold. As a result, it is possible to state that the incremental price: firstly, it may be below cost or negative, even though the average discounted price may be not predatory (cf. Example 1)[5]; secondly, it decreases as the discount rate, the marginal and the total units necessary to reach the threshold increase (cf. Figure 1)[6].

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[3]Faella, G. (2008), *The Antitrust Assessment of Loyalty Discounts and Rebates*, Journal of Competition Law & Economics, Vol. 4, Issue 2, Oxford University Press, Oxford, United Kingdom, p. 377.

[4]Rigaud, F.P. (2005), *Switching Costs in Retroactive Rebates - What's Time Got to Do with It?*, Competition Law Review, Vol. 26, No. 5, Sweet & Maxwell, London, United Kingdom, p. 274; *supra* note 3, p. 378.

[5]Federico, G. (2005), *When are Rebates Exclusionary?*, European Competition Law Review, Vol. 26, No. 9, Sweet & Maxwell, London, United Kingdom, p. 477.

[6]Maier-Rigaud, F.P. (2006), *Article 82 Rebates: Four Common Fallacies*, European Compe-

Formula 1 - *Incremental Price*

$$P^I = P^L [X_m - (r \times X_t)] / X_m$$

P^I = incremental price
P^L = list price
r   = discount rate
X_m= marginal units necessary to reach the threshold
X_t = total units necessary to reach the threshold

Example 1 - *Incremental Price and Predatory Price*

The firm sells to the customer a unit of product, whose average total cost is of 0.90€, at a list price of 1€. Furthermore, the firm grants a retroactive rebate of 5% if the customer reaches a volume threshold of 1,000 units. Thus, if the customer increases the amount of units purchased from 999 to 1,000, the total expenditure decreases from 999€ to 950€, which in turn implies that the incremental price calculated on the last unit is negative (applying the analytical formula above shown: 1 [1 - (5%×1,000)] / 1 = -49), although the final and total average discounted price, which is equal to 0.95€ (950€/1,000 units), results not predatory, being higher than the average total cost of 0.90€.

In relation to the reference period, the switching cost due to the suction effect is moderately low for first purchases and extremely high close to the threshold, when it may lead to a negative incremental price (cf. Example 2)[7]. In the extreme case where the purchasing target is defined by the supplier at a level superior to the real customer's requirements, the suction effect may be even more severe, since it would push the customer to purchase a quantity of units that it neither needs nor would purchase absent the retroactive rebate. In conclusion, the present section demonstrated from an economic perspective how the suction effect due to a retroactive scheme may potentially generate a reduction of the contestable portion of the demand, which in turn, if a dominant firm is involved, may entail an anti-competitive foreclosure on actual or potential competitors, as it will be further explained in the next section.

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tition Journal, Vol. 2, No. 2, Hart Publishing, Oxford, United Kingdom and Portland, United States, p. 87.

  [7]Kallaugher, J., Sher, B. (2004), *Rebates Revisited: Anti-Competitive Effects and Exclusionary Abuse under Article 82*, European Competition Law Review, Vol. 25, No. 5, Sweet & Maxwell, London, United Kingdom, p. 267.

Figure 1 - *Incremental Price and Suction Effect*
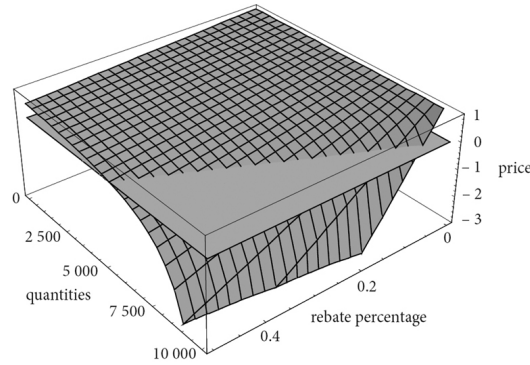
Figure 1 illustrates the suction effect related to a retroactive rebate which presents the following characteristics: 1. discount rate ranging from 0% to 50%; 2. normalized price base of 1; 3. volume threshold of 10,000 units. The area squared represents the price a competitor must match in order to leave the customer indifferent between its offer and the retroactive rebate proposed by the rival firm. As shown, the price the competitor must match decreases as the discount rate offered and the level of sales made by the rival firm increase, becoming negative when it falls below the solid colour plan.

Example 2 - *Incremental Price and Reference Period*

The firm sells to the customer a unit of product at a list price of 100€. Furthermore, the firm grants to the customer a retroactive rebate of 5% if the customer reaches an annual threshold of 1,000 units. At the same time, the customer is willing to purchase 500 units from a new entrant. However, if the customer purchases 500 units from the new entrant, it would not be able to reach the purchasing target set by the incumbent firm. Therefore, what should be the price the rival firm must offer to the customer to compensate it of switching part of its sales? The rival firm should return to the customer the total discount lost from the incumbent firm, that is equal to 5,000€ (discount rate applied to the total sales made at the list price: 5% of 100€×1,000). Nevertheless, the discount rate the rival firm should offer to the customer depends on the quantity of units over which it can recover and spread the total discount, which in turn depends on the period of the year during which the rival firm is able to convince the customer to switch. Assuming that the customer purchases on average the same quantity of units each month, it follows that: during the first month (500 units available - 12/12 of 500), the rival firm would need to compensate the total discount of 5,000€ offering a unit discount of 10€ (5,000€/500), which is equal to a discount rate of 10% (10€/100€); at half year (250 units available - 6/12 of 500), the rival firm would need to compensate the total discount of 5,000€ offering a unit discount of 20€ (5,000€/250), which is equal to a discount rate of 20% (20€/100€); during the last month (42 units available - 1/12 of 500 units available), the rival firm would need to compensate the total discount of 5,000€ offering a unit discount of 119€ (5,000€/250), which is equal to a discount rate of 119% (119€/100€). It is important to note that in proximity of the end of the reference period the rival firm is induced to offer a negative price and thus to incur a loss, being the net price (-19) equal to difference between the list price of 100€ and the unit discount of 119€.

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3 The Guidance Paper on the Application of Article 102 of the TFEU

In the Guidance Paper on the application of Article 102 of the Treaty on the Functioning of the European Union (TFEU)[8], whereby the European Commission provides essential guidelines to apply an effects-based analysis to exclusionary abuses of dominant position, an "As-Efficient-Competitor" test has been developed to evaluate whether a rebate structure granted by a dominant undertaking presents actual or potential foreclosure effects. After the further confirmation of the per se prohibition against dominant firm's retroactive rebates established in the renowned cases *British Airways*[9] and *Michelin II*[10], a significant number of academic commentators has started to show that, despite the loss of a complete but imperfect legal certainty, an economic approach was definitely more suitable to correctly implement an antitrust assessment of the commercial practice at issue, especially considering its potential efficiencies and its regular use in all the industrial sectors. In fact, if a retroactive rebate causes only a minimal and negligible exclusionary impact, a form-based rule would impede behaviours beneficial for the competitive process, such as, for instance, elimination of double marginalization, prevention of free-riding and recoupment of fixed costs of production.

Accordingly, the Commission states in its enforcement guidelines that the anticompetitive nature of a conduct can be deduced without carrying out a detailed examination only if the practice generates no efficiencies and hampers competition (Guidance Paper, paragraph 22). In particular, following intense discussion preceding its publication, the enforcement guidance has proposed a variant of the predation test for the evaluation of discount structures. In a nutshell, the price-cost test designed at EU level consists of a two-phase model, which basically aims at verifying if an equally efficient competitor would be able to contest the price resulting from the application of a rebate scheme by a dominant firm, persuading the customer involved to renounce to the economic conditions proposed by the latter.

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[8]European Commission (2009), *Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings*, Official Journal of the European Union, 2009/C 45/02, 24 February 2009.

[9]Commission Decision of 14 July 1999, *Virgin-British Airways*, Case IV/D-2/34.78, Official Journal of the European Communities, 2000/74/EC L 30/1, 4 February 2000.

[10]Commission Decision of 20 June 2001, *PO - Michelin*, Case COMP/E-2/36.041, Official Journal of the European Communities, 2002/405/EC L 143/1, 31 May 2002.

In general terms, it is important to underline that in its recent guidelines the Commission, although it remains rather careful in the assessment of rebate schemes, makes a significant breakthrough towards the adoption of a real economic approach. On one side, it affirms that a discount system may produce foreclosure effects comparable to those produced by exclusive purchasing obligations, even without resulting in a profit sacrifice. It also asserts that a dominant firm may monopolistically exploit the non-contestable share of the customer's demand as leverage to reduce the price on the contestable share, increasing its total profits (Guidance Paper, respectively paragraphs 37 and 39)[11].

On the other side, it openly admits that loyalty and suction effects are maximum in proximity of the threshold. In practical terms, the mere existence of product volumes sold at a very low discounted price, which in turn might be the result of a negative incremental price, does not constitute a sufficient condition (cf. the two above-mentioned cases) to declare that an equally or even more efficient competitor would be subject to an anti-competitive foreclosure. On the contrary, it is necessary to perform a complete assessment of the impact of the dominant firm's rebate system, in order to ascertain if there is the risk of an exclusionary effect on actual or potential competitors (Guidance Paper, paragraph 40).

Furthermore, the Commission correctly emphasizes that the evaluation of a rebate structure strongly depends on the nature of the threshold, which may be individualized or standardized. Analogously to exclusive purchasing obligations, in case of individualised threshold, which is typically defined as a percentage of the customer's purchasing requirements or as a specific volume target, the loyalty-enhancing effect is maximum, since the dominant firm is assumed to be able to set the threshold at a level that corresponds to the customer's entire demand. Instead, in case of standardized threshold, which is usually expressed as a generic target equal for all customers, the loyalty-inducing effect may be high for smaller customers and low for larger customers. As it should be, the Commission is then likely to intervene only if the standardized threshold reflects the purchasing requirements of a substantial proportion of the total demand (Guidance Paper, paragraph 45).

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[11]For an alternative and further analytical assessment of the leverage effect that permits to a dominant firm to profitably tie the non-contestable portion of the customer's demand (brand product as monopolized sub-market) to the contestable portion (generic product as competitive sub-market): Greenlee, P., Reitman, D. (2005), *Competing with Loyalty Discounts*, U.S. Department of Justice, Economic Analysis Group, Discussion Paper 04-2, Washington D.C., United States, pp. 26-28.

3.1 The First Phase of the As-Efficient Competitor Test: the Estimation of the Contestable Demand

In the first phase of the price-cost test, for an incremental rebate, the relevant range of sales that is necessary to consider in order to verify the pro-competitive or anti-competitive nature of the discount scheme is normally equal to the part of sales made above the threshold. On the contrary, for a retroactive rebate, it is required to estimate the contestable portion of the customer's demand, that is the part of sales for which a rival firm could realistically compete against the dominant firm. If customers could switch large part of the demand to an actual or potential competitor, then the relevant range would be large. On the contrary, if customers could switch only small part of the demand, then the relevant range would be small. As practical guidelines, for an existing competitor a helpful indication of the relevant range may come from the data related to the fluctuations of sales over time, whereas, for a potential competitor, a useful suggestion may derive from the evaluation of the scale of sales that a new entrant would reasonably be able to reach. In case this calculation were difficult, it is advised to observe the past trend registered by new entrants in the same or similar markets (Guidance Paper, paragraph 42).

The essential condition for a retroactive rebate to cause a risk of anti-competitive foreclosure is the control by the dominant firm of a substantial share of the customer's requirements, i.e. the so-called "assured base of sales". As in case of exclusive dealings, the key factors which allow a dominant undertaking to benefit from an inelastic portion of the demand may be several, such as, brand loyalty due to the necessity for dealers and retailers to offer must-stock items produced by dominant firms, capacity constraints faced by rival firms, reputational effects which prevent competitors from selling high amounts of units before their own product has been tested by customers, switching costs suffered by consumers (Guidance Paper, paragraph 36). Therefore, assuming that rival firms may not be able to compete for the entire demand since dominant firms play generally the role of an unavoidable trading partner, in case of retroactive rebates the enforcement guidance requires estimating the volume of sales which can be judged contestable.

The existence of an assured base of sales on which the dominant firm holds a significant market power implies that the customer would buy in any case a certain amount of its purchasing requirements from it, despite the fact that a rival firm could offer a product of higher quality at a lower price. Nevertheless, an anti-competitive foreclosure arises only if an equally or even more efficient competitor is unable to

compete not for the entire size of the customer's demand, but just for the portion of demand which is not monopolized by the dominant firm. The principal purpose of the price-cost test is therefore to ascertain if an "as-efficient" competitor would be capable of competing on the contestable part of the demand without incurring any loss with the price following the implementation of a dominant firm's retroactive scheme.

3.2 The Second Phase of the As-Efficient Competitor Test: the Estimation of the Effective Price

In the second phase of the price-cost test, in case of retroactive rebates, it is required to estimate the average price that a competitor would need to propose to the customer to compensate the loss of the discount offered by the dominant firm (in case of incremental rebates, the effective price is simply equal to the discounted price granted to the additional units purchased above the threshold)[12]. In this regard, it is worth noting two characteristics concerning the compensating price the rival firm must match. Firstly, it is not equal to the discounted price proposed by the dominant firm, which instead is equal to the list price minus the premium recognized on all the previous purchases. In fact, the rival firm can refund the customer of the rebate lost from the dominant undertaking only relying on the contestable demand. Hence, the effective price the rival firm must offer to match the dominant firm's discounted price would certainly be lower than the latter. Secondly, it increases alongside of the level of sales made by the rival firm and thus the size of the contestable demand, because the competitor is progressively in a better position to recoup the discount lost by the customer over a higher number of units.
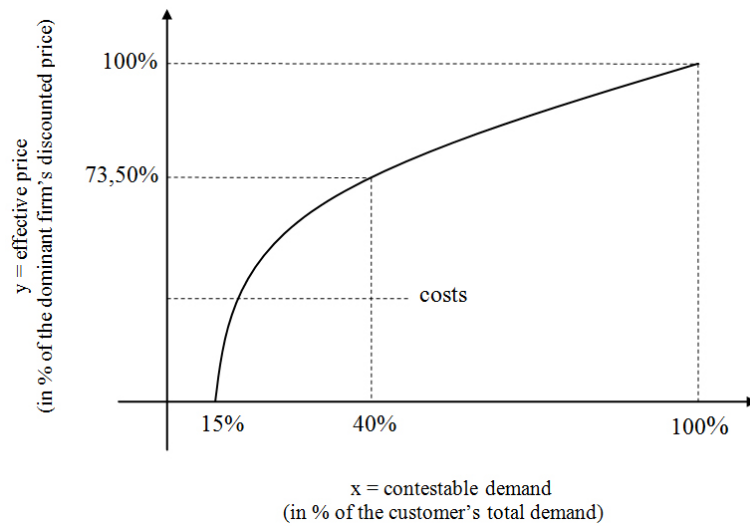
Accordingly, it is possible to show graphically the relationship between the effective price (in percentage terms of the dominant firm's discounted price) and the level of sales (in percentage terms of the customer's total demand) that the rival firm respectively has to offer and make in order to leave the customer indifferent (cf. Figure 2)[13]. Nevertheless, the level of sales a rival firm may realize is constrained by and depends on the contestable portion of demand. Assuming for instance in the

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[12]Federico, G. (2011), *The Antitrust Treatment of Loyalty Discounts in Europe: Towards a more Economic Approach*, Journal of European Competition Law & Practice, Vol. 2, Issue 3, Oxford University Press, Oxford, United Kingdom, p. 278.

[13]*Supra* note 12, p. 284.

graph below that the contestable demand is equal to 40% of the total demand and that the discount rate offered by the dominant firm is equal to 15% of the list price, the curve representing the effective price indicates that the rival firm would need to offer a compensating price equal to 73.50% of the discounted price and to 62.50% of the list price, which in turn is equal to a 37.50% discount on the list price. From the example, therefore, it is possible to observe how the existence of a limited portion of contestable demand strongly influences the capacity of a competitor to compete. In fact, the rival firm would need to more than double the discount offered by the dominant undertaking in order to remain competitive in the market concerned.

Figure 1 - *Incremental Price and Suction Effect*

In analytical terms, the effective price a rival firm must offer to match the dominant firm's rebate scheme may be expressed by the following equation (cf. Formula 2)[14]. As a result, in relation to the effective price it is possible to state that: it decreases as the discount rate and the non-contestable share of demand increase; it increases as the contestable share of demand increases; it is positive if the contestable share of demand is higher than the discount rate; it is equal to zero if the discount rate is equal to the contestable share of demand.

Furthermore, from the formula shown below, it is possible to understand why a discount system does not generate distortions and thus problems from a competition

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[14] *Supra* note 4, p. 274.

law point of view if a rival firm can compete on an equal footing with the dominant firm for the total customer's purchase requirements. In fact, if the dominant firm cannot benefit from an assured base of sales, implying that a distinction between contestable and non-contestable demand is not necessary, then the price the rival firm must offer to remain competitive in the relevant market is exactly the same as the dominant firm's discounted price. Consequently, the type of price competition that follows benefits rather than reduce the general level of consumer welfare.

Formula 2 - *Effective Price*

$$P^E = P^L \ [X - r \ (X + Y)] \ / \ X$$
$$D \ = X + Y = 1$$
$$P^E = P^L \ [1 - (r \ / \ X)]$$

P^E = effective price
P^L = list price
r   = discount rate
D   = total demand
X   = share of demand contestable
Y   = share of demand non-contestable

As the ultimate objective of the price-cost test is to evaluate whether the effective price following the adoption of a rebate scheme by a dominant firm may be matched by an equally or even more efficient competitor using the contestable portion of demand, it is necessary, as the final step, to compare the value of the compensating price with a correct cost benchmark. In this test, as in the case of price discrimination, the measures of cost to be used to distinguish between pro-competitive and anti-competitive forms of discounting are those relative to the dominant firm.

The essential motivations that support the employment of the cost structure of the dominant firm and not of the rival firm as term of comparison are: the price-cost test aims to safeguard only competitors that are as-efficient as the dominant undertaking; the use of the cost structure of the dominant firm as the key parameter permits to establish whether its conduct entails a profit sacrifice, in which case it is possible to judge the latter as exclusionary, since its only economic justification is the desire to reduce the level of competition; the fact that a dominant firm cannot know the costs of production borne by its competitors, therefore the obligation to respect a measure of cost sustained by rival firms would cause an excessive legal uncertainty.

In this context, there are two main rules for the assessment of the exclusionary effect produced by a retroactive rebate on actual or potential competitors: if the effective price associated to the contestable demand is below the Average Avoidable Cost (AAC) of the dominant firm, then the retroactive rebate is considered capable of foreclosing an equally or even more efficient competitor, thus it must be judged abusive; if the effective price is between the Average Avoidable Cost (AAC) and the Long Run Average Incremental Cost (LRAIC) of the dominant firm, then the retroactive rebate would not be normally capable of generating an anticompetitive foreclosure, since an equally or even more efficient competitor would be able to compete despite the presence of the dominant firm's retroactive rebate.

In the latter case, the Guidance Paper calls for the opening of a further investigation by the Commission, in order to verify if any other available element confirms or rejects the obstruction to the entry or the expansion by an as-efficient firm in the relevant market. Therefore, the enforcement guidance requires considering all the effective and realistic counterstrategies that are at disposal of competitors to compete with the dominant undertaking, such as, for instance, the power to use the non-contestable portion of demand of the own customers as a leverage to reduce the price linked to the contestable portion of demand (Guidance Paper, paragraph 44).

It should be noted that the use of cost-based measures needs the definition of a time frame for the evaluation of the conduct. Obviously, for a discount scheme, the relevant period over which it is applied represents the most appropriate temporal benchmark to realize the comparison between the level of effective price and the level of avoidable costs. Nevertheless, as the reference period increases, costs become more avoidable and incremental. Consequently, it is extremely important to be able to determine the exact reference period, which is critical to assess whether the effective price is above or below the relevant cost based measures and thus crucial to judge the potential foreclosure of actual or potential competitors[15].

As a result, cost-based rules remain a helpful but imperfect tool to measure the exclusionary nature of the commercial practices at issue (even though the estimation itself of costs of production remains problematic). Therefore, a broader fact-based

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[15]Office of Fair Trading (2005), *Selective Price Cuts and Fidelity Rebates*, Economic Discussion Paper, A report prepared for the Office of Fair Trading by RBB Economics, London, United Kingdom, p. 63.

analysis capable of estimating the competitive harm seems not only desirable, but also indispensable, as it will be examined in details in the next sections.

4 Critical Assessment of the As-Efficient Competitor Test

Although part of the criticisms addressed to the price-cost test designed by the European Commission in its Guidance Paper appears rather reasonable (in essence the complexity to estimate the effective price), the proposal frequently advanced in the academic debate by numerous commentators to abolish completely the model based on the concept of contestable demand and to adopt, along the lines of the US antitrust system, a standard predatory test[16], applying the latter on the quantity of units that once reached triggers retroactively the rebate scheme, seems to be not justified from an economic perspective. Even though a standard predatory test would certainly be much more straightforward to implement, at the same time it would risk to be excessively simplified and to cause false-negative errors, judging lawful a conduct that instead is direct to foreclosure and eliminate a competitor (cf. Example 3)[17].

Example 3 (Part I) - *Contestable Share Test and Standard Predatory Test*

The dominant firm sells to the customer a unit of product, whose average total cost is of 0.90€, at a list price of 1€. Furthermore, the customer's total demand is equal to 120 units and the dominant firm grants a retroactive rebate of 5% if the customer reaches a volume threshold of 100 units. At the same time, an as-efficient competitor, which may potentially attract a maximum of 40 (i.e. customer's contestable demand) of the 120 units available (i.e. customer's total demand) is willing to enter in the market. However, applying a standard predatory test on the threshold volume, the retroactive rebate proposed by the dominant firm would not be judged exclusionary, since the latter would be able to bear total costs of 90€ (total sales times average total cost: 100×0.90€) and to obtain total revenues of 95€ (total sales made at the list price, minus discount rate applied to total sales: 100×1€ - 100×5%), for a positive level of profits of 5€. Thus, the retroactive rebate, not entailing a profit sacrifice, would be considered lawful.

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[16]Sher, B. (2009), *Leveraging Non-Contestability: Exclusive Dealing and Rebates under the Commission's Article 82 Guidance*, Antitrust Chronicle, Vol. 2, Issue 1, Competition Policy International, Boston, United States, p. 8.

[17]Lang, J.T., Renda, A. (eds.) (2009), *Treatment of Exclusionary Abuses under Article 82 of the EC Treaty*, Centre for European Policy Studies, Brussels, Belgium, pp. 46-48.

As a matter of fact, a standard predatory test would risk to neglect the importance of the factor "scale of production", not performing a correct As-Efficient Competitor analysis. In fact, a rival firm is unlikely to be able to remain competitive in the market relying only on the quantity of units corresponding to the difference between the customer's total demand and the dominant undertaking's threshold volume. Even if it aims to sell exclusively the incremental units above the threshold, being consequently constrained to match only the dominant firm's discounted price but not to offer the much lower effective price that would recompense the customer for the loss of the discount proposed by the dominant firm, the rival firm would probably not survive, since it would be incapable to achieve an efficient scale of production. Therefore, it is plausible to assume that the competitor, in order to reach an optimal scale of operations, would be forced to supply a quantity of units higher than the incremental units above the threshold and thus it would be obliged to convince the customer to switch, renouncing to the dominant firm's retroactive rebate.

Example 3 (Part II) - *Contestable Share Test and Standard Predatory Test*

Since the customer's total demand is equal to 120 units and the threshold set by the dominant firm is equal to 100 units, if the rival firm competes just for the quantity of units above the threshold, i.e. 20 units, the customer can still continue to buy 100 units and to benefit from the dominant firm's retroactive rebate. Thus, the price the rival firm must match is equal to 0.95€, i.e. the price discounted the customer pays to the dominant firm for the incremental units once the threshold has been crossed. However, the rival firm, in order to achieve its minimum efficient scale of production and to remain competitive in the market, could be forced to sell more than the incremental units above the threshold. Nevertheless, counting only on the contestable demand, which is equal to 40 of the 120 total units, the rival firm would be obliged to offer to the customer an effective price of 0.85€ (applying the Formula 2 above shown: 1 [1 - (5% / 33%)], being the contestable portion of demand equal to 40/120), which is not sufficient to cover the average total cost of 0.90€. Likewise, the effective price of 0.85€ can be calculated as difference between the total amount the customer would pay if it satisfies its total demand from the dominant firm (120×0.95€ = 114€) and the total amount the customer would pay if it satisfies only its non contestable portion of demand from the dominant firm switching its contestable portion of demand to the rival firm (120-40×1€ = 80€), all divided by the contestable demand (34/40 = 0.85€). As a result, the rival firm would bear total costs of 36€ (total sales of the units of the contestable demand times average total cost: 40×0.90€) and would obtain total revenues of 34€ (total sales of the units of the contestable demand times effective price: 40×0.85€), for a final and negative level of profits of 2€. In fact, the rival firm would need to sell at least 60 units ([1 - (5% / 50%)] = 0.90€, being 50% (60/120) the market share the rival firm must supply to reach its minimum efficient scale of production), in order to offer a price equal to the average total cost and to not suffer a loss, despite the fact it faces potentially the same costs as the dominant firm (average total cost per unit of 0.90€ for both firms).

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As the example shows, although the retroactive rebate granted by the dominant undertaking does not entail a profit sacrifice, the rival firm, given that it can rely only on the contestable portion of demand, is forced to offer an effective price below cost, which in the long-term would oblige the same firm to exit from the market. Therefore, notwithstanding the competitor is as-efficient as the dominant firm, the fact that the contestable demand is not large enough to permit to the rival firm to achieve the minimum efficient scale of production would make it unable to compete even for the portion of market still left open to competition. Thus, the application of a standard predatory test would be erroneous, since it is likely to judge lawful a retroactive rebate offered by a dominant undertaking, even though, as it has been demonstrated in the example, it is actually capable of foreclosing an equally efficient competitor. In theory, a standard predatory test could be applied only in industrial sectors with no or low economies of scales, which is in practice an improbable scenario when a dominant firm is present. In this regard, it is worth to remind that such an evaluation is neither required by the test promoted by the Commission, which is based on the cost structure of the dominant firm.

Nevertheless, at least in the critical cases where the effective price is between the AAC and the LRAIC, the antitrust assessment of a dominant firm's retroactive rebate, in order to be sound from an economic point of view, should always evaluate whether the portion of the market still left open to competition allows an as-efficient competitor to achieve its optimal scale of production. After all, it is reasonable to assume that a dominant firm is generally able to act distinguishing the monopolized portion of the customer's demand from its contestable share, at least for the largest customers. As a result, albeit the estimation of the contestable share as well as of the loss of the rebate are more difficult to determine than the measurement of the same costs of production, this does not exempt the EU institutions from the duty to bear the higher workload the new approach (with its possible adjustments) requires to reach a more precise result.

5 EU Case-Law: Tomra

In 2006, the European Commission imposed a fine of 24 millions euro on the multinational corporation Tomra for violation of the EU antitrust rules on abuse of dominant position (Art. 102 TFEU) by engaging in a combination of prohibited conducts capable to exclude competitors from the market of the so-called "reverse-vending machines", which are generally installed in outlets and supermarkets to facilitate the

collection of empty and used beverage containers for recycling purposes. The infringements, committed by Tomra and detected by the Commission after a complaint lodged by the German manufacturer Prokent, consisted in the implementation of a system of commercial contracts including practices classifiable as exclusivity agreements, individualized quantity commitments and individualized retroactive rebates, employed in the sale of the machines to large retail chain operators active in 5 national markets (i.e. Austria, Germany, Netherlands, Norway, Sweden), where the Norwegian group operated through its local subsidiaries[18].

The Commission determined that, during the period of the infringement (1998-2002) and in the countries under examination, on average Tomra's market shares were approximately 80 percent and the practices in question foreclosed about 40 percent of the total demand. The investigations undertaken by the Commission eventually concluded that the unilateral conducts adopted by Tomra impeded or at least made more difficult the market entry of new competitors, although in some cases rival suppliers were completely eliminated through acquisitions or insolvencies. In 2006, Tomra filed an appeal to the General Court for annulment of the Commission Decision. In the claim, the company complained that the decision was based on elements which could not satisfactorily prove the exclusionary intent of the practices objected. The General Court substantially confirmed and upheld the evaluation carried out by the Commission[19].

The particular interest generated by the *Tomra* case in the antitrust community is due to the fact that it represents the first proceeding where the European institutions deal with the new effects-based approach to loyalty discounts designed in the Discussion Paper (2005)[20] and embraced in the Guidance Paper (2009). However, in the light of a critical assessment of the decision issued by the Commission and the judgements rendered by the General Court and the Court of Justice[21], it is possible to state that the test proposed to verify the presence of an exclusionary conduct has been only partially carried out.

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[18]Commission Decision of 29 March 2006, *Prokent-Tomra*, Case COMP/E-1/38.113, C(2006)734.
[19]Judgment of the General Court of 9 September 2010, *Tomra Systems and Others v Commission*, Case T-155/06, Official Journal of the European Union, 2010/C 288/31, 23 October 2010.
[20]European Commission (2005), *DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses*, Brussels, Belgium.
[21]Judgment of the Court (Third Chamber) of 19 April 2012, *Tomra Systems and Others v Commission*, Case C-549/10, Official Journal of the European Union, 2012/C 165/6, 9 June 2012.

5.1 The Decision of the European Commission (2006)

In an article published in the Competition Policy Newsletter of the Directorate General for Competition (DG COMP)[22], members of the case team working on the *Tomra* case offer the possibility to better comprehend and reconstruct the economic reasoning developed by the Commission (in fact, at paragraphs 364-390, the text of the decision describes only in a formal manner the theoretical model proposed by Tomra, whereas the article reports also a numerical example submitted by Tomra as response to the statement of objections, although in both cases the logic remains of course the same). The combined analysis of the two documents results therefore essential to evaluate the application made in this case of the new effects-based approach towards retroactive rebates adopted in the Guidance Paper. Thus, in the present section, the focus will be on the economic assessment introduced and realized by the Commission, while in the next section, the focus will be on the legal assessment confirmed and extended by the General Court.

5.1.1 The Economic Reasoning developed by Tomra

The economic report presented by Tomra assumes the following scenario. A dominant firm sells to the customer a unit of product at a list price of 1€. Furthermore, the customer's total demand is equal to 120 units and the dominant firm grants a retroactive rebate of 10% if the customer reaches a volume threshold of 100 units. Moreover, the economic report assumes the extreme situation where the suction effect produced by the retroactive rebate is maximum, that is in correspondence of the last unit before the threshold (i.e. an amount of units purchased by the customer equal to 99). Hence, if the customer increases the quantity of units purchased from 99 to 100 triggering the discount of 10%, the customer pays a negative price of 9€ for the 100th unit and the total revenues for the firm fall from 99€ to 90€. Therefore, counting only on the contestable demand, which is equal to 21 of the 120 total units, the rival firm would be obliged to offer to the customer an effective price of 0.43€ (applying the Formula 2 above shown: 1 [1 - (10% / 17.5%)], being the share of contestable demand equal to 21/120). Likewise, the effective price of 0.43€ can be calculated as the difference between the total amount the customer would pay if it satisfies its total demand from the dominant firm (120×0.90€ = 108€)

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[22]Maier-Rigaud, F.P., Vaigauskaite, D. (2006), *Prokent/Tomra, A Textbook Case? Abuse of Dominance under Perfect Information*, EC Competition Policy Newsletter, Issue 2, European Commission, Brussels, Belgium, pp. 23-24.

and the total amount the customer would pay if it satisfies only its non-contestable portion from the dominant firm switching the contestable portion to the rival firm (120-21×1€ = 99€), all divided by the contestable demand (9/21 = 0.43€). Thus, according to Tomra, even if calculated on the last unit, the effective price the rival firm should match would be feasible for any competitor, being sufficient to cover the average total cost of production (the report suggests that the average total cost of production borne by Tomra is lower than 0.43€).

Figure 3 - *The Economic Reasoning developed by Tomra*

(A)

(B)
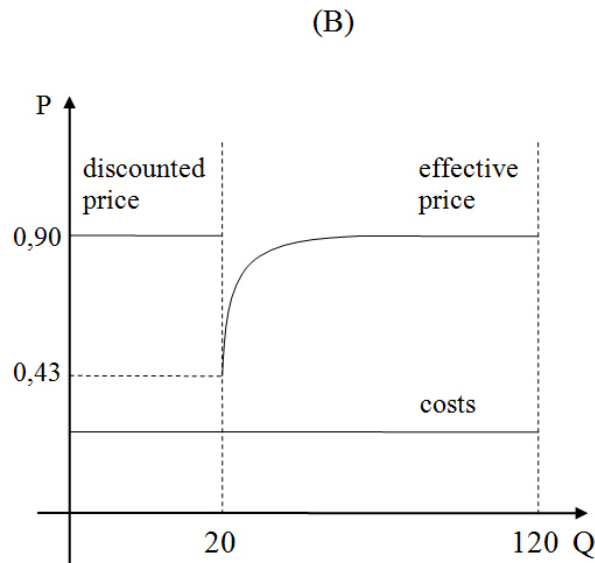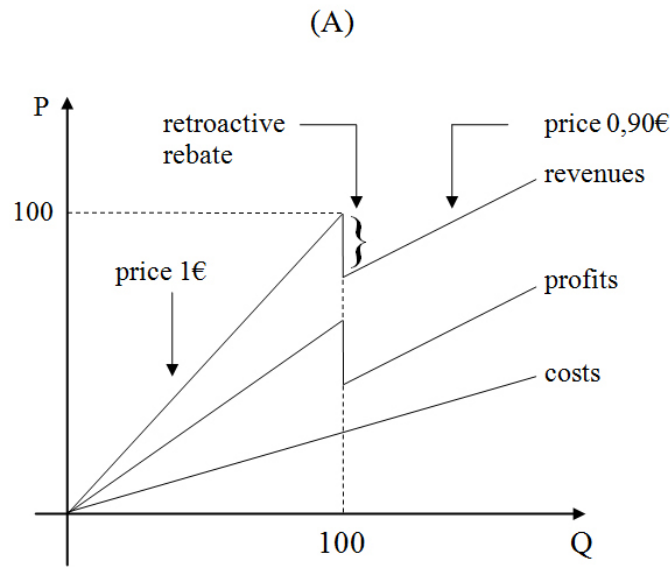
Figure 3(B) illustrates the effective price that the rival firm must offer to recompense the customer in case of loss of the discount proposed by the dominant undertaking. Furthermore, the graph shows two other extreme cases. On one side, if the rival firm competes just for the quantity of units above the threshold, i.e. 20 units, then the customer can still continue to buy 100 units and to benefit from the dominant firm's retroactive rebate. Thus, the price the rival firm has to match is equal to 0.90€, i.e. the price discounted the customer pays to the dominant firm for the incremental units once the threshold quantity has been reached. On the other side, if the rival firm is able to compete for the entire size of the customer's demand, i.e. 120 units, then the retroactive rebate granted by the dominant firm loses its loyalty effect, turning into a price cut. Again, the price the rival firm must match, in order to take away all customers from the dominant firm, is equal to 0.90€[23].

Between the two extreme cases, the rival firm is obliged to offer to the customer an effective price below 0.90€. In particular, the more units the rival firm sells, the higher is the price it can charge, being gradually in a better position to recoup over a larger number of units the retroactive rebate lost by the customer. On the contrary, in the worst scenario, that is where the rival firm has only an additional unit over which to spread the discount (i.e. 21 units sold by the rival firm and 99 units sold by the dominant firm), the rival firm must cut the price until the minimum level of €0.43, in order to leave the customer indifferent between its offer and the one proposed by the dominant undertaking.

In conclusion, the defence presented by Tomra is essentially based on the analysis of the average price the rival firm must offer to compete with the retroactive rebate granted by the dominant undertaking: the focus is on the average price per unit (theoretically, the rival firm could adopt a non-linear pricing, setting a certain price for the 20 units above the threshold and a different price starting from the 21st unit onward). However, the final aim of the economic reasoning developed by Torma is to demonstrate that an as-efficient competitor would be able to compete profitably, covering the costs of production even in the worst case, that is when it sells just the sufficient quantity of units that prevents the customer from benefiting from the

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[23]RBB Economics (2007), *Tomra: Rolling Back Form-Based Analysis of Rebates?*, RBB Brief 21, available on the web-site www.rbbecon.com, pp. 1-2.

retroactive rebate and that obliges the rival firm to offer the lowest effective price possible in order to compensate the customer for the discount lost.

5.1.2 The Economic Reasoning developed by the European Commission

The Commission rejects the analysis proposed by Tomra, since the behaviour of the rival firm would not be profit maximizing (although, it is important to underline, it does not mean that it would not obtain a positive profit in case it matches the retroactive rebate granted by the dominant undertaking selling 21 units). In fact, for the rival firm would be more convenient and rational to forego the last unit and to sell exclusively the incremental units above the threshold (i.e. 20 instead of 21 units), being constrained to match only the dominant firm's discounted price (i.e. 0.90€) but not to offer the much lower effective price that would compensate the customer for the loss of the discount (i.e. 0.43€).
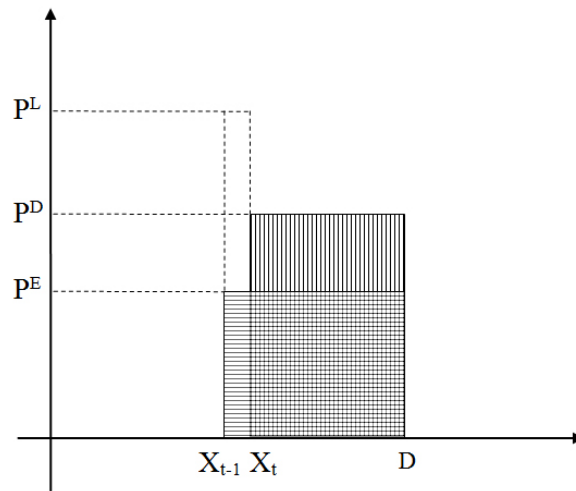
As a result, renouncing to offer the last unit, the rival firm would obtain total revenues of 18€ (total sales of the units above the threshold times discounted price: 20×0.90€), instead of 9€ (total sales of the units above plus last unit before the threshold, times effective price: 21×0.43€). Furthermore, not only the rival firm would lose revenues selling the marginal unit at a negative price, but it would dispense the dominant firm from granting the rebate, increasing the revenue gap between the two competitors)[24].

Figure 4 illustrates the higher level of total revenues the rival firm would obtain in case it renounces to the last and marginal unit and sells only the units above the threshold at the discounted price (i.e. area shaded by vertical lines), in comparison with the lower level of total revenues the rival firm would obtain in case it sells also the last and marginal unit at the effective price, matching the retroactive rebate granted by the dominant firm (i.e. area shaded by horizontal lines)[25].

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[24]The Commission explains in the following terms why compensating and matching the retroactive rebate, bearing a loss at the margin, does not make economic sense, being against the individual rationality: "*Selling all D-(T-1) units implies making profits of (D-T)p* minus the negative price of the marginal unit before the threshold. This clearly violates individual rationality. [...] It makes no sense to behave like this because by taking the unnecessary loss of selling the marginal unit, the incumbent avoids paying out the rebate. In fact, stepping in with a negative price saves the incumbent from paying out the rebate*", (paragraphs 388-389 of the Commission Decision).

[25]*Supra* note 18, p. 150.

Figure 4 - *The Economic Reasoning developed by the European Commission*

P^L = list price
P^D = discounted price
P^E = effective price
D = total demand
X$_t$ = total units necessary to reach the threshold

5.1.3   Critical Assessment

The prohibition decision issued by the Commission in the *Torma* case is mainly based on the observation that the retroactive rebate granted by the dominant undertaking would be potentially able to force the rival firm to adopt an irrational behaviour, obliging it to bear an unnecessary loss and to renounce to a higher level of profits. However, the approach adopted by the Commission, since it appears to focus exclusively on the last unit prior to the threshold and to consider a negative price for the marginal unit equal to an exclusionary foreclosure, risks to establish a per se prohibition for any type of retroactive rebate.

As it has been demonstrated above in the economic analysis of loyalty discounts and rebates, the incremental price, which a customer has indirectly to pay for the marginal units necessary to reach the threshold, is most of the times negative. Given the non linear and rollback nature of the rebate, the total expenditure borne by the customer faces a discontinuity in correspondence of the threshold. As a result, an assessment that focuses solely on the units in proximity of such discontinuity seems

incomplete because it ends up stating that the retroactive rebate is exclusionary just because it entails a negative price for the units close to the purchasing target. In fact, the same DG Competition Discussion Paper had already suggested in 2005, even before the publication of the final Guidance Paper in 2009, that: "*The suction effect in principle is strongest on the last purchased unit of the product before the threshold is exceeded. However, what is relevant for an assessment of the loyalty enhancing effect is not competition to provide an individual unit, but the foreclosing effect of the rebate system on commercially viable amounts supplied by (potential) competitors of the dominant supplier*" (paragraph 154 of the Discussion Paper, substantially reproduced in the paragraph 40 of the Guidance Paper).

Furthermore, as it has been explained above in the critical assessment of the As-Efficient Competitor test, a retroactive rebate causes an anti-competitive foreclosure only if the dominant firm faces an inelastic portion of the demand, which in turn prevents the rival firm from reaching its minimum efficient scale of production (as shown, the contestable portion of the customer's demand would oblige the rival firm to offer a below cost price). It is therefore extremely important in detecting the anti-competitive effect of a retroactive rebate to demonstrate the presence of an assured base of sales, which however must not be assumed to exist just because there is a dominant firm in the relevant market.

As a result, regarding the theoretical example advanced by Torma and rejected by the Commission, two critical considerations appear necessary. Firstly, assuming for the purpose of the present critical assessment that the average total cost per unit is equal to 0.30€, only if the assured base of sales is at least equal to 86 units, the retroactive rebate would oblige the rival firm to offer a below cost price (applying the Formula 2 above shown: $1 [1 - (10\% / 14\%)] = 0.29$€, being the share of contestable demand equal to $14/100$). It is worthy to note that in our analysis, as a conservative assumption, we count only the contestable units below the threshold (i.e. 14 units) and not, as instead Tomra assumes, also the units above the threshold (i.e. 20 units, being the customer's total demand equal to 120 units and the threshold set by the dominant firm equal to 100 units, for a total of 34 contestable units, as Tomra would suppose, over which the rival firm could recoup the retroactive rebate). Considering the units above the threshold as not foreclosed, one could argue that it is not correct to count these units before as not closed to competition and then to use the same units to deny the existence of an anti-competitive foreclosure, as Tomra seems to do with its "average" logic.

Secondly, assuming a more realistic scenario where the inelastic portion of the customer's demand is at a lower level than the one supposed in the extreme scenario proposed by Tomra and analysed by the Commission, such that an as-efficient competitor could compete at least for 32 units, the result would be a higher level of profits for the rival firm in case it matches the retroactive rebated granted by the dominant firm compensating the customer for the discount lost, than in case it sells only the units above the threshold. In fact, in the first case, the rival firm would obtain total profits of 12.4€ (total units below the threshold times effective price, 32×0.69€, all minus the relative costs, 32×0.30€; applying the Formula 2 above shown, the effective price is equal to: 1 [1 - (10% / 32%)] = 0.69€, being the share of contestable demand equal to 32/100), instead of 12€ (total units above the threshold times discounted price, 20×0.90€, all minus the relative costs, 20×0.30€).

Also here, it is worthy to note that, given the conservative assumption above-mentioned, we count only the contestable units below the threshold (i.e. both the dominant and rival firm would remain totally free to compete for the units above the threshold, over which however we do not spread the loyalty discount for the calculation of the effective price). Thus, in a more realistic scenario, the rival firm, through the margins gained from the expansion of production on the incremental units, would be able to more than compensate the discount lost by the customer, earning a level of profits higher than if competing just for the 20 units above the threshold.

Even in the extreme scenario where the dominant firm sets the threshold level perfectly equal to the customer's demand, the rival firm could profitably match the retroactive rebate granted by the dominant undertaking. In fact, if the average total cost is lower than 0.43€, the rival firm, selling 21 units, would obtain a positive profit, despite the fact that the implicit price of the first units would be negative. The critical assessment here developed demonstrates therefore how, in the theoretical example advanced by Torma and rejected by the Commission, the focus on the last marginal unit amounts to a partial analysis, which does not permit to express a complete judgement about the possibility for the rival firm to contest the retroactive rebate granted by the dominant firm (as it has been show, in fact, the loss of profit in correspondence of the cross from the 20th to the 21st unit could be more than compensated in a more realistic scenario).

In conclusion, the main problem in the economic reasoning developed to reject the Tomra's defence is the generalisation and overestimation of an evident and nar-

row result, to state that the rebate system granted by the dominant undertaking is capable of foreclosing actual or potential competitors. However, if the price a rival firm has to contest is calculated only on very limited portion of contestable demand, the risk is to protect inefficient firms from a healthy and lawful price competition.

5.2   The Judgement of the General Court (2010)

In the *Tomra* case, the General Court, losing the opportunity to launch the envisaged application of an economic analysis to unilateral conducts by dominant firms, confirmed the established case-law, considering unnecessary the evaluation of the actual effects produced on the relevant markets by the alleged abuses. Entirely consistently with the position adopted by the Commission in relation to the key points of the case in question, the General Court essentially based its judgment on the mere capability of the strategies undertaken by the Norwegian group of foreclosing its main competitors. In the light of these premises, the General Court itself, in the course of its ruling, disregards any in-depth examination of the economic assessment carried out by the Commission to ascertain the unlawful nature of the practices objected to Tomra, dismissing the appeal made by the company, mainly founded on economic arguments.

5.2.1   Intention to Foreclosure vs Intention to Harm

The judgement rendered by the General Court starts by making the following observations: a rebate scheme which has a foreclosure effect on the relevant market must be considered abusive if it is applied by a dominant firm (paragraph 211); in order to evaluate whether a rebate scheme is to be deemed abusive, it is necessary to verify if, "*following an assessment of all the circumstances*", it is "*capable*" or "*intended*" to restrict the level of competition on the concerned market (paragraph 215). Therefore, although the General Court, like the Commission, seems to recognize a rule of reason rather than a per se rule given the requisite to evaluate "*the circumstances*" and "*the context*" in which the practice takes place, its ruling actually does not explain the elements that an examination of the "*the circumstances*" and "*the context*" of the case is to incorporate. The General Court, approving with no *caveats* the approach endorsed in the Commission Decision, does not provide any further and specific guidance in this regard. In addition, this clarification appears to be in contrast to what rightly declared in relation to the intention to harm. The General Court states that the Commission has not based its decision against Tomra

neither on its internal documentation, nor on its premeditated actions, being merely facts useful to contextualize the alleged practices, but without any substantial impact on the finding of abuse (paragraphs respectively 39 and 40).

5.2.2 As-Efficient Competitor Test

In its appeal, Tomra affirms that the Commission, in order to establish the existence of an anti competitive foreclosure, has erroneously focused on the "*content*" of the agreements rather than on the "*context*" of the markets (paragraph 200). Consequently, the applicant advances the economic argument according to which the coverage of its agreements was not sufficiently large to be capable of having an exclusionary effect on an as-efficient competitor, demonstrating that its practices affected only a limited part of the market, whereas the residual part continued to be completely contestable (on average around 61% for the five national markets). Furthermore, the company emphasizes the fact that the Commission, contrary to what advocated in the Discussion Paper, has not verified whether the market situation was such as to allow one or more competitors to compete profitably, neither estimating the contestable portion of the customer's demand and the minimum viable scale, nor performing a quantitative price-cost test to prove empirically the capability of the alleged practices of foreclosing competitors and harming consumers. On the contrary, it has merely calculated the incremental price a rival firm would need to offer to match the retroactive rebate granted by the dominant firm on the last units. In particular, in the opinion of Tomra, the Commission Decision has not shown the capability of retroactive rebates of forcing the main rivals to set a below-cost price (paragraphs 247-249).

Even though the claim filed by Tomra was based on an solid background in line with the Guidance Paper, the General Court completely rejected the plea, asserting that the foreclosure of a substantial part of the relevant market cannot be defended by displaying that the size of the contestable market is large enough to permit to a limited number of rival firms to compete. In this regard, the three principal motivations provided by the General Court are: firstly, "*the customers on the foreclosed part of the market should have the opportunity to benefit from whatever degree of competition is possible on the market*" (paragraph 241); secondly, "*the competitors should be able to compete on the merits for the entire market and not just for a part of it*", as well as "*it is not the role of the dominant undertaking to dictate how many viable competitors will be allowed to compete for the remaining contestable portion of demand*" (paragraph 241); thirdly, "*it is difficult to concur with the ap-*

plicants' argument that a competitor may offset the lower prices that it is obliged to charge a customer for units below the threshold by selling additional units to the same customer (above the threshold). In fact, that customer's remaining demand is at best limited, so the competitor's average price will remain structurally unattractive" (paragraph 270). These statements seem to resemble what assumed by the Commission in its decision, that is, given the presence of a retroactive rebate, if the customer's demand is higher than the threshold level then all units below the latter are foreclosed, or if the if the customer's demand is lower than the threshold level then the entire customer's demand is foreclosed (paragraphs 365-377).

However, it is important to notice that the three lines of reasoning abovementioned appear to be affected by many flaws. In the first statement, the General Court does not focus on the market foreclosure but on the customer foreclosure, therefore it seems to consider that also a customer foreclosure itself is an abusive conduct (such a reasoning, for instance, would be particularly risky in case of exclusive dealings)[26]. In the second statement, it seems to assume that any retroactive rebate entails an abusive foreclosure, when instead it should be presumed only in case it is granted on the entire demand. Such a reasoning, in extremis, would lead also a 1 percent coverage under the scrutiny of the Art. 102 TFEU . Despite this, the fact that a loyalty scheme generates a foreclosure effect resides in its nature, but it certainly does not mean that it is anti-competitive and thus able to influence the entry or exit decision of a rival firm. In the third statement, which appears as the most problematic, it seems to suppose that, given the existence of a retroactive rebate and the fact that the price set by the dominant firm for the incremental units before the threshold is likely to be very low, the compensating price the rival firm must offer would remain *"structurally unattractive"*, even in the case the rival firm is able to use the units above the threshold as leverage to counterbalance the lower price to be offered for the units below the threshold[27].

As it has been shown in the previous sections, the Guidance Paper expressly states that to correctly evaluate the exclusionary nature of a retroactive rebate is not enough to focus exclusively on the marginal incremental unit before the thresh-

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[26]Ryan, A. (2011), *Case T-155/06 Tomra v. Commission. What exactly are the Rules?*, in *Rebates Law Revisited? The General Court's Ruling in Tomra v. Commission*, Global Competition Law Centre, Brussels, Belgium, 21 January 2011, p. 7.

[27]Federico, G. (2011), *Tomra v Commission of the European Communities: Reversing Progress on Rebates?*, European Competition Law Review, Vol. 32, No. 3, Sweet & Maxwell, London, United Kingdom, p. 140.

old (and in more general, on the last units, as the General Court seems to do), but instead it is necessary to realize a complete examination of the rebate structure (Guidance Paper, paragraph 40: *"what is in the Commission's view relevant for an assessment of the loyalty enhancing effect of a rebate is not simply the effect on competition to provide the last individual unit but the foreclosing effect of the rebate system"*). For this purpose, it is thus required to calculate the effective price a rival firm would need to set to match the dominant firm's rebate system (Guidance Paper, paragraph 41: *"the Commission will estimate what price a competitor would have to offer in order to compensate the customer for the loss of the conditional rebate if the latter would switch part of its demand (the relevant range) away from the dominant undertaking"*). Only doing this, it is possible to verify whether an equally efficient rival would be able to compete profitably, relying on the contestable portion of the customer's demand (Guidance Paper, paragraph 42: *"it will generally be relevant to assess in the specific market context how much of a customer's purchase requirements can realistically be switched to a competitor"*).

As it has been demonstrated above in the economic analysis of loyalty discounts and rebates, even if the average price a rival firm must offer to the customer is lower than the discounted price proposed by the dominant firm, it does not absolutely mean that for the former would not be profitable, using the contestable portion of the customer's demand at its disposal, even at the cost of bearing a negative incremental price for the units around the threshold. The presumption on which the third statement is based appears therefore to be not justified from an economic standpoint. Only after having applied a price-cost test such as the one designed by the Commission and performed in the *Intel* case (section 4.2.3 of the Commission Decision, where it is shown that the contestable share at disposal of the main rival ADM was not sufficient to contest the discount scheme offered by Intel[28], a similar conclusion could be reached, showing that the effective price a rival firm would need to match is below cost. As a result, being in sharp contrast to the new approach recommended in the Guidance Paper, this passage can be indubitably considered as the least satisfactory part of the analysis made by the two EU institutions.

Moreover, in this respect, the General Court makes a further questionable assertion in the section of the judgement where it seems to implicitly affirm that one of the essential aim of Art. 102 TFEU is the protection of competitors, in parallel to

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[28]Commission Decision of 13 May 2009, *Intel*, Case COMP/C-3/37.990, D(2009) 3726.

and separately from the protection of consumers (paragraph 206: *"the prohibition laid down in that provision is - also - justified by the concern not to cause harm to consumers"*, emphasis added). Consequently, according to the General Court, both the protection of competitors or the protection of customers would be a sufficient reason to find an abuse, when instead the Commission in its Guidance Paper affirms that it is necessary to detect simultaneously an anti-competitive foreclosure leading to consumer harm. In fact, what matters is *"protecting an effective competitive process and not simply protecting competitors"*, as well as *"to ensure that dominant undertakings do not impair effective competition by foreclosing their competitors in an anti-competitive way, thus having an adverse impact on consumer welfare"* (Guidance Paper, respectively paragraphs 5 and 19).

5.2.3   Form-Based Approach vs Effects-Based Approach

As a matter of fact, in the Commission Decision, it must be recognized that an economic analysis of the actual effects of the alleged practices is not totally absent. However, in the present assessment, for form based analysis we do not simply mean that a certain conduct is presumed abusive if it presents predetermined and specific characteristics, but rather the absence of a deep examination of the conduct in terms of consumer and competition harm. In fact, the analysis carried out by the Commission appears limited to: the comparison between the tied markets shares and the market shares held by the Norwegian group (on the base of the equation: the higher the former, the more stable the latter, the less strong the competitors); the fact that the prices set by Tomra, despite the rebates granted, did not fall but rose; the observation of the Prokent's insolvency. In its petition, Tomra contests these findings, showing on the contrary that: the diagrams illustrating the suction effect contained mathematical errors; most of the results provided by the Commission were contradicted by empirical evidence; the prices did not increase and were not negative, even considering only the last unit before the threshold; the relationship between the tied markets shares and the market shares held by Tomra was statistically inconsistent; the German supplier left the market only after the termination of the alleged abuses.

Nonetheless, it is the same General Court to eventually clarify the matter, explicitly admitting that the Commission has not based its finding of abuse on the actual impact of the alleged practices, but it has *"merely complemented"* it with a *"brief examination"* of the effects produced by the contested practices on the national markets (paragraph 288, which is in open contrast to the paragraph 219, where the General Court states that *"the Commission, even though the case-law does not*

require it, also analysed, in the light of market conditions, the actual effects of the applicants' practices", analysis that as mentioned appears substantially limited in the text of the decision). Recalling the traditional case-law, the General Court reminds once again that, in order to establish an infringement, it is not compulsory to prove that the abusive conduct causes a competitive impact on the relevant market, but it is sufficient to show that it "*tends to restrict competition*" or "*is capable of having that effect*" (paragraphs 288-289)[29].

In the opinion of the General Court, considered that the analysis realized by the Commission "*merely complemented its finding of infringement*", some errors (although actually most of the graphs contained fundamental mistakes) in the same analysis cannot be used to invalidate its decision (paragraphs 268 and 290). The General Court seems to mean that even a wrong analysis of the actual effects could not be used to confute the conclusions reached by the Commission in regard to the foreclosure nature of Tomra's retroactive rebates. In fact it affirms that "*the fact that the retroactive rebate schemes oblige competitors to ask negative prices from the applicants' customers benefiting from rebates cannot be regarded as one of the fundamental bases of the contested decision in showing that retroactive rebate schemes are capable of having anti-competitive effects*" (paragraph 258), statement that summarizes and underlines how the evaluation of the two EU institutions is particularly distant from the price-cost test proposed in the Guidance Paper. Once again, the General Court appears to attach more importance to the loyalty effect of the practice itself rather than to its actual capability of excluding competitors from the market, as demonstrated by the fact that the General Court rejects entirely Tomra's proof regarding the absence of actual foreclosure and instead focuses only on the potential nature of the alleged conducts to foreclose competition. Nonetheless, such a reasoning seems to be particularly worrying, since a dominant firm would be in any case incapable to prove the lack of actual effects and thus unable to contrast a finding of abuse.

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[29]The Court in the paragraph 288 of the judgement delivered for the *Tomra* case quotes the rulings rendered for the *British Airways* and *Michelin II* cases, where itself had already stated that: "*The effect referred to in the case-law (...) does not necessarily relate to the actual effect of the abusive conduct complained of. For the purposes of establishing an infringement of Article [102 TFEU], it is sufficient to show that the abusive conduct of the undertaking in a dominant position tends to restrict competition or, in other words, that the conduct is capable of having that effect*" (paragraph 239 of the *Michelin II* judgement which is conceptually equal to the paragraph 293 of the *British Airways* ruling).

5.2.4 Pro-Competitive vs Anti-Competitive Practices (Theory of Consumer Harm)

As a result, it appears clear that the General Court does not fully address the complaint presented by Tomra, according to which a correct and proper foreclosure analysis should be necessarily based on a detailed economic-oriented examination, in line with the test proposed by the same Commission in the Guidance Paper. The General Court affirms only in general terms that, foreclosing on average approximately 40 percent of the total demand and thus involving a substantial part of the market, the practices at stake were capable of reducing the number of rivals operating in the market. Therefore, an assessment of the circumstances and the context of the case, such as the one carried out by the Commission, is enough to determine whether the practices of a dominant undertaking are capable of excluding competitors (paragraphs 242-243). In a subsequent paragraph, the General Court seems to consider even possible to presume (despite it does not mean to ascertain) the exclusionary potential of a retroactive rebate simply taking into account a set of generic and qualitative elements typical of a rebate structure, such as its individualised and retroactive nature, as well as its application to a large portion of customers (paragraphs 260-261).

However, in the passages above-mentioned, the main concern derives from the exclusive focus on the ability of the practices of decreasing the number of competitors, which actually should be deemed only as a necessary but not sufficient condition to judge the alleged conducts as anti-competitive. In fact, the risk is to make an erroneous distinction between pro-competitive and anti-competitive practices, as well as to safeguard a certain and existing market structure only because any variation is presumed to cause consumer harm, while instead it could be the result of a price competition among firms which would increase the consumer welfare.

In the light of the critical assessment developed in the previous section (where it has been demonstrated that a standard predatory test would not be suitable in case of loyalty discounts), it is necessary to recognize that the General Court in its judgement correctly asserts that a retroactive rebate granted by a dominant firm must not entail a profit sacrifice for it to be considered anti-competitive. The justification provided is that a loyalty discount can be spread over a large amount of units such as to allow the dominant firm to set an average price above cost (paragraph 267), statement which in turn seems to remind what declared by the Commission in its Guidance Paper (paragraph 39: "*a conditional rebate granted by a dominant*

undertaking may enable it to use the non-contestable portion of demand of each customer [...] as leverage to decrease the price to be paid for the contestable portion of demand", reasoning adopted as well in the *Intel* decision at the paragraphs 1005 and 1612). Thus, according to the General Court, Tomra on one side has foreclosed part of its main competitors through the implicit setting of a very low incremental price, and on the other side has imposed its retroactive rebates on customers, depriving them of the possibility to benefit from the offers proposed by other competitors.

In this regard, the main criticism to the leverage effect theory has been the following one. It is certainly true that if a dominant firm grants a retroactive rebate spread on both the non-contestable and contestable portion of the customer's demand, then the rival firm must match it only using the contestable share. Anyway, this would not mean that the dominant firm has an absolute advantage on the contestable share, for which both firms set the same effective price and that the resulting foreclosure does not entail a profit sacrifice (reason why, in order to condemn the allege conduct, it should be proved the possibility of a future recoupment)[30].

Nevertheless, as above shown, the main problem is not so much the leverage effect, but the impossibility for an as-efficient rival to reach its minimum efficient scale of production given the presence of a monopolized portion of demand, which can entail an anti-competitive foreclosure even though the dominant firm does not bear a profit sacrifice. Moreover, the leverage effect itself is not enough to have the practices in question to be considered not only anti-competitive, but also leading to consumer harm. Indeed, in particular in a case such as *Tomra* where, as often underlined, the contestable portion of the demand was rather substantial, the presence of other rivals firm could be likely to impede the dominant firm from engaging in exclusionary conducts able to generate a consumer harm. Hence, in such a scenario, an incomplete and partial analysis could easily result in a false-negative error, judging unlawful a conduct that instead is beneficial rather than harmful to consumers.

Apart from this, although the two EU institutions seem rightly to not embrace a predatory theory of harm, on the other hand neither the Commission nor the General Court have explicitly adopted a specific theory of harm to evaluate the alleged

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[30]Federico, G., Regibeau, P. (2010), *Exclusionary Discounts under Article 102: In Search of the Right Theory of Harm*, in *Competition with Non-Linear Pricing and Loyalty Discounts*, Centre for Law and Economics, Alma Mater Studiorum - Università di Bologna, Bologna, Italy, 6 November 2010, p. 14.

conducts. The mere fact that around 60% of the total demand was fully contestable would have required not only to carry out a complete effects-based analysis of the practices contested, but also an empirical assessment of the harm suffered by consumers, taking into account of course the approximations that such a evaluation would entail (among the lines of what realized in the *Intel* case, where, beyond the as-efficient competitor test, it has been provided abundant qualitative and quantitative evidence of consumer harm - cf. section 4.2.6 of the Commission Decision).

5.2.5   Serious Infringement vs Very Serious Infringement

Finally, even though the amount of the fine is rather small in comparison with those imposed in other cases, if its value is measured in proportion of the turnover of the firm, it constitutes the highest sanction ever levied for an abuse of dominant position in the EU case-law. It appears particularly significant therefore the fact that for a company which results only 57th in terms of size in its country, as well as for a such narrow industrial sector, the Commission has decided to impose against a *"serious infringement"* a fine equal to 8 percent of the Tomra's turnover, while in earlier cases it has decided to impose against a *"very serious infringement"* a fine equal, for instance, only to 1,5 percent of the Microsoft's turnover (paragraph 305).

Though the General Court reminds that fines imposed in other cases must not be considered source of comparison having a binding effect (paragraph 314), one could argue that, after the several criticisms received for the formalistic approach utilized in the past for fundamental cases in the field of loyalty discounts and rebates, through the *Tomra* case, the main intention of the Commission was to create a *"textbook case"* (as it has been defined by the same officers working in the case). The aim has been to test what was previously proposed in the academic community, subsequently designed in the Discussion Paper and ultimately adopted in the Guidance Paper, although, as the present section has shown, its application has not been fully satisfied, being particularly distant from an analytical and quantitative approach.

5.3   The Judgment of the Court of the European Union (2012)

In 2012 the Court of Justice of the European Union confirmed the administrative sanction towards Tomra, rejecting entirely the appeal filed by the Norwegian multi-

national corporation against the judgment rendered by the General Court in 2010, which in turn had validated the decision provided by the Commission in 2006. Therefore, through the judgment of the Court in the third and last instance, a proceeding started a decade earlier finally comes to an end.

5.3.1 Objective Intent vs Subjective Intent

In its appeal, Tomra contests the fact that the Commission did not demonstrate the anticompetitive intent of the practices objected, as well as it did not take into account the evidence offered by the Scandinavian group related to its intent on competing on the merits. The Court then reminds that the notion of abuse of dominant position must be considered as an objective concept. In fact, the Commission did not base its decision exclusively on the evidence connected to the Tomra's subjective intent. Nevertheless, *"it is clearly legitimate for the Commission to refer to subjective factors, namely the motives underlying the business strategy in question"* (paragraph 19). Thus, the presence of an anticompetitive intent represents only one factor among several to be examined to ascertain the existence of an abuse, however it must not be considered binding. Therefore, according to the Court, the Commission was not obliged to attest the anticompetitive intent, rather to prove, considering all the relevant circumstances, that Tomra's conducts tended or were able to foreclose competitors. In other terms, according to the Court, if the conduct of a dominant firm is able to restrict competition, it is not necessary to analyze the concrete effects of such conduct. Furthermore, the Court affirms that the intent on competing on the merits, even in the case it is established, in any case cannot prove the absence of an abuse.

5.3.2 Foreclosure Threshold

In addition, the Norwegian group declares that the General Court did not provide sufficient evidence in order to demonstrate that the contractual agreements proposed by Tomra were able to cover a portion of the total demand such to restrict competition, as well as it did not explain what it meant for substantial part of the market. In fact, in the opinion of Tomra, the Commission should have applied an analytic test following objective benchmarks. The Court, recalling the traditional notion of dominant position constantly recurring in the European competition law, then declares, along the lines of what already stated by the General Court, that the foreclosure of a substantial part of the market by a dominant firm cannot be justified

showing that the contestable portion is enough to leave space to a limited number of competitors. Customers must always have the opportunity to benefit from whatever degree of competition is possible on the market, as well as competitors must always be in the conditions to compete for the entire market and not only for a part of it. Moreover, the Court rejects the possibility to apply a minimum viable scale test, since the definition of a foreclosure threshold above which the practices objected become illegal is deemed not necessary for the purposes of applying Art. 102 TFEU. As mentioned for the judgement rendered by the General Court, in our opinion, such statements appear not justified from an economic point of view. In fact, the risk is that any exclusive agreement, even if applied to a *de minimis* portion of the relevant market, is judged illegal. The Court seems aware of the weakness of its statements, such that it tries to head off plausible criticisms declaring that it is possible to determine the portion of the market above which the conducts of a dominant firm become illegal only after having implemented, following a case-by-case approach, an analysis of the circumstances similar to that one realized by the Commission for the case at issue.

5.3.3 Form-based Analysis vs Effects-based Analysis

Lastly, Tomra deems that the General Court committed a mistake not asking to the Commission to demonstrate that the retroactive rebates offered by the Norwegian group generated below cost sells. The Court then affirms that a fidelity scheme proposed by a dominant firm must be judged illegal if it prevents customers from switching supplier. Furthermore, the presence of negative prices must be not considered an essential requirement to judge abusive a loyalty discount. Hence, the Court approves the position taken by the General Court according to which, thanks to its suction effect, a fidelity discount itself is able to foreclose rivals from the contestable portion of the demand (for this reason, it is not necessary to apply a price-cost test). It was therefore sufficient for the Commission to demonstrate that the retroactive rebates offered by Tomra, which covered almost the total demand of the customers, together with their retroactive nature, provided strong incentives to the customers to satisfy the purchasing expenditure almost totally from Tomra (*"it is necessary to consider all the circumstances, particularly the criteria and rules governing the grant of the rebate, and to investigate whether, in providing an advantage not based on any economic service justifying it, the rebates tend to remove or restrict the buyer's freedom to choose his sources of supply, to bar competitors from access to the market, or to strengthen the dominant position by distorting competition"*, paragraph 71).

In the opinion of the Court, in correspondence of a similar fidelity effect, it was not necessary to demonstrate that the price set by Tomra were or not lower than the long run average incremental cost, as well as it was not necessary to realize an analysis of the real effects of the conducts objected, since, for the purposes of applying Art. 102 TFEU, it is enough to demonstrate that the conducts alleged are potentially able to restrict competition. Given that the judgment rendered by the Court presents again almost entirely the motivations advanced by the General Court, we judge such statements not justified from an economic standpoint for the reasons explained in the previous section.

5.4   Conclusions and Perspectives

The evaluation of Tomra's retroactive rebates carried out by the EU institutions, despite the fact that it is not based on a per se prohibition but tries to implement a sound economic methodology of analysis, still resembles to some extent the formalistic-legal approach that has characterized in the past decades the EU case-law, constantly leading to an artificial taxonomy and to different interpretations of commercial practices with the same market effects. On the basis of this case-law, the only form of rebate judged as not entailing anti-competitive effects has been that one having an incremental application to standardised volumes of units, even though it was necessary to demonstrate the presence of cost savings or other efficiencies in the distribution phase[31].

In this context, the enforcement guidance offered by the Commission has certainly prospected a decisive and useful step towards a more solid economic background in the assessment of exclusionary practices. However, in the *Tomra* case, both the decision provided by the Commission and the subsequent judgements by the General Court and the Court highlight how the EU institutions are still not fully ready to leave behind the established case-law and to implement the policy reform of the enforcement of Art. 102 TFEU, probably frightened by the consistent workload that the new approach requires, as well as by the risk of more costly, lengthy and uncertain administrative proceedings.

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[31]De La Mano, M. (2011), *Competitive Effects of Rebates: Seeking Economic and Legal Consistency*, in *Rebates Law Revisited? The General Court's Ruling in Tomra v. Commission*, Global Competition Law Centre, Brussels, Belgium, 21 January 2011, p. 5.

Nevertheless, all these reasons cannot prevent the Commission from performing a concrete estimation of the actual effects and consumer harm that an abusive conduct generates in a relevant market. Yet, it must be admitted that the economic reasoning at the base of the *Torma* case has probably been developed prior to the publication of both the discussion and guidance papers, and thus at a time where the as-efficient competitor test was only under discussion. Moreover, from a conservative perspective, one could argue that even today the price-cost test is suggested only as a possible, but not compulsory, tool.

Indeed, running cases without implementing an as-efficient competitor analysis would still be compatible not only with the recent EU case-law, but also with Commission general policies, since the Guidance Paper is a support document for internal priority setting purposes and is not intended to represent a statement of law. Nonetheless, such a line of reasoning would risk to compromise the establishment of an effects-based assessment, which, beyond any doubt, appears more and more necessary in the treatment of exclusionary abuses under the EU competition law[32].

What seems to emerge is an institutional dyscrasia, typical of the enforcement of the EU rules. The Commission declares that it will carry out its analyses in a certain manner, described in a soft-law document (which explicitly states that it is not binding for the EU Courts) that moves away from the existing case-law (which is not *de jure* but only *de facto* binding). As a result, firms, even though they will comply with the new rules, will be condemned in any case. Therefore, the EU institutions, if not an opponent of the antitrust reforms, appear as laggards that will start to apply the new rules, finally renouncing to the old jurisprudence, only in a remote future.

It is absolutely true that evaluating empirically the contestable portion of a customer's demand, and more generally, the potential anti-competitive effects of an unilateral conduct is often a particularly complex task (as admitted by the Commission; Guidance Paper, paragraph 41: "*The Commission will take into account the margin of error that may be caused by the uncertainties inherent in this kind of analysis*"). However, an economic approach, even though not flawless, appears

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[32]Report by the Economic Advisory Group for Competition Policy (EAGCP) (2005), *An economic approach to Article 82*, available on the web-site www.ec.europa.eu/competition.

certainly more useful to distinguish between competitive and exclusionary conducts by dominant firms than a formalistic approach. In this sense, an as-efficient competitor test can definitely represent a helpful safe harbour, which should always be considered in any assessment involving loyalty schemes (Guidance Paper, paragraph 27: "*If (...) the data suggest that the price charged by the dominant undertaking has the potential to foreclose equally efficient competitors, then the Commission will integrate this in the general assessment of anti-competitive foreclosure (...), taking into account other relevant quantitative and/or qualitative evidence*").

However, it could be argued that the principles set in the guidelines were already known by the stakeholders due to the public consultations. Furthermore, a timeline dividing pre and post 2009 seems to be arbitrary given that: firstly, the EU Courts have continuously stated that the concept of abuse must be considered objective; secondly, it appears extremely difficult to prove the objective nature of an abuse without implementing a scientific analysis of the effects produced by the conducts objected, such as the as-efficient competitor test (whose application would have been indispensable in a case such as *Tomra*, where both the General Court and the Court have deemed not necessary to evaluate the intent on competing on the merits by the Norwegian group).

In any case, the conclusions reached for the *Tomra* case are in contrast with the economic criterion recently adopted by the Court and the General Court themselves for some margin squeeze and predatory pricing cases[33] (in particular, in contrast with what established in the judgment rendered for the *Post Danmark* case, where the Court has asked to a Danish court, apart from considering all the relevant circumstances, to apply the as-efficient competitor test).

At the moment, it is difficult to forecast whether a national competition authority or a national court will prefer to adopt the approach followed by the EU Courts or that one followed by the Commission. In principle, if a national court is called to judge a loyalty discount case, both for a damage compensation or for an appeal related to a decision by a national competition authority, is obliged to apply the

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[33]Judgment of the Court (Grand Chamber) of 27 March 2012, *Post Danmark A/S v Konkurrencerådet*, Case C-209/10, Official Journal of the European Union, 2012/C 151/4, 26 May 2012; Judgment of the General Court (Eight Chamber) of 29 March 2012, *Kingdom of Spain v European Commission*, Case C-209/10; Judgment of the General Court (Eight Chamber) of 29 March 2012, *Telefónica, SA and Telefónica de España, SA v European Commission*, Case T-336/07.

law as interpreted by the Court. Therefore, the position adopted by the EU Courts cannot certainly be neglected.

As a result, along the lines of the *Intel* case, where the Commission endeavoured to evaluate whether the rebates granted were capable of having a foreclosure effect on an as-efficient competitor, the hope is that also in future abuse of dominance cases the EU institutions will be apt to adopt more explicitly an economic approach, as well as to rely more openly on the Guidance Paper.

References

[1] Ahlborn, C., Bailey, D. (2006), *Discounts, Rebates and Selective Pricing by Dominant Firms: A Trans-Atlantic Comparison*, in Marsden, P. (eds.), *Handbook of Research in Trans-Atlantic Antitrust*, Edward Elgar, Cheltenham, United Kingdom and Northampton, United States.

[2] De La Mano, M. (2011), *Competitive Effects of Rebates: Seeking Economic and Legal Consistency*, in *Rebates Law Revisited? The General Court's Ruling in Tomra v. Commission*, Global Competition Law Centre, Brussels, Belgium, 21 January 2011.

[3] Faella, G. (2008), *The Antitrust Assessment of Loyalty Discounts and Rebates*, Journal of Competition Law & Economics, Vol. 4, Issue 2, Oxford University Press, Oxford, United Kingdom.

[4] Federico, G. (2005), *When are Rebates Exclusionary?*, European Competition Law Review, Vol. 26, No. 9, Sweet & Maxwell, London, United Kingdom.

[5] Federico, G., Regibeau, P. (2010), *Exclusionary Discounts under Article 102: In Search of the Right Theory of Harm*, in *Competition with Non-Linear Pricing and Loyalty Discounts*, Centre for Law and Economics, Alma Mater Studiorum - Università di Bologna, Bologna, Italy, 6 November 2010.

[6] Federico, G. (2011), *The Antitrust Treatment of Loyalty Discounts in Europe: Towards a more Economic Approach*, Journal of European Competition Law & Practice, Vol. 2, Issue 3, Oxford University Press, Oxford, United Kingdom.

[7] Federico, G. (2011), *Tomra v Commission of the European Communities: Reversing Progress on Rebates?*, European Competition Law Review, Vol. 32, No. 3, Sweet & Maxwell, London, United Kingdom.

[8] Greenlee, P., Reitman, D. (2005), *Competing with Loyalty Discounts*, U.S. Department of Justice, Economic Analysis Group, Discussion Paper 04-2, Washington D.C., United States.

[9] Kallaugher, J., Sher, B. (2004), *Rebates Revisited: Anti-Competitive Effects and Exclusionary Abuse under Article 82*, European Competition Law Review, Vol. 25, No. 5, Sweet & Maxwell, London, United Kingdom.

[10] Lang, J.T., Renda, A. (eds.) (2009), *Treatment of Exclusionary Abuses under Article 82 of the EC Treaty*, Centre for European Policy Studies, Brussels, Belgium.

[11] Maier-Rigaud, F.P. (2006), *Article 82 Rebates: Four Common Fallacies*, European Competition Journal, Vol. 2, No. 2, Hart Publishing, Oxford, United Kingdom and Portland, United States.

[12] Maier-Rigaud, F.P., Vaigauskaite, D. (2006), *Prokent/Tomra, A Textbook Case? Abuse of Dominance under Perfect Information*, EC Competition Policy Newsletter, Issue 2, European Commission, Brussels, Belgium.

[13] O'Donoghue, R., Padilla, A.R. (2006), *The Law and Economics of Article 82 EC*, Hart Publishing, Oxford, United Kingdom and Portland, United States.

[14] Office of Fair Trading (2005), *Selective Price Cuts and Fidelity Rebates*, Economic Discussion Paper, A report prepared for the Office of Fair Trading by RBB Economics, London, United Kingdom.

[15] RBB Economics (2007), *Tomra: Rolling Back Form-Based Analysis of Rebates?*, RBB Brief 21, available on the web-site www.rbbecon.com.

[16] Rigaud, F.P. (2005), *Switching Costs in Retroactive Rebates - What's Time Got to Do with It?*, Competition Law Review, Vol. 26, No. 5, Sweet & Maxwell, London, United Kingdom.

[17] Ryan, A. (2011), *Case T-155/06 Tomra v. Commission. What exactly are the Rules?*, in *Rebates Law Revisited? The General Court's Ruling in Tomra v. Commission*, Global Competition Law Centre, Brussels, Belgium, 21 January 2011.

[18] Sher, B. (2009), *Leveraging Non-Contestability: Exclusive Dealing and Rebates under the Commission's Article 82 Guidance*, Antitrust Chronicle, Vol. 2, Issue 1, Competition Policy International, Boston, United States.

Legislation

[1] Commission Decision of 14 July 1999, *Virgin-British Airways*, Case IV/D-2/34.78, Official Journal of the European Communities, 2000/74/EC L 30/1, 4 February 2000.

[2] Commission Decision of 20 June 2001, *PO - Michelin*, Case COMP/E-2/36.041, Official Journal of the European Communities, 2002/405/EC L 143/1, 31 May 2002.

[3] Commission Decision of 29 March 2006, *Prokent-Tomra*, Case COMP/E-1/38.113, C(2006)734.

[4] Commission Decision of 13 May 2009, *Intel*, Case COMP/C-3/37.990, D(2009) 3726.

[5] European Commission (2005), *DG Competition discussion paper on the application of Article 82 of the Treaty to exclusionary abuses*, Brussels, Belgium.

[6] European Commission (2009), *Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings*, Official Journal of the European Union, 2009/C 45/02, 24 February 2009.

[7] Judgment of the General Court of 9 September 2010, *Tomra Systems and Others v Commission*, Case T-155/06, Official Journal of the European Union, 2010/C 288/31, 23 October 2010.

[8] Judgment of the Court (Grand Chamber) of 27 March 2012, *Post Danmark A/S v Konkurrencerådet*, Case C-209/10, Official Journal of the European Union, 2012/C 151/4, 26 May 2012.

[9] Judgment of the General Court (Eight Chamber) of 29 March 2012, *Kingdom of Spain v European Commission*, Case C-209/10.

[10] Judgment of the General Court (Eight Chamber) of 29 March 2012, *Telefónica, SA and Telefónica de España, SA v European Commission*, Case T-336/07.

[11] Judgment of the Court (Third Chamber) of 19 April 2012, *Tomra Systems and Others v Commission*, Case C-549/10, Official Journal of the European Union, 2012/C 165/6, 9 June 2012.

[12] Report by the Economic Advisory Group for Competition Policy (EAGCP) (2005), *An economic approach to Article 82*, available on the web-site www.ec.europa.eu/competition.

The Effectiveness of Competition Policy:
An Econometric Assessment
in Developed and Developing Countries *

Danilo Samà

Abstract

The ultimate objective of the present paper is to empirically investigate the effectiveness of competition policy in developed and developing countries. Although its importance is continuously increasing, the effectiveness of competition policy still seems to lack the attention that it would deserve. At the present state of art, the number of academic contributions that attempts to estimate its impact on relevant economic variables appears very limited, in particular for the less developed countries. However, an empirical literature aimed at measuring in objective terms the effect of competition policy on economic growth is emerging, starting from narrow variables of interest, such as Gross Domestic Product and Total Factor Productivity. As a result, the principal aim of the current work is to contribute to this branch of research, focusing on broader indicators of market performance, in order to understand whether the presence of an antitrust authority has a significant impact, thus an effective utility, on the level of competition of a country.

Keywords: Competition Authorities, Competition Policy, Developed Countries, Developing Countries, Economic Development, Economic Growth, Law & Economics, Market Concentration, Market Efficiency, Market Performance, New Institutional Economics, Political Economy.

JEL Classification: C21; C26; K21; L40

*≪This was one of the best things about Lennon and McCartney,
the competitive element within the team. It was great. But hard to live with≫.*

Paul McCartney

1 Research Proposal

The ultimate objective of the present paper is to empirically investigate the effectiveness of competition policy in developed and developing countries. Although its importance is continuously increasing, the effectiveness of competition policy still seems to lack the attention that it would deserve. At the present state of art, the number of academic contributions that attempts to estimate its impact on relevant economic variables appears very limited, in particular for the less developed countries. However, an empirical literature aimed at measuring in objective terms the effect of competition policy on economic growth is emerging, starting from narrow variables of interest, such as Gross Domestic Product (GDP) and Total Factor Productivity (TFP).

As a result, the current work intends to contribute to this branch of research, focusing on broader indicators of market performance, to understand whether the presence of an antitrust authority has a significant impact, thus an effective utility, on the level of competition of a country. In other terms, the research question behind the current work is rather straightforward: is a competition authority active in a developed or developing country able to implement effectively its primary role? If not, which are the institutional functions and powers that should be strengthened?

From a policy perspective, the aim of the present paper is also to comprehend whether the enforcement of a competition policy regime in a developing country has the same beneficial effects on the intensity of competition usually claimed to take place in the most developed countries. At the same time, it may also be understood whether industrial and institutional differences jeopardize the effectiveness of such a tool of political economy, so much that in emerging countries it would be worthier to assign funds and priority to other tools for economic development.

2 Literature Review

According to the mainstream economic school of thought, competition is the critical process for a market economy to ensure the optimal allocation of resources and the highest level of social welfare. As it is common knowledge, competitive markets enable consumers to purchase better products at lower prices and incentivize firms to improve the quality of the goods and services offered. However, the functioning of competition is not automatic but must be sustained through an intervention by the state, which normally occurs with the adoption of a competition legislation and the creation of a competition authority predisposed to the role of promoter of market democracy. Nevertheless, despite the general consensus, at least from a theoretical standpoint, on the necessity of fostering competition in order to support economic efficiency and fairness on the markets, what appears extremely surprising is the quasi absence of academic contributions trying to assess empirically the effectiveness of competition policy. In the present section, therefore, we provide an exhaustive overview of the results obtained in the empirical literature.

Dutz and Vagliasindi (2000)[1] are the first authors to overcome the traditional approach of the literature, based upon subjective indicators limited to an evaluation of the competition legislations as "in the books". The authors, in fact, exploiting cross-sectional data and looking at the actual practice in 18 transition countries, measure the effectiveness of the different competition policy regimes according to three criteria (i.e. 1. enforcement; 2. competition advocacy; 3. institutional effectiveness). The main result is a positive impact of competition policy on the intensity of competition, the latter as captured by an indicator of economy-wide enterprise mobility. However, the essential drawback of the study remains the low number of countries for which data are available.

Krakowski (2005)[2], after a regression analysis over a sample of 101 countries, reaches two main conclusions: firstly, the experience of the competition authority and the institutional quality of the government explain a substantial part of the perception of the effectiveness of competition policy; secondly, the perceived effec-

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[1]Dutz, M.A., Vagliasindi, M. (2000), *Competition Policy Implementation in Transition Economies: An Empirical Assessment*, European Economic Review, Vol. 44, Elsevier, Amsterdam, The Netherlands, pp. 762-772.

[2]Krakowski, M. (2005), *Competition Policy Works: The Effect of Competition Policy on the Intensity of Competition. An International Cross-Country Comparison*, Hamburg Institute of International Economics, Discussion Paper No. 332, Hamburg, Germany, pp. 1-18.

tiveness of competition policy and the size of the economy have a significant influence on the perceived intensity of local competition, while the presence of a protectionist trade policy seems to not have any impact.

Kee and Hoekman (2007)[3], analyzing a dataset of 42 countries and 18 industries from 1981 to 1998 and controlling for the number of firms and for imports, study the effect of competition policy on a derived industry mark-up function of price over marginal cost, which is taken as a proxy for the intensity of competition. Although no significant impact is found, the authors observe that market entry is facilitated by the existence of a competition legislation, thus such a legislation has an indirect and positive effect on the level of domestic competition. The main drawback of the contribution is that it simply employs a binary variable indicating whether a competition policy regime is in force.

Petersen (2013)[4], using a dataset of 154 countries from 1960 to 2005, finds that competition policy has a strong effect on the level of GDP after ten years, whilst there is no relevant impact on the quality of democracy. Thus, market fragmentation seems neither to favor the transition to a democratic regime nor to strengthen the stability of an established democracy. The most plausible reason for this might be that competition policy is not designed to prevent economic concentration at conglomerate and national level (which, in turn, could promote democracy), but only in particular and specific sectors. Also here, the main weakness of the study is that the effect of competition policy is merely controlled for by a dummy variable.

Finally, Buccirossi *et al.* (2013)[5] estimate the impact of competition policy on productivity growth, analyzing a sample of 22 industries in 12 OECD countries from 1995 to 2005. In order to measure the effectiveness of the different competition policy regimes, the authors construct, principally on the base of a tailored questionnaire, a set of Competition Policy Indicators (CPIs), assessing, for each country and each year, the antitrust infringements (the Antitrust CPI), the merger control

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[3]Kee, H.L., Hoekman, B. (2007), *Imports, Entry and Competition Law as Market Disciplines*, European Economic Review, Volume 51, Issue 4, Elsevier, Philidelphia, United States, pp. 831-858.

[4]Petersen, N. (2013), *Antitrust Law and the Promotion of Democracy and Economic Growth*, Journal of Competition Law & Economics, Vol. 9, Oxford University Press, Oxford, United Kingdom, pp. 593-636.

[5]Buccirossi, P., Ciari, L., Duso, T., Spagnolo, G., Vitale, C. (2013), *Competition Policy and Productivity Growth: An Empirical Essessment*, The Review of Economics and Statistics, Vol. 95(4), MIT Press, Cambridge, United States, pp. 1324-1336.

process (the Mergers CPI), the institutional features (the Institutional CPI), the enforcement features (the Enforcement CPI) and all the information on the competition policy regime in a jurisdiction (the Aggregate CPI). The main conclusion consists in a positive and significant relationship between competition policy and TFP. Although the only drawback of the contribution is the small size of the sample, exclusively restricted to a part of the OECD countries, the methodology adopted as well as the indicators built are certainly very useful for further in-depth analyses and refinements.

3 Dataset Description

In the present paper, the empirical assessment has been divided into two main parts. The first part analyzes developed and developing countries together, to obtain a general overview of the phenomenon studied. The second part examines exclusively developing countries, to understand whether the adoption of a competition policy regime should be among the priorities in the political agenda of an emerging country. The main reason for this distinction is to disentangle the effect of competition policy in such different contexts. This comparison may provide a better picture of the impact, also because in developing countries competition policy has been introduced only recently in comparison to developed countries (cf. Appendix A - Figure A.1 & A.2).

Accordingly, the first group includes the majority of OECD countries (i.e. 28 nations), whilst the second group includes all the developing countries for which data for the purposes of the current work are available (i.e. 51 nations). Hence, the total number of countries present in the sample is 79 (by 2008, 111 countries had enacted a competition legislation[6]). The result is a cross-sectional dataset, created *ad hoc* merging several existing datasets, with 2008 as common reference year. For definitional sake, the term competition policy should be intended as any national law which promotes market fairness by regulating anti-competitive conducts undertaken by firms. With competition authority it is meant any institution which is set up for enforcing competition policy and is not sector specific.

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[6]Papadopoulos, A.S. (2010), *The International Dimension of EU Competition Law and Policy*, Cambridge University Press, Cambridge, United Kindom, p. 15.

The independent variables of our dataset, i.e. the set of input variables to be tested in order to verify if they are the cause of the phenomenon object of study, results from a questionnaire submitted to competition agencies worldwide in 2007 and from which four indicators relative to the institutional quality of competition policy of each country are derived and used in Voigt (2009)[7]. In particular, the survey, whose response rate is around 63%, was sent to 140 agencies belonging to the International Competition Network or participating to the Intergovernmental Group of Experts on Competition Law and Policy. The questionnaire was constructed so that respondents would not have to express personal perceptions but to provide factual information about the national competition policies (cf. Appendix A - Table A.1.1 & A.1.2).

The dependent variables of our dataset, i.e. the set of output variables to be tested in order to verify if they are instead the effect of the phenomenon object of study, results from the Global Competitiveness Report, annually published by the World Economic Forum (2013). It assesses the class of factors, institutions and policies that influence the current and medium-term levels of economic prosperity of 144 different countries. Since 2004, the report proposes a wide range of data, based on 110 variables across 12 pillars, about areas such as competition, education, finance, health, infrastructure, institutions, labour and technology. Data are collected through over 15,000 surveys with leading business executives who are asked to rank the determinants of competitiveness of their respective countries. This corresponds to an average of 100 respondents per country. For our purposes, the study offers the Global Competitiveness Indexes (GCI)[8] measuring the microeconomic and macroeconomic foundations of national competitiveness worldwide (cf. Appendix A - Table A.2.1 & A.2.2).

In this regard, it is necessary to notice that, at least at the present state of art, there is a practical impossibility to find objective data about the intensity of market power, a solution that would represent of course a first best scenario for our study. The basic reason for this limitation is that data such as level of concentration, mark-up on prices or number of market entries are available only for specific sectors

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[7]Voigt, S. (2009), *The Effects of Competition Policy on Development. Cross-Country Evidence Using Four New Indicators*, The Journal of Development Studies, Volume 45, Issue 8, Routledge, London, United Kindom, pp. 1225-1248.

[8]World Economic Forum (2013), *The Global Competitiveness Index 2012-2013 Data Platform*, Geneva, Switzerland, available on the web-site www.weforum.org.

of certain nations and in any case would remain rather insignificant if computed with respect to an entire economy. Thus, we are forced to proceed to a second best scenario, that is to resort to indicators of market performance obtained from evaluations expressed by business respondents about a country competitions intensity. Despite the unavoidable drawbacks that this solution entails, being data extracted from surveys not perfectly objective, the present paper still intends to investigate at a macroeconomic level whether the presence of a competition authority affects the degree of competition of a nation. Future research, having at its disposal more rigorous and significant data, could certainly provide further answers to the research question at issue.

4 Econometric Model

The econometric model developed for the present paper aims at estimating the effect on market performance of competition policy in developed and developing countries, the latter evaluated according to four institutional indicators. These indicators, built in Voigt (2009) and originally used to assess empirically the impact of competition policy on TFP, measure: 1. the substantive content of the competition law; 2. the degree to which the competition law incorporates an economic approach; 3. the formal independence of the competition authority; 4. the factual independence of the competition authority. In particular, as mentioned in the previous section, this set of indicators has been constructed as a result of a questionnaire formed of 30 questions and submitted to 140 competition authorities worldwide. Each institutional indicator has been adjusted and weighted in order to take a value between 0 and 1, where a greater value implies a higher degree of competition orientation or authority independence.

The first institutional indicator, related to the substantive content of the competition law, results from 5 questions: if the constitution of the country mentions competition as a right to be protected; if a specific legislation promoting competition is enforced; the number of other objectives, beyond competition in the strict sense, that competition law safeguards (e.g. employment, innovation, international trade, regional development, small and medium enterprises); the number of years that competition law has been in place; the number of anti-competitive practices for which competition law provides measures and remedies (e.g. abuse of dominant position, cartel, merger, predatory pricing, price discrimination).

The second institutional indicator, concerning the degree to which competition law rely on an economic reasoning, results from 3 questions: the number of anti-competitive practices subject to a rule of reason (i.e. case-by-case and effects-based approach) instead of a per se rule (i.e. formal and legal-based approach); the number of concepts and theories developed by economists in recent years which are contemplated by the competition law (e.g. collective dominance, conglomerate effects, effects doctrine, leniency programs); in case of merger control, if efficiencies and remedies are set forth by the competition law, under the assumption that both instruments reflect a rule of reason rather than a per se rule.

The third institutional indicator, related to the formal independence of the competition authority, results from 13 questions: if the competition authority is supervised by and subject to the power of the government; if members of the government can issue instructions or overrule the decisions provided by the competition authority; if the decisions of the competition authority are subject to judicial review by the courts; if competition is the only objective pursued by the competition authority or it also has other tasks; the number of competences assigned to the competition authority; the level of influence of the government on the appointment of the competition authority's head; the length of service of the competition authority's head; if the competition authority's head can be re-appointed and how it can be dismissed; if there is a rule preventing reduction in wages for the officials; if there is a rule for the allocation of incoming cases among the officials; if the competition authority is required to publish the motivations of the decisions taken.

The fourth indicator, concerning the factual independence of the competition authority, results from 9 questions: if there is one or more authorities in charge of the application of the competition legislation (e.g., as in the United States, the Antitrust Division of the Department of Justice and the Federal Trade Commission); if on average the effective length of service of the officials corresponds to the expected one; if the budget of the competition authority and the income of the officials have at least remained constant in real terms since 1990; how many times any member of the government had issued instructions and overruled decisions provided by the competition authority between 1990 and 2000; if courts have referred to any policy objective other than competition in order to overrule a decision of the competition authority; if the competition authority has the power to open a proceeding or it needs the intervention of other parties (e.g. competitors, consumers, courts, government, parliament); in case of merger control, how long is the time period between the preliminary notification until and the final decision of the highest court.

As a result, the four institutional indicators, which evaluate the degree of competition orientation and authority independence of developed and developing countries, are investigated in the current work with respect to the impact on five indicators of market performance. These five indicators of market performance, built by the World Economic Forum (2013), measure: 1. the intensity of local competition; 2. the extent of market dominance; 3. the effectiveness of anti-monopoly policy; 4. the intensity of national competition; 5. the goods market efficiency. In particular, as mentioned in the previous section, this set of indicators has been extracted from the 6th pillar (i.e. Goods Market Efficiency) of the Global Competitiveness Indexes (GCI). Each performance indicator has been adjusted and weighted in order to take a value between 1 and 7, where a greater value implies a higher degree of market efficiency.

The first performance indicator results from the question concerning the intensity of competition in the respective local markets, ranging from limited to intense in most industries; the second performance indicator results from the question to characterize the corporate activity in the respective countries, ranging from dominated by a few business groups to spread among many firms; the third performance indicator results from the question to evaluate to what extent anti-monopoly policy promotes competition in their respective countries; the fourth and fifth performance indicators result from the questions to evaluate the intensity of competition and the goods market efficiency at aggregate and national level.

Accordingly, in our econometric model, the four institutional indicators are employed as explanatory and independent variables, whilst the five performance indicators are used as explained and dependent variables. Nevertheless, all the variables that may affect the relationship between the variables of primary interest must be monitored, even though they may not be the focus of the study. Control variables, in fact, allow the econometrician to strictly measure the effect under examination, avoiding the so-called omitted-variables bias and improving the goodness of fit of the econometric model. Therefore, along the lines of Voigt (2009), we employ four standard economic control variables, such as government consumption, trade openness, rate of inflation (Heston *et al.*, 2002)[9] and patents protection (U.S. Department of

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[9]Aten, B., Heston, A., Summers, R. (2002), *Penn World Table*, Center for International Comparisons at the University of Pennsylvania, Philadelphia, United States, available on the web-site pwt.sas.upenn.edu.

Commerce, 2005)[10], under the reasonable assumption that they are all factors which influence, positively or negatively, the establishment of a competitive environment. Moreover, we must consider two other control variables, that are an EU dummy, as our dataset includes countries members of the European Union, which are thus subject not only to the respective national competition authorities but also to the vigilance exercised by the Directorate-General for Competition (DG COMP) of the European Commission, and an OECD dummy, given the higher level of social welfare of OECD countries (cf. Appendix A - Table A.3.1 & A.3.2). The five control variables are the same regardless of the dependent variable used, since the performance indicators are likely to be affected by similar dynamics. As a result, our regression equation can be written as follow:

$$PERF_i = \alpha + \beta(COMP_i) + \gamma(CTRL_i) + \varepsilon_i$$

The high intensity of competition typical of developed countries, as well as the high extent of market dominance typical of developing countries, might facilitate the establishment and the effectiveness of a competition authority. This mechanism raises the question of endogeneity, as reverse causality (i.e. the effect precedes the cause, contrary to normal causation) might emerge between the dependent and independent variables of our econometric model. In order to deal with this issue, we employ a further category of variables, that are the instrumental variables. In a nutshell, an instrument is a variable, not present in the regression equation, which affects the explained variable only through its effect on the explanatory variable, meaning that it is correlated with the latter but not with the (error term of the) former. Using an instrumental variable is therefore a method to clean out any endogenous relationship between dependent and independent variables, since we obtain new and filtered explanatory variables which can be correctly tested on the explained variables. In particular, in our econometric model, we use the same three instrumental variables for each of the four independent variables. Actually, endogeneity problems may still remain due to omitted variables. However, to address the omitted variable bias, we recur to several controls as mentioned above.

The first instrument is a dummy variable for former British colonies (Heston *et al.*, 2002). As proved by historical evidence, a common law legal system, typical of countries that in the past belonged to the British Empire, is more likely to adopt

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[10]U.S. Department of Commerce (2005), *Patent Counts by Country/State and Year, Utility Patents Report*, Alexandria, United States, available on the web-site www.uspto.gov.

a competition policy regime compare to a civil law legal system, so that the legal origin influences the enforcement of an institution such as a competition authority. The second instrument is the age of democratic regime (Keefer *et al.*, 2013)[11], under the assumption that a country with a longer democratic tradition is in more suitable conditions to establish and enforce a competition policy regime. The third instrument is the ethnic and linguistic fractionalization (Alesina *et al.*, 2003)[12], element that traduces the difficulty of implementing valuable institutions (cf. Appendix A - Table A.4.1 & A.4.2).

We can now proceed with the estimation. At a first step, we will employ as estimation technique the Ordinary Least Squares (OLS) method, without and with control variables, in order to carry out a preliminary assessment. At a second step, after evaluating the validity of the instruments chosen through the Sargan test, we will employ as estimation techniques the Two-Stage Least Square (2SLS) and the Generalized Method of Moments (GMM), which are able to improve the prediction quality of our econometric model exploiting the information provided by the instruments.

5   Estimation Results

In order to obtain a general overview of the phenomenon object of the study, firstly we analyze developed and developing countries together. Table 1 contains the OLS regression estimates without and with the standard economic control variables. It can observed that all the institutional indicators present the expected sign, that is competition policy has a positive impact on all the performance indicators, although rather marginal but more significant when control variables are considered. This means that competition authorities, even if to a limited extent, are usually able to implement effectively the role of promoters of fair competition. From Table 2, which contains instead the OLS regression estimates over developing countries only, we can observe that only the formal independence of the competition authorities impacts positively on the performance indicators, while the degree to which the

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[11]Beck, T., Clarke, G., Groff, A., Keefer, P., Walsh, P. (2001), *New Tools in Comparative Political Economy: The Database of Political Institutions*, World Bank Economic Review, The World Bank, Washington D.C., United States, pp. 165-176, available (updated to 2013) on the web-site www.worldbank.org.
   [12]Alesina, A. *et al.* (2003), *Fractionalization*, Journal of Economic Growth, Volume 8, Issue 2, pp. 155-194.

competition law incorporates an economic approach and the formal independence of the competition authority present a significant impact in a limited number of cases. On the contrary, the fact that an emerging country has adopted a specific legislation safeguarding competition seems to not have any effect on the markets.

For a more sophisticated inference analysis based on estimation methods such as 2SLS and GMM it is necessary first of all to check the relevance of the instruments chosen. In an overidentified model like ours, where the number of instrumental variables exceeds the number of explanatory variables, we can use the Sargan's test to verify the validity of the instruments selected. The Sargan's statistic, which is a particular case of the Hansen's test for overidentified restrictions, is distributed as a Chi-Squared with K - L degrees of freedom, where K is equal to the number of instruments and L is equal to the numbers of endogenous regressors in the original model, under the null hypothesis that the error term is uncorrelated with the instruments. Therefore, in the present setting, we have two degrees of freedom, having for each regression equation three instruments and one endogenous regressor. The validity of the instruments for all four institutional indicators of both developed and developing countries has been tested. The result is similar for all, that is a p-value higher than the standard level of significance of 0.05, thus we cannot reject the null hypothesis and we can conclude that the overidentifying restriction is valid. Consequently, even though this test has low power and provides no guarantee that the instruments used are valid, it brings further evidence to support the direction of our results.

Proceeding with the more advanced estimation techniques, from Table 3, which contains the 2SLS and GMM regression estimates for the entire sample, we can observe results that confirm those obtained under OLS. Although the substantive content of the competition law seems to lose statistical significance, what emerges, and this is more important for our purposes is that the estimates for the other three institutional indicators are stronger than those obtained through the OLS estimation, reaching in several cases the standard significance level of 5%. Instead, from Table 4, which presents the 2SLS and GMM regression estimates only for the subsample of developing countries, we can observe results that confirm as well what is stated in Table 2, that is the fact that in emerging countries the factual independence of competition authorities seems to matter most. Furthermore, the impact of the formal independence of competition authorities appears strengthened in comparison to that one obtained through the OLS estimation, whilst the presence of economists still maintains a positive effect in some cases.

6 Policy Conclusions

In the present paper, the aim has been to investigate the effectiveness of competition policy in developed and developing countries from an empirical standpoint. It has shown that four competition indicators, originally built to explain differences in productivity, once controlled with the proper economic and institutional variables, seem to have an effect on five market indicators. Although not particularly strong, the presence of a competition authority increases the degree of competition of a country.

In particular, two main results are worth recapping. Firstly, as a general trend, apart from the mere adoption of a competition legislation by the national parliaments, all the institutional indicators exercise a positive impact on the markets, therefore competition authorities seem to be effective in enhancing the level of competitiveness of the respective countries. Secondly, as for the poorest countries, with respect to which we are interested in verifying whether the enforcement of a competition policy regime should be favored, what seems to be the the the most important factor for its effectiveness is the factual independence of the authorities predisposed. The essential reason for this should be that the quality of the institutions of developing countries is certainly lower than the one of the industrialized nations, being affected more frequently for example by cases of corruption or government interference. In any case, one conclusion seems certain, that is competition policy is not harmful to development.

However, emerging countries, historically characterized by the nationalization of basic industries, are still adopting or constructing primordial competition policy frameworks, whose results could be seen only in delay, so in the near future. Actually, to be more precise, 81 of the 111 of the existing competition authorities worldwide have been created only in the last twenty years. Moreover, private enforcement, although still in an embryonic phase even in the developed countries, could undoubtedly make the market surveillance, thus the market efficiency, stronger.

As a result, the current work shows that in developed countries competition policy has actually beneficial effects on the intensity of competition, result so far unclear and often claimed only on the paper or taken for granted, while in developing countries it shows that is not the mere existence or the degree of competence, but the institutional quality of the competition authorities matters most for the effectiveness of a competition policy regime. In both cases, therefore, the creation of a competition authority is definitely worth, even though its functions and powers should be strengthened in order to register a more significant impact on the markets

in comparison to the current results. Future research, exploiting more precise data that we hope will be available soon (e.g. panel data concerning specific sectors and not as here cross-sectional data related to an entire economy), could certainly offer further support to the conclusions reached in the present study.

Table 1 - OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables (Developed and Developing Countries)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competiton	PERF competiton	PERF efficiency	PERF efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{law}$	1.331***	0.431	1.594***	0.245	1.785***	0.457	0.858**	0.066	1.123***	0.234
	(0.316)	(0.330)	(0.454)	(0.404)	(0.448)	(0.427)	(0.299)	(0.263)	(0.309)	(0.273)
R^2	0.189	0.458	0.140	0.622	0.173	0.585	0.098	0.589	0.148	0.608
SER	0.675	0.550	0.968	0.671	0.955	0.711	0.638	0.438	0.659	0.455
N	78	69	78	69	78	69	78	69	78	69
$COMP_{economics}$	1.068***	0.604*	1.483***	0.825*	1.725***	1.176***	0.820***	0.536*	0.988***	0.657**
	(0.235)	(0.287)	(0.321)	(0.331)	(0.299)	(0.322)	(0.217)	(0.210)	(0.225)	(0.218)
R^2	0.228	0.492	0.233	0.671	0.322	0.685	0.170	0.666	0.216	0.686
SER	0.677	0.549	0.925	0.634	0.862	0.617	0.625	0.403	0.647	0.418
N	72	63	72	63	72	63	72	63	72	63
$COMP_{dejure}$	1.452***	1.017**	1.907***	1.264**	2.334***	1.806***	1.092***	0.856***	1.324***	1.009***
	(0.309)	(0.314)	(0.434)	(0.375)	(0.400)	(0.360)	(0.289)	(0.240)	(0.298)	(0.244)
R^2	0.234	0.526	0.212	0.679	0.321	0.702	0.166	0.667	0.215	0.697
SER	0.665	0.521	0.932	0.622	0.860	0.597	0.620	0.626	0.640	0.405
N	74	65	74	65	74	65	74	65	74	65
$COMP_{defacto}$	1.163***	0.848***	1.568***	0.960***	1.818***	1.376***	0.870***	0.614**	1.060***	0.764***
	(0.206)	(0.226)	(0.288)	(0.272)	(0.259)	(0.267)	(0.200)	(0.182)	(0.203)	(0.181)
R^2	0.329	0.574	0.313	0.698	0.431	0.706	0.225	0.665	0.295	0.708
SER	0.629	0.512	0.880	0.615	0.791	0.604	0.612	0.413	0.620	0.411
N	67	59	67	59	67	59	67	59	67	59

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$ (standard errors in parentheses)

Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU.

Table 2 - *OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables (Developing Countries)*

Variables	$PERF_{local}$	$PERF_{local}$	$PERF_{dominance}$	$PERF_{dominance}$	$PERF_{antitrust}$	$PERF_{antitrust}$	$PERF_{competiton}$	$PERF_{competiton}$	$PERF_{efficiency}$	$PERF_{efficiency}$
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{law}$	0.538	0.389	0.006	0.074	0.273	0.341	-0.168	-0.236	0.174	0.120
	(0.390)	(0.416)	(0.464)	(0.489)	(0.453)	(0.516)	(0.341)	(0.314)	(0.352)	(0.334)
R^2	0.038	0.299	0.000	0.370	0.008	0.295	0.005	0.495	0.005	0.469
SER	0.641	0.573	0.762	0.673	0.745	0.711	0.561	0.433	0.579	0.461
N	50	42	50	42	50	42	50	42	50	42
$COMP_{economics}$	0.321	0.382	0.320	0.758	0.677*	1.108**	0.094	0.405	0.279	0.583*
	(0.319)	(0.392)	(0.370)	(0.422)	(0.329)	(0.384)	(0.274)	(0.259)	(0.281)	(0.274)
R^2	0.024	0.329	0.018	0.477	0.092	0.510	0.003	0.619	0.023	0.610
SER	0.673	0.599	0.780	0.645	0.693	0.587	0.578	0.396	0.593	0.419
N	44	36	44	36	44	36	44	36	44	36
$COMP_{dejure}$	0.708	0.818	0.774	1.116	1.236**	1.664	0.347	0.649	0.580	0.839**
	(0.357)	(0.384)	(0.418)	(0.429)	(0.376)	(0.396)	(0.315)	(0.278)	(0.319)	(0.285)
R^2	0.082	0.378	0.072	0.488	0.197	0.547	0.027	0.583	0.070	0.597
SER	0.645	0.564	0.755	0.630	0.678	0.582	0.569	0.409	0.576	0.418
N	46	38	46	38	46	38	46	38	46	38
$COMP_{defacto}$	0.601*	0.641*	0.648	0.843*	1.076***	1.362***	0.277	0.483*	0.474	0.664**
	(0.274)	(0.298)	(0.337)	(0.355)	(0.294)	(0.318)	(0.257)	(0.228)	(0.257)	(0.228)
R^2	0.110	0.427	0.087	0.497	0.256	0.584	0.029	0.598	0.080	0.629
SER	0.632	0.556	0.777	0.660	0.678	0.592	0.591	0.425	0.593	0.424
N	41	34	41	34	41	34	41	34	41	34

$* p < 0.05$, $** p < 0.01$, $*** p < 0.001$ (standard errors in parentheses)

Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU.

Table 3 - *2SLS and GMM Estimation of Performance Indicators on Competition Policy Indicators with Control and Instrumental Variables (Developed and Developing Countries)*

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{law}$	1.319	1.411	1.770	2.033	1.448	1.285	0.293	-0.065	0.980	0.806
	(0.949)	(0.816)	(1.218)	(1.065)	(1.211)	(0.796)	(0.720)	(0.495)	(0.787)	(0.523)
R^2	0.394	0.377	0.534	0.499	0.549	0.545	0.583	0.580	0.561	0.574
SER	0.546	0.554	0.701	0.727	0.697	0.700	0.414	0.416	0.453	0.446
N	69	69	69	69	69	69	69	69	69	69
$COMP_{economics}$	2.265	2.434**	2.857	2.732*	3.734*	4.053*	1.486	1.778*	2.105	2.398**
	(1.407)	(0.887)	(1.660)	(1.107)	(1.824)	(1.730)	(0.952)	(0.843)	(1.132)	(0.875)
R^2	0.183	0.116	0.4460	0.472	0.3241	0.227	0.543	0.451	0.436	0.323
SER	0.651	0.677	0.76881	0.751	0.84442	0.903	0.441	0.483	0.524	0.574
N	63	63	63	63	63	63	63	63	63	63
$COMP_{dejure}$	2.335*	2.445	2.678*	2.636	4.689**	4.710	2.289*	2.404	2.586**	2.511
	(1.111)	(0.825)	(1.295)	(0.975)	(1.622)	(1.480)	(0.945)	(0.878)	(0.994)	(0.765)
R^2	0.380	0.354	0.599	0.603	0.367	0.361	0.458	0.495	0.475	0.495
SER	0.558	0.570	0.651	0.648	0.815	0.818	0.475	0.490	0.500	0.490
N	65	65	65	65	65	65	65	65	65	65
$COMP_{defacto}$	1.880*	1.999***	1.845*	1.823**	3.069**	3.292**	1.485*	1.747*	1.813*	1.994**
	(0.825)	(0.567)	(0.919)	(0.660)	(1.098)	(1.206)	(0.675)	(0.751)	(0.718)	(0.702)
R^2	0.400	0.357	0.635	0.636	0.473	0.406	0.515	0.410	0.517	0.444
SER	0.565	0.585	0.629	0.628	0.751	0.798	0.462	0.510	0.492	0.528
N	59	59	59	59	59	59	59	59	59	59

$^* p < 0.05, ^{**} p < 0.01, ^{***} p < 0.001$ (standard errors in parentheses)

Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU.
Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.

Table 4 - 2SLS and GMM Estimation of Performance Indicators on Competition Policy Indicators with Control and Instrumental Variables (Developing Countries)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{law}$	0.740	0.729	0.560	-0.114	-0.396	-0.482	-0.770	-0.861	0.025	-0.169
	(1.028)	(0.995)	(1.211)	(1.195)	(1.297)	(0.890)	(0.799)	(0.551)	(0.818)	(0.645)
R^2	0.284	0.283	0.352	0.363	0.254	0.209	0.4535	0.437	0.468	0.456
SER	0.529	0.529	0.623	0.618	0.667	0.687	0.41112	0.417	0.421	0.426
N	42	42	42	42	42	42	42	42	42	42
$COMP_{economics}$	1.972	2.004	2.624	2.463*	2.383	2.407*	-0.088	-0.138	0.872	0.883
	(1.964)	(1.034)	(2.184)	(1.167)	(1.806)	(1.130)	(1.099)	(0.676)	(1.117)	(0.668)
R^2	0.125	0.182	0.125	0.182	0.324	0.309	0.571	0.550	0.595	0.591
SER	0.749	0.724	0.749	0.724	0.619	0.626	0.377	0.386	0.383	0.385
N	36	36	36	36	36	36	36	36	36	36
$COMP_{dejure}$	1.438	1.746***	2.149*	2.127**	3.192**	3.097***	1.438	1.746***	2.149*	2.127**
	(0.899)	(0.466)	(1.051)	(0.675)	(1.084)	(0.892)	(0.899)	(0.466)	(1.051)	(0.675)
R^2	0.325	0.257	0.392	0.394	0.330	0.557	0.325	0.257	0.392	0.394
SER	0.530	0.557	0.620	0.619	0.640	0.380	0.530	0.557	0.620	0.619
N	38	38	38	38	38	38	38	38	38	38
$COMP_{defacto}$	1.282*	1.279***	1.458*	1.499***	2.087**	1.880*	0.826	0.620	1.040*	0.944*
	(0.618)	(0.274)	(0.715)	(0.437)	(0.665)	(0.877)	(0.455)	(0.491)	(0.457)	(0.409)
R^2	0.329	0.330	0.440	0.431	0.503	0.535	0.565	0.581	0.591	0.604
SER	0.536	0.536	0.620	0.625	0.576	0.558	0.394	0.387	0.396	0.390
N	34	34	34	34	34	34	34	34	34	34

$* p < 0.05$, $** p < 0.01$, $*** p < 0.001$ (standard errors in parentheses)

Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU.

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.

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References

[1] Alesina, A. *et al.* (2003), *Fractionalization*, Journal of Economic Growth, Volume 8, Issue 2, pp. 155-194.

[2] Aten, B., Heston, A., Summers, R. (2002), *Penn World Table*, Center for International Comparisons at the University of Pennsylvania, Philadelphia, United States, available on the web-site pwt.sas.upenn.edu.

[3] Beck, T., Clarke, G., Groff, A., Keefer, P., Walsh, P. (2001), *New Tools in Comparative Political Economy: The Database of Political Institutions*, World Bank Economic Review, The World Bank, Washington D.C., United States, pp. 165-176, available (updated to 2013) on the web-site www.worldbank.org.

[4] Buccirossi, P., Ciari, L., Duso, T., Spagnolo, G., Vitale, C. (2013), *Competition Policy and Productivity Growth: An Empirical Essessment*, The Review of Economics and Statistics, Vol. 95(4), MIT Press, Cambridge, United States, pp. 1324-1336.

[5] Kee, H.L., Hoekman, B. (2007), *Imports, Entry and Competition Law as Market Disciplines*, European Economic Review, Volume 51, Issue 4, Elsevier, Philidelphia, United States, pp. 831-858.

[6] Krakowski, M. (2005), *Competition Policy Works: The Effect of Competition Policy on the Intensity of Competition. An International Cross-Country Comparison*, Hamburg Institute of International Economics, Discussion Paper No. 332, Hamburg, Germany, pp. 1-18.

[7] Papadopoulos, A.S. (2010), *The International Dimension of EU Competition Law and Policy*, Cambridge University Press, Cambridge, United Kindom, pp. 1-362.

[8] Petersen, N. (2013), *Antitrust Law and the Promotion of Democracy and Economic Growth*, Journal of Competition Law & Economics, Vol. 9, Oxford University Press, Oxford, United Kingdom, pp. 593-636.

[9] U.S. Department of Commerce (2005), *Patent Counts by Country/State and Year, Utility Patents Report*, Alexandria, United States, available on the web-site www.uspto.gov.

[10] Voigt, S. (2009), *The Effects of Competition Policy on Development. Cross-Country Evidence Using Four New Indicators*, The Journal of Development Studies, Volume 45, Issue 8, Routledge, London, United Kindom, pp. 1225-1248.

[11] World Economic Forum (2013), *The Global Competitiveness Index 2012-2013 Data Platform*, Geneva, Switzerland, available on the web-site www.weforum.org.
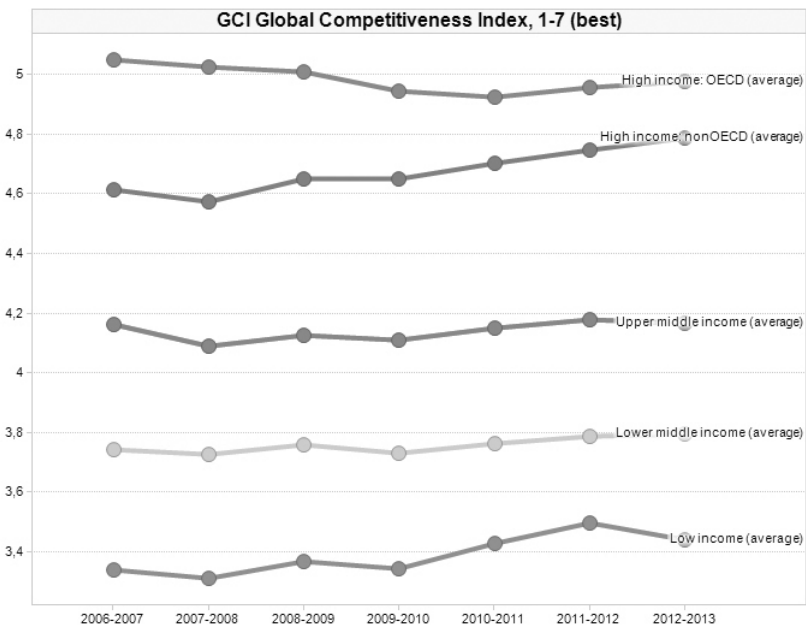
Appendix A - Descriptive Data

Figure A.1 - *Global Competitiveness Index Heat Map*

Source: World Economic Forum (2013)

Figure A.2 - *Global Competitiveness Index*

Source: World Economic Forum (2013)

Table A.1.1 - *Competition Policy Indicators: Developed Countries* (Independent Variables)

Country	x_1 $COMP_{law}$	x_2 $COMP_{economics}$	x_3 $COMP_{dejure}$	x_4 $COMP_{defacto}$
Australia	0.620	0.389	0.592	0.872
Austria	0.322	0.595	0.523	n.a.
Belgium	0.288	0.750	0.331	0.800
Canada	0.474	0.667	0.554	0.798
Czech Republic	0.371	0.917	0.477	0.922
Denmark	0.404	0.903	0.508	0.944
Estonia	0.365	0.233	0.650	0.500
Finland	0.343	0.905	0.650	0.969
France	0.313	0.740	0.564	0.663
Germany	0.471	0.700	0.625	0.967
Greece	0.287	0.583	0.550	0.421
Hungary	0.499	0.972	0.630	0.802
Ireland	0.371	0.639	0.585	0.893
Israel	0.173	0.850	0.500	0.953
Italy	0.708	0.611	0.644	0.911
Japan	0.375	0.821	0.517	0.917
Mexico	0.324	0.476	0.442	0.722
Netherlands	0.474	0.722	0.417	1.000
New Zealand	0.454	0.319	0.485	0.550
Poland	0.249	0.816	0.425	0.781
Portugal	0.561	0.716	0.438	n.a.
Slovakia	0.663	0.840	0.525	0.678
Spain	0.453	0.774	0.692	0.933
Sweden	0.564	0.792	0.454	0.656
Switzerland	0.664	0.833	0.446	0.939
Turkey	0.696	0.357	0.618	0.922
United Kingdom	0.750	0.833	0.577	0.875
United States	0.667	0.611	0.459	0.372

Source: Voigt (2009)

Indicators

x_1 = Substantive Content of the Competition Law

x_2 = Degree to which the Competition Law incorporates an Economic Approach

x_3 = Formal Independence of the Competition Authority

x_4 = Factual Independence of the Competition Authority

[0 = min; 1 = max]

Table A.1.2 - *Competition Policy Indicators: Developing Countries* (Independent Variables)

Country	x_1 $COMP_{law}$	x_2 $COMP_{economics}$	x_3 $COMP_{dejure}$	x_4 $COMP_{defacto}$
Albania	0.318	0.792	0.410	n.a.
Argentina	0.612	0.667	0.362	0.450
Armenia	0.595	0.188	0.500	0.230
Bangladesh	0.000	0.000	0.000	0.000
Benin	0.000	0.000	0.000	0.000
Bolivia	0.000	0.000	0.000	0.000
Brazil	0.664	0.500	0.581	0.903
Bulgaria	0.559	0.583	0.400	0.694
Chad	0.000	0.000	0.000	0.000
China	0.115	0.375	0.238	n.a.
Colombia	0.618	0.762	0.692	0.642
Costa Rica	0.360	0.472	0.542	0.814
Croatia	0.526	0.694	0.400	0.594
Cyprus	0.086	0.731	0.350	0.819
Dominican Republic	0.333	n.a.	n.a.	n.a.
Ecuador	0.000	0.000	0.000	0.000
Egypt	0.000	0.000	0.000	0.000
El Salvador	0.333	n.a.	n.a.	n.a.
Guatemala	0.333	n.a.	n.a.	n.a.
Guyana	0.000	0.000	0.000	0.000
Honduras	0.000	0.000	0.000	0.000
Indonesia	0.181	0.786	0.548	0.708
Jamaica	0.240	0.143	0.607	0.772
Kazakhstan	0.080	0.000	0.417	0.775
Latvia	0.243	0.786	0.577	0.636
Lithuania	0.702	0.750	0.625	0.781
Madagascar	0.000	0.000	0.000	0.000
Malaysia	0.000	0.000	0.000	0.000
Mali	0.000	0.000	0.000	0.000
Mauritania	0.000	0.000	0.000	0.000
Moldova	0.333	n.a.	n.a.	n.a.
Morocco	0.012	0.810	0.558	0.396
Mozambique	0.000	0.000	0.000	0.000
Nepal	0.000	0.000	0.000	0.000
Nicaragua	0.000	0.000	0.000	0.000
Nigeria	0.000	0.000	0.000	0.000
Paraguay	0.333	n.a.	n.a.	n.a.
Peru	0.621	0.643	0.446	0.572
Phillipines	0.550	n.a.	0.000	n.a.
Senegal	0.154	0.063	0.636	n.a.
Singapore	0.000	0.000	0.000	0.000
South Africa	0.073	n.a.	0.769	0.813
Taiwan	0.288	0.250	0.511	0.683
Tajikistan	0.000	0.000	0.000	0.000
Tanzania	0.238	0.476	0.624	0.867
Thailand	0.323	0.214	0.417	n.a.
Uganda	0.000	0.000	0.000	0.000
Venezuela	0.577	0.484	0.500	0.638
Vietnam	0.000	0.000	0.000	0.000
Zambia	0.154	0.722	0.460	0.822
Zimbawe	0.023	0.595	0.457	0.714

Source: Voigt (2009)

Table A.2.1 - *Performance Indicators: Developed Countries* (Dependent Variables)

Country	y_1 $PERF_{local}$	y_2 $PERF_{dominace}$	y_3 $PERF_{antitrust}$	y_4 $PERF_{competition}$	y_5 $PERF_{efficiency}$
Australia	5.733	5.148	5.916	5.289	5.321
Austria	6.058	5.906	5.752	5.215	5.407
Belgium	5.966	5.399	5.518	5.032	5.201
Canada	5.671	5.174	5.464	5.161	5.259
Czech Republic	5.727	4.430	4.637	4.727	4.652
Denmark	5.566	5.777	5.940	5.358	5.431
Estonia	5.571	4.331	4.866	5.060	4.950
Finland	5.730	5.740	6.048	5.253	5.354
France	5.800	5.354	5.693	4.885	5.032
Germany	6.315	6.207	6.123	5.167	5.291
Greece	4.929	4.040	4.425	4.149	4.244
Hungary	5.425	3.769	4.534	4.509	4.258
Ireland	5.475	5.330	5.191	5.422	5.414
Israel	5.641	4.124	5.429	4.960	5.001
Italy	4.623	4.383	4.162	4.130	4.321
Japan	6.025	5.948	5.398	4.891	5.218
Mexico	4.905	3.301	3.623	4.152	4.230
Netherlands	5.883	5.792	5.986	5.329	5.368
New Zealand	5.402	4.675	5.633	5.366	5.354
Poland	4.725	4.183	3.957	4.215	4.123
Portugal	5.275	3.882	5.011	4.642	4.589
Slovakia	5.346	4.793	4.565	4.958	4.658
Spain	5.567	4.590	4.619	4.465	4.591
Sweden	6.016	5.234	5.824	5.223	5.370
Switzerland	5.527	5.948	5.321	5.167	5.389
Turkey	5.455	4.427	4.642	4.566	4.538
United Kingdom	5.985	5.680	5.820	5.281	5.295
United States	5.904	5.694	5.498	5.226	5.317

Source: World Economic Forum (2013)

Indicators

y_1 = Intensity of Local Competition
("*How would you assess the intensity of competition in the local markets in your country?*")
[1 = limited in most industries; 7 = intense in most industries]

y_2 = Extent of Market Dominance
("*How would you characterize corporate activity in your country?*")
[1 = dominated by a few business groups; 7 = spread among many firms]

y_3 = Effectiveness of Anti-Monopoly Policy
("*To what extent does anti-monopoly policy promote competition in your country?*")
[1 = does not promote competition; 7 = effectively promotes competition]

Aggregate Indicators

y_4 = Competition
[1 = min; 7 = max]

y_5 = Good Market Efficiency
[1 = min; 7 = max]

Table A.2.2 - *Performance Indicators: Developing Countries* (Dependent Variables)

Country	y_1 $PERF_{local}$	y_2 $PERF_{dominace}$	y_3 $PERF_{antitrust}$	y_4 $PERF_{efficiency}$	y_5 $PERF_{efficiency}$
Albania	3.665	2.866	2.833	3.536	3.506
Argentina	4.156	3.248	3.336	3.326	3.528
Armenia	3.634	2.475	2.518	3.770	3.713
Bangladesh	4.736	2.755	2.820	3.906	3.838
Benin	4.328	3.779	3.743	3.906	3.760
Bolivia	4.091	3.133	2.875	3.431	3.260
Brazil	5.252	4.157	4.273	3.572	3.803
Bulgaria	4.497	3.689	3.248	3.910	3.891
Chad	3.215	2.960	2.831	3.022	2.843
China	5.338	3.761	3.688	4.205	4.258
Colombia	4.936	3.142	3.927	3.727	3.927
Costa Rica	5.104	4.493	3.941	4.214	4.397
Croatia	4.974	3.553	3.730	4.126	4.103
Cyprus	5.371	4.201	4.837	4.611	4.653
Dominican Republic	4.355	2.918	2.888	3.610	3.736
Ecuador	4.246	2.547	2.616	3.456	3.349
Egypt	4.712	3.934	3.507	4.150	4.031
El Salvador	4.894	3.103	3.477	4.342	4.320
Guatemala	5.007	3.690	3.287	4.251	4.228
Guyana	4.245	2.920	3.019	3.904	3.717
Honduras	4.182	3.033	3.418	3.981	3.905
Indonesia	5.510	5.228	5.147	4.884	5.058
Jamaica	5.140	3.776	5.398	4.370	4.291
Kazakhstan	4.666	3.441	3.505	4.088	4.200
Latvia	4.976	3.766	3.954	4.534	4.472
Lithuania	5.365	3.842	4.354	4.475	4.518
Madagascar	4.142	2.998	3.294	3.922	3.713
Malaysia	5.665	5.106	4.911	5.171	5.201
Mali	4.374	4.044	3.474	4.051	3.819
Mauritania	3.688	2.874	3.408	3.440	3.418
Moldova	n.a.	n.a.	n.a.	n.a.	n.a.
Morocco	4.575	3.733	4.129	4.175	4.131
Mozambique	3.610	2.778	2.964	3.441	3.221
Nepal	4.585	2.499	3.059	3.870	3.730
Nicaragua	4.013	2.514	2.851	3.771	3.613
Nigeria	4.486	3.919	3.690	4.258	4.189
Paraguay	4.118	3.026	2.735	3.594	3.514
Peru	5.091	3.397	3.783	4.079	4.136
Phillipines	5.019	3.023	3.575	4.037	4.191
Senegal	5.128	3.950	3.154	4.026	3.982
Singapore	5.482	5.225	5.076	5.931	5.762
South Africa	5.091	4.418	5.388	4.800	4.732
Taiwan	5.797	5.605	5.033	5.059	5.230
Tajikistan	4.014	3.091	3.347	3.400	3.472
Tanzania	4.486	3.245	3.812	4.056	3.922
Thailand	5.296	4.077	4.054	4.605	4.663
Uganda	4.725	2.916	3.326	3.802	3.665
Venezuela	3.693	3.072	3.566	3.056	3.276
Vietnam	4.982	4.314	3.161	4.073	4.070
Zambia	3.425	2.606	3.170	4.023	3.609
Zimbawe	3.419	3.273	3.371	3.090	3.152

Source: World Economic Forum (2013)

Table A.3.1 - *Socio-Economic Variables: Developed Countries* (Control Variables)

Country	z_1 CTRL govtcons[1]	z_2 CTRL openness[1]	z_3 CTRL inflation[1]	z_4 CTRL patents[2]	z_5 CTRL OECD	z_6 CTRL EU
Australia	7.23	36.85	-7.10	2,253	1	0
Austria	6.17	79.28	-5.34	1,676	1	1
Belgium	18.15	134.61	-5.28	2,102	1	1
Canada	14.80	70.53	-6.17	10,667	1	0
Czech Republic	11.86	104.66	11.19	21	0	1
Denmark	7.32	67.18	-5.20	1,177	1	1
Estonia	32.58	132.03	24.89	3	0	1
Finland	7.40	64.57	-9.48	1,859	1	1
France	8.32	44.45	-5.91	14,255	1	1
Germany	7.39	51.22	-5.78	34,050	1	1
Greece	10.47	44.22	-3.78	60	0	1
Hungary	14.48	84.25	2.30	225	0	1
Ireland	5.33	138.87	-2.98	304	1	1
Israel	27.38	75.31	-0.59	2,066	0	0
Italy	6.58	45.88	-7.40	6,017	1	1
Japan	5.91	17.95	2.69	112,673	1	0
Mexico	7.56	58.07	5.10	213	0	0
Netherlands	9.93	107.21	-5.08	4,056	1	1
New Zealand	8.30	55.02	-7.46	257	1	0
Poland	8.08	46.73	14.43	60	0	1
Portugal	17.92	64.36	-2.60	22	1	1
Slovakia	17.41	117.72	0.27	4	0	1
Spain	6.82	44.97	-7.68	681	1	1
Sweden	13.37	70.82	-7.28	n.a.	1	1
Switzerland	10.22	68.51	-5.33	5,557	1	0
Turkey	14.66	46.34	-6.80	12	0	0
United Kingdom	7.66	57.80	-1.95	12,138	1	1
United States	12.01	23.01	0.00	287,848	1	0

Source: Heston *et al.* (2002)[1], US Department of Commerce (2005)[2]

z_1 = Government Consumption
("*Government share of Real Gross Domestic Price Level between 1990 and 2000*")

z_2 = Openness
("*Exports plus imports divided by Real Gross Domestic Price Level between 1990 and 2000*")

z_3 = Inflation
[*Rate of inflation between 1990 and 2000 with United States = 0*]

z_4 = Patents
("*Number of patents for invention for country of origin granted by the US Department of Commerce between 1993 and 1997*")

z_5 = OECD
("*Did the country belong to the Organisation for Economic Co-operation and Development in 2008?*")
[0 = no; 1 = yes]

z_6 = EU
("*Did the country belong to the European Union in 2008?*")
[0 = no; 1 = yes]

Table A.3.2 - *Socio-Economic Variables: Developing Countries* (Control Variables)

Country	z_1 CTRL govtcons[1]	z_2 CTRL openness[1]	z_3 CTRL inflation[1]	z_4 CTRL patents[2]	z_5 CTRL OECD	z_6 CTRL EU
Albania	23.99	45.20	13.51	0	0	0
Argentina	14.50	20.29	-1.60	152	0	0
Armenia	33.64	113.53	61.83	1	0	0
Bangladesh	10.54	25.73	-5.94	0	0	0
Benin	12.15	63.83	-10.98	n.a.	0	0
Bolivia	18.21	47.91	0.28	1	0	0
Brazil	24.69	15.03	-5.91	305	0	0
Bulgaria	34.69	105.93	22.87	16	0	0
Chad	25.23	48.94	-15.36	0	0	0
China	25.28	38.75	-0.51	271	0	0
Colombia	19.57	30.28	1.69	n.a.	0	0
Costa Rica	21.18	89.76	11.81	14	0	0
Croatia	34.87	90.68	-6.64	23	0	0
Cyprus	22.30	99.01	0.96	9	0	1
Dominican Republic	19.76	66.05	0.81	2	0	0
Ecuador	21.16	51.34	-1.89	3	0	0
Egypt	10.11	45.96	-6.13	12	0	0
El Salvador	16.68	54.88	7.03	2	0	0
Guatemala	14.11	42.35	8.93	7	0	0
Guyana	32.56	203.64	-5.69	0	0	0
Honduras	16.74	96.77	6.77	2	0	0
Indonesia	19.02	48.54	-10.74	23	0	0
Jamaica	24.70	113.31	11.33	3	0	0
Kazakhstan	22.95	67.86	6.75	2	0	0
Latvia	26.98	98.92	132.99	0	0	1
Lithuania	27.87	117.23	49.87	3	0	1
Madagascar	13.28	46.46	-5.39	0	0	0
Malaysia	18.66	162.34	-1.48	59	0	0
Mali	20.87	57.25	-17.75	0	0	0
Mauritania	27.73	96.50	-15.66	0	0	0
Moldova	33.79	113.06	-2.08	0	0	0
Morocco	16.78	49.01	-7.73	4	0	0
Mozambique	28.03	52.17	-2.57	n.a.	0	0
Nepal	23.17	50.36	-9.67	n.a.	0	0
Nicaragua	32.60	103.89	16.05	1	0	0
Nigeria	13.22	70.06	3.83	3	0	0
Paraguay	19.59	84.81	-0.45	0	0	0
Peru	12.92	26.60	-5.00	10	0	0
Phillipines	16.79	75.06	-2.68	17	0	0
Senegal	17.27	76.85	-17.68	0	0	0
Singapore	7.41	313.93	0.05	324	0	0
South Africa	25.87	43.15	-6.13	529	0	0
Taiwan	14.45	91.05	-3.84	8206	0	0
Tajikistan	21.96	144.37	-15.94	n.a.	0	0
Tanzania	23.08	49.44	13.46	0	0	0
Thailand	14.12	83.72	-6.01	34	0	0
Uganda	27.38	32.11	-7.90	3	0	0
Venezuela	15.40	58.22	15.62	133	0	0
Vietnam	18.52	74.50	25.23	0	0	0
Zambia	24.55	76.12	-6.32	0	0	0
Zimbawe	18.73	73.62	-14.25	6	0	0

Source: Heston *et al.* (2002)[1], US Department of Commerce (2005)[2]

Table A.4.1 - *Socio-Economic Variables: Developed Countries* (Instrumental Variables)

Country	iv_1 britishcolony[1]	iv_2 agedemregime[2]	iv_3 ethnic−linguistic[3]
Australia	1	111	0.093
Austria	0	79	0.107
Belgium	0	154	0.555
Canada	1	145	0.712
Czech Republic	0	46	0.322
Denmark	0	93	0.082
Estonia	0	36	0.506
Finland	0	95	0.132
France	0	119	0.103
Germany	0	63	0.168
Greece	0	122	0.158
Hungary	0	22	0.152
Ireland	1	91	0.121
Israel	1	64	0.344
Italy	0	64	0.115
Japan	0	60	0.012
Mexico	0	12	0.542
Netherlands	0	91	0.105
New Zealand	1	155	0.397
Poland	0	30	0.118
Portugal	0	52	0.047
Slovakia	0	19	0.254
Spain	0	44	0.417
Sweden	0	95	0.060
Switzerland	0	164	0.531
Turkey	0	55	0.320
United Kingdom	1	132	0.121
United States	1	212	0.490

Source: Heston *et al.* (2002)[1], Keefer *et al.* (2013)[2], Alesina *et al.* (2003)[3]

Indicators

iv_1 = British Colony
("*Was the country a British colony?*")
[0 = no; 1 = yes]

iv_2 = Age of Democratic Regime
("*Number of consecutive years a democratic regime has been established in the country*")

iv_3 = Ethnic-Linguistic Fractionalization
[0 = mininum fractionalization; 1 = maximum fractionalization]

Table A.4.2 - *Socio-Economic Variables: Developing Countries* (Instrumental Variables)

Country	iv_1 $britishcolony^1$	iv_2 $agedemregime^2$	iv_3 $ethnic-linguistic^3$
Albania	0	10	0.220
Argentina	0	29	0.339
Armenia	0	4	0.127
Bangladesh	1	0	0.045
Benin	0	154	0.787
Bolivia	0	30	0.740
Brazil	0	28	0.541
Bulgaria	0	22	0.402
Chad	0	0	0.862
China	0	0	0.154
Colombia	0	75	0.601
Costa Rica	0	183	0.237
Croatia	0	12	0.369
Cyprus	1	48	0.094
Dominican Republic	0	17	0.429
Ecuador	0	22	0.655
Egypt	0	6	0.184
El Salvador	0	21	0.198
Guatemala	0	16	0.512
Guyana	1	0	0.620
Honduras	0	13	0.187
Indonesia	0	13	0.735
Jamaica	1	53	0.413
Kazakhstan	0	0	0.617
Latvia	0	36	0.587
Lithuania	0	29	0.322
Madagascar	0	17	0.879
Malaysia	1	12	0.588
Mali	0	14	0.691
Mauritania	0	0	0.615
Moldova	0	19	0.554
Morocco	0	0	0.484
Mozambique	0	0	0.693
Nepal	1	6	0.663
Nicaragua	0	17	0.484
Nigeria	1	11	0.851
Paraguay	0	20	0.169
Peru	0	24	0.657
Phillipines	0	25	0.239
Senegal	0	12	0.694
Singapore	1	4	0.386
South Africa	1	101	0.752
Taiwan	0	20	0.274
Tajikistan	0	0	0.511
Tanzania	1	0	0.735
Thailand	1	16	0.634
Uganda	1	4	0.930
Venezuela	0	43	0.497
Vietnam	0	0	0.238
Zambia	1	5	0.781
Zimbawe	1	9	0.387

Source: Heston *et al.* (2002)[1], Keefer *et al.* (2013)[2], Alesina *et al.* (2003)[3]

Appendix B - Descriptive Statistics

Table B.1.1 - *Competition Policy Indicators*: *Developed Countries*

Independent Variable	Observations	Mean	Standard Deviation	Min	Max
x_1 - $COMP_{law}$	28	0.461	0.157	0.173	0.750
x_2 - $COMP_{economics}$	28	0.692	0.192	0.233	0.972
x_3 - $COMP_{dejure}$	28	0.531	0.088	0.331	0.692
x_4 - $COMP_{defacto}$	28	0.798	0.178	0.372	1

Table B.1.2 - *Competition Policy Indicators*: *Developing Countries*

Independent Variable	Observations	Mean	Standard Deviation	Min	Max
x_1 - $COMP_{law}$	51	0.207	0.233	0	0.702
x_2 - $COMP_{economics}$	44	0.284	0.322	0	0.810
x_3 - $COMP_{dejure}$	46	0.275	0.269	0	0.769
x_4 - $COMP_{defacto}$	41	0.349	0.365	0	0.902

Table B.2.1 - *Performance Indicators*: *Developed Countries*

Dependent Variable	Observations	Mean	Standard Deviation	Min	Max
y_1 - $PERF_{local}$	28	5.580	0.411	4.623	6.315
y_2 - $PERF_{dominance}$	28	4.974	0.795	3.301	6.207
y_3 - $PERF_{antitrust}$	28	5.200	0.688	3.623	6.123
y_4 - $PERF_{comp}$	28	4.921	0.413	4.130	5.422
y_5 - $PERF_{efficiency}$	28	4.971	0.449	4.123	5.431

Table B.2.2 - *Performance Indicators*: *Developing Countries*

Dependent Variable	Observations	Mean	Standard Deviation	Min	Max
y_1 - $PERF_{local}$	50	4.590	0.647	3.215	5.797
y_2 - $PERF_{dominance}$	50	3.522	0.754	2.474	5.605
y_3 - $PERF_{antitrust}$	50	3.630	0.740	2.518	5.398
y_4 - $PERF_{comp}$	50	4.021	0.556	3.022	5.931
y_5 - $PERF_{efficiency}$	50	3.994	0.574	2.843	5.762

Table B.3.1 - *Socio-Economic Variables*: *Developed Countries*

Control Variable	Observations	Mean	Standard Deviation	Min	Max
z_1 - $CTRL_{govtcons}$	28	11.618	6.472	5.330	32.579
z_2 - $CTRL_{openness}$	28	69.729	32.506	17.953	138.871
z_3 - $CTRL_{inflation}$	28	-1.725	7.686	-9.477	24.889
z_4 - $CTRL_{patents}$	27	18,528	58,182	3	287,848
z_5 - $CTRL_{OECD}$	27	0.667	0.4804	0	1
z_6 - $CTRL_{EU}$	26	0.692	0.4707	0	1

Table B.3.2 - *Socio-Economic Variables*: *Developing Countries*

Control Variable	Observations	Mean	Standard Deviation	Min	Max
z_1 - $CTRL_{govtcons}$	51	21.170	6.812	7.414	34.868
z_2 - $CTRL_{openness}$	51	77.379	49.859	15.029	313.927
z_3 - $CTRL_{inflation}$	51	3.760	23.757	-17.753	132.993
z_4 - $CTRL_{patents}$	46	221.304	1208.163	0	8206
z_5 - $CTRL_{OECD}$	47	0	0	0	0
z_6 - $CTRL_{EU}$	50	0.06	0.240	0	1

Table B.4.1 - *Socio-Economic Variables*: *Developed Countries*

Instrumental Variable	Observations	Mean	Standard Deviation	Min	Max
iv_1 - $IV_{britishcolony}$	28	0.25	0.441	0	1
iv_2 - $IV_{agedemregime}$	28	86.61	50.04	12	212
iv_3 - $IV_{ethnic-linguistic}$	28	0.253	0.194	0.012	0.712

Table B.4.2 - *Socio-Economic Variables*: *Developing Countries*

Instrumental Variable	Observations	Mean	Standard Deviation	Min	Max
iv_1 - $IV_{britishcolony}$	51	0.275	0.451	0	1
iv_2 - $IV_{agedemregime}$	51	23.529	35.492	0	183
iv_3 - $IV_{ethnic-linguistic}$	51	0.491	0.233	0.045	0.930

Appendix C.1 - Estimation (Developing and Developed Countries)

Table C.1.1.1 - OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables
(Substantive Content of the Competition Law as Independent Variable)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{law}$	1.331***	0.431	1.594***	0.245	1.785***	0.457	0.858**	0.066	1.123***	0.234
	(0.316)	(0.330)	(0.454)	(0.404)	(0.448)	(0.427)	(0.299)	(0.263)	(0.309)	(0.273)
$CTRL_{govtcons}$		-0.020		-0.033*		-0.011		-0.021*		-0.024*
		(0.011)		(0.014)		(0.014)		(0.009)		(0.009)
$CTRL_{openness}$		0.003		0.005**		0.004*		0.006***		0.006***
		(0.002)		(0.002)		(0.002)		(0.001)		(0.001)
$CTRL_{inflation}$		-0.002		-0.003		-0.006		0.001		0.001
		(0.004)		(0.005)		(0.005)		(0.003)		(0.003)
$CTRL_{patents}$		0.000		0.000		0.000		0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
$CTRL_{OECD}$		0.356		1.017***		1.139***		0.618***		0.721***
		(0.227)		(0.278)		(0.294)		(0.181)		(0.188)
$CTRL_{EU}$		0.369		0.315		0.488*		0.133		0.068
		(0.185)		(0.226)		(0.239)		(0.147)		(0.153)
costant	4.550***	4.791***	3.570***	3.854***	3.664***	3.540***	4.089***	4.070***	4.011***	4.094***
	(0.121)	(0.266)	(0.174)	(0.324)	(0.171)	(0.344)	(0.115)	(0.212)	(0.118)	(0.220)
R²	0.189	0.458	0.140	0.622	0.173	0.585	0.098	0.589	0.148	0.608
SER	0.675	0.550	0.968	0.671	0.955	0.711	0.638	0.438	0.659	0.455
N	78	69	78	69	78	69	78	69	78	69

$* \ p < 0.05$, $** \ p < 0.01$, $*** \ p < 0.001$ (standard errors in parentheses)

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Table C.1.1.2 - OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables
(Degree the Competition Law incorporates an Economic Approach as Independent Variable)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competiton	PERF competiton	PERF efficiency	PERF efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{economics}$	1.068***	0.604*	1.483***	0.825*	1.725***	1.176***	0.820***	0.536*	0.988***	0.657**
	(0.235)	(0.287)	(0.321)	(0.331)	(0.299)	(0.322)	(0.217)	(0.210)	(0.225)	(0.218)
$CTRL_{govtcons}$		-0.020		-0.037**		-0.016		-0.0223**		-0.025**
		(0.011)		(0.013)		(0.013)		(0.008)		(0.009)
$CTRL_{openness}$		0.004*		0.006**		0.006**		0.007***		0.007***
		(0.002)		(0.002)		(0.002)		(0.001)		(0.001)
$CTRL_{inflation}$		-0.002		-0.003		-0.005		0.000		0.001
		(0.004)		(0.004)		(0.004)		(0.003)		(0.003)
$CTRL_{patents}$		0.000		0.000		0.000		0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
$CTRL_{OECD}$		0.368		0.913***		1.031***		0.554**		0.679***
		(0.222)		(0.257)		(0.250)		(0.163)		(0.169)
$CTRL_{EU}$		0.171		-0.030		0.0220		-0.077		-0.172
		(0.215)		(0.248)		(0.241)		(0.158)		(0.164)
costant	4.490***	4.656***	3.444***	3.701***	3.483***	3.322***	4.001***	3.881***	3.926***	3.900***
	(0.131)	(0.281)	(0.179)	(0.324)	(0.167)	(0.315)	(0.121)	(0.206)	(0.125)	(0.214)
R^2	0.228	0.492	0.233	0.671	0.322	0.685	0.170	0.666	0.216	0.686
SER	0.677	0.549	0.925	0.634	0.862	0.617	0.625	0.403	0.647	0.418
N	72	63	72	63	72	63	72	63	72	63

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$ (standard errors in parentheses)

Table C.1.1.3 - OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables (Formal Independence of the Competition Authority as Independent Variable)

Variables	$PERF$ local	$PERF$ local	$PERF$ dominance	$PERF$ dominance	$PERF$ antitrust	$PERF$ antitrust	$PERF$ competition	$PERF$ competition	$PERF$ efficiency	$PERF$ efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{dejure}$	1.452***	1.017**	1.907***	1.264**	2.334***	1.806***	1.092***	0.856***	1.324***	1.009***
	(0.309)	(0.314)	(0.434)	(0.375)	(0.400)	(0.360)	(0.289)	(0.240)	(0.298)	(0.244)
$CTRL_{govtcons}$		-0.021		-0.036**		-0.015		-0.022*		-0.025**
		(0.011)		(0.013)		(0.012)		(0.008)		(0.008)
$CTRL_{openness}$		0.004*		0.006***		0.006**		0.007***		0.007***
		(0.002)		(0.002)		(0.002)		(0.001)		(0.001)
$CTRL_{inflation}$		-0.003		-0.005		-0.008		-0.001		-0.000
		(0.004)		(0.004)		(0.004)		(0.003)		(0.003)
$CTRL_{patents}$		0.000		0.000*		0.000		0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
$CTRL_{OECD}$		0.297		0.862**		0.938***		0.509**		0.623***
		(0.212)		(0.253)		(0.243)		(0.162)		(0.165)
$CTRL_{EU}$		0.218		0.078		0.159		-0.019		-0.098
		(0.184)		(0.219)		(0.210)		(0.140)		(0.143)
costant	4.425***	4.549***	3.381***	3.543***	3.385***	3.131***	3.960***	3.778***	3.874***	3.801***
	(0.139)	(0.265)	(0.194)	(0.316)	(0.179)	(0.303)	(0.129)	(0.202)	(0.133)	(0.206)
R²	0.234	0.526	0.212	0.679	0.321	0.702	0.166	0.667	0.215	0.697
SER	0.665	0.521	0.932	0.622	0.860	0.597	0.620	0.626	0.640	0.405
N	74	65	74	65	74	65	74	65	74	65

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$ (standard errors in parentheses)

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Table C.1.1.4 - *OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables (Factual Independence of the Competition Authority as Independent Variable)*

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competiton	PERF competiton	PERF efficiency	PERF efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{defacto}$	1.163***	0.848***	1.568***	0.960***	1.818***	1.376***	0.870***	0.614**	1.060***	0.764***
	(0.206)	(0.226)	(0.288)	(0.272)	(0.259)	(0.267)	(0.200)	(0.182)	(0.203)	(0.181)
$CTRL_{govtcons}$		-0.021		-0.033*		-0.015		-0.022*		-0.024**
		(0.011)		(0.013)		(0.013)		(0.009)		(0.009)
$CTRL_{openness}$		0.004*		0.006***		0.006**		0.007***		0.007***
		(0.002)		(0.002)		(0.002)		(0.001)		(0.001)
$CTRL_{inflation}$		-0.002		-0.004		-0.007		-0.000		0.001
		(0.004)		(0.004)		(0.004)		(0.003)		(0.003)
$CTRL_{patents}$		0.000*		0.000*		0.000		0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
$CTRL_{OECD}$		0.205		0.792**		0.737**		0.443*		0.542**
		(0.225)		(0.270)		(0.265)		(0.182)		(0.181)
$CTRL_{EU}$		0.202		0.078		0.123		-0.017		-0.100
		(0.184)		(0.222)		(0.218)		(0.149)		(0.148)
costant	4.340***	4.448***	3.286***	3.487***	3.326***	3.145***	3.914***	3.780***	3.811***	3.765***
	(0.132)	(0.264)	(0.185)	(0.317)	(0.167)	(0.311)	(0.129)	(0.213)	(0.131)	(0.212)
R²	0.329	0.574	0.313	0.698	0.431	0.706	0.225	0.665	0.295	0.708
SER	0.629	0.512	0.880	0.615	0.791	0.604	0.612	0.413	0.620	0.411
N	67	59	67	59	67	59	67	59	67	59

$^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$ (standard errors in parentheses)

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Table C.1.2.1 - 2SLS and GMM Estimation of Performance Indicators on Competition Policy Indicators with Control Variables
(Substantive Content of the Competition Law as Independent Variable)

Variables	$PERF_{local}$	$PERF_{local}$	$PERF_{dominance}$	$PERF_{dominance}$	$PERF_{antitrust}$	$PERF_{antitrust}$	$PERF_{competition}$	$PERF_{competition}$	$PERF_{efficiency}$	$PERF_{efficiency}$
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{law}$	1.319	1.411	1.770	2.033	1.448	1.285	0.293	-0.065	0.980	0.806
	(0.949)	(0.816)	(1.218)	(1.065)	(1.211)	(0.796)	(0.720)	(0.495)	(0.787)	(0.523)
$CTRL_{govtcons}$	-0.019	-0.022*	-0.032*	-0.031*	-0.010	-0.024*	-0.021*	-0.028***	-0.023*	-0.031***
	(0.011)	(0.010)	(0.014)	(0.012)	(0.014)	(0.011)	(0.008)	(0.008)	(0.009)	(0.008)
$CTRL_{openness}$	0.004*	0.003*	0.007**	0.007***	0.005*	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
$CTRL_{inflation}$	-0.004	-0.003	-0.007**	-0.007	-0.008	-0.005	0.0002	0.002	-0.000	0.001
	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.004)	(0.003)	(0.002)	(0.004)	(0.002)
$CTRL_{patents}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000**	0.000***	0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$CTRL_{OECD}$	0.185	0.210	0.722*	0.764*	0.948**	1.019***	0.574**	0.579***	0.577*	0.622***
	(0.284)	(0.227)	(0.364)	(0.315)	(0.362)	(0.255)	(0.215)	(0.174)	(0.235)	(0.163)
$CTRL_{EU}$	0.303	0.271	0.201	0.172	0.414	0.429*	0.116	0.191	0.012	0.008
	(0.195)	(0.169)	(0.251)	(0.223)	(0.249)	(0.197)	(0.148)	(0.130)	(0.162)	(0.133)
costant	4.515***	4.562***	3.380***	3.276***	3.231***	3.422***	4.000***	4.200***	3.862***	4.020***
	(0.383)	(0.305)	(0.491)	(0.407)	(0.488)	(0.332)	(0.290)	(0.202)	(0.317)	(0.200)
R^2	0.394	0.377	0.534	0.499	0.549	0.545	0.583	0.580	0.561	0.574
SER	0.546	0.554	0.701	0.727	0.697	0.700	0.414	0.416	0.453	0.446
N	69	69	69	69	69	69	69	69	69	69

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (standard errors in parentheses)

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.

Table C.1.2.2 - *2SLS and GMM Estimation of Performance Indicators on Competition Policy Indicators with Control Variables*
(Degree the Competition Law incorporates an Economic Approach as Independent Variable)

Variables	$PERF$ local	$PERF$ local	$PERF$ dominance	$PERF$ dominance	$PERF$ antitrust	$PERF$ antitrust	$PERF$ competition	$PERF$ competition	$PERF$ efficiency	$PERF$ efficiency
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{economics}$	2.265	2.434**	2.857	2.732*	3.734*	4.053*	1.486	1.778*	2.105	2.398**
	(1.407)	(0.887)	(1.660)	(1.107)	(1.824)	(1.730)	(0.952)	(0.843)	(1.132)	(0.875)
$CTRL_{govtcons}$	-0.017	-0.016	-0.034*	-0.029	-0.012	0.014	-0.021*	-0.021	-0.023*	-0.022
	(0.014)	(0.013)	(0.016)	(0.015)	(0.018)	(0.020)	(0.009)	(0.011)	(0.011)	(0.013)
$CTRL_{openness}$	0.006*	0.006***	0.009**	0.009***	0.010**	0.010**	0.009***	0.009***	0.009***	0.009***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
$CTRL_{inflation}$	-0.004	-0.005	-0.006	-0.007	-0.009	-0.009*	-0.001	-0.001	-0.001	-0.000
	(0.005)	(0.003)	(0.006)	(0.004)	(0.007)	(0.003)	(0.003)	(0.002)	(0.004)	(0.002)
$CTRL_{patents}$	0.000	0.000	0.000	0.000*	6.14^{E}-08	5.19^{E}-08	0.0000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$CTRL_{OECD}$	0.159	0.153	0.657	0.727***	0.710	0.648	0.435*	0.324	0.497*	0.451*
	(0.315)	(0.210)	(0.371)	(0.270)	(0.408)	(0.364)	(0.213)	(0.178)	(0.253)	(0.213)
$CTRL_{EU}$	-0.463	-0.498	-0.805	-0.788	-0.953	-1.020	-0.439	-0.485	-0.724	-0.791
	(0.579)	(0.425)	(0.684)	(0.475)	(0.751)	(0.798)	(0.392)	(0.402)	(0.466)	(0.411)
costant	3.964***	3.843***	2.855***	2.815***	2.257**	2.154*	3.485***	3.383***	3.297***	3.151***
	(0.659)	(0.469)	(0.778)	(0.620)	(0.854)	(0.853)	(0.446)	(0.420)	(0.530)	(0.464)
R^2	0.183	0.116	0.446	0.472	0.324	0.227	0.543	0.451	0.436	0.323
SER	0.651	0.677	0.769	0.751	0.844	0.903	0.441	0.483	0.524	0.574
N	63	63	63	63	63	63	63	63	63	63

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$ (standard errors in parentheses)

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.

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Table C.1.2.3 - *2SLS Estimation of Performance Indicators on Competition Policy Indicators with Control Variables (Formal Independence of the Competition Authority as Independent Variable)*

Variables	$PERF_{local}$	$PERF_{local}$	$PERF_{dominance}$	$PERF_{dominance}$	$PERF_{antitrust}$	$PERF_{antitrust}$	$PERF_{competition}$	$PERF_{competition}$	$PERF_{efficiency}$	$PERF_{efficiency}$
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{dejure}$	2.335*	2.445	2.678*	2.636	4.689**	4.710	2.289*	2.404	2.586**	2.511
	(1.111)	(0.825)	(1.295)	(0.975)	(1.622)	(1.480)	(0.945)	(0.878)	(0.994)	(0.765)
$CTRL_{govtcons}$	-0.023	-0.023	-0.038**	-0.035	-0.019	-0.021	-0.024*	-0.026	-0.027**	-0.029
	(0.012)	(0.010)	(0.013)	(0.011)	(0.017)	(0.014)	(0.010)	(0.009)	(0.010)	(0.009)
$CTRL_{openness}$	0.005*	0.006	0.008***	0.009	0.010**	0.010	0.009***	0.009	0.009***	0.009
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
$CTRL_{inflation}$	-0.006	-0.007	-0.008	-0.008	-0.014*	-0.014	-0.004	-0.003	-0.003	-0.003
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.007)	(0.004)	(0.004)	(0.004)	(0.004)
$CTRL_{patents}$	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$CTRL_{OECD}$	0.115	0.096	0.666*	0.665	0.539	0.519	0.310	0.281	0.405	0.418
	(0.271)	(0.214)	(0.315)	(0.253)	(0.395)	(0.329)	(0.230)	(0.191)	(0.242)	(0.179)
$CTRL_{EU}$	-0.013	-0.003	-0.170	-0.144	-0.346	-0.364	-0.270	-0.311	-0.375	-0.370
	(0.270)	(0.174)	(0.315)	(0.256)	(0.395)	(0.318)	(0.230)	(0.201)	(0.242)	(0.181)
costant	4.077***	4.008	3.037***	2.972	2.100**	2.131	3.265***	3.276	3.237***	3.287
	(0.473)	(0.389)	(0.551)	(0.496)	(0.690)	(0.654)	(0.402)	(0.401)	(0.423)	(0.372)
R^2	0.380	0.354	0.599	0.603	0.367	0.361	0.458	0.495	0.475	0.495
SER	0.558	0.570	0.651	0.648	0.815	0.818	0.475	0.490	0.500	0.490
N	65	65	65	65	65	65	65	65	65	65

$*\ p < 0.05,\ **\ p < 0.01,\ ***\ p < 0.001$ (standard errors in parentheses)

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.

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Table C.1.2.4 - *2SLS Estimation of Performance Indicators on Competition Policy Indicators with Control Variables (Factual Independence of the Competition Authority as Independent Variable)*

Variables	$PERF_{local}$	$PERF_{local}$	$PERF_{dominance}$	$PERF_{dominance}$	$PERF_{antitrust}$	$PERF_{antitrust}$	$PERF_{competition}$	$PERF_{competition}$	$PERF_{efficiency}$	$PERF_{efficiency}$
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{defacto}$	1.880*	1.999***	1.845*	1.823**	3.069**	3.292**	1.485*	1.747*	1.813*	1.994**
	(0.825)	(0.567)	(0.919)	(0.660)	(1.098)	(1.206)	(0.675)	(0.751)	(0.718)	(0.702)
$CTRL_{govtcons}$	-0.023	-0.025*	-0.036**	-0.031*	-0.019	-0.018	-0.024*	-0.0260*	-0.027*	-0.029*
	(0.0122)	(0.012)	(0.014)	(0.012)	(0.016)	(0.018)	(0.010)	(0.012)	(0.011)	(0.012)
$CTRL_{openness}$	0.006**	0.006***	0.008***	0.008***	0.009**	0.009**	0.009***	0.009***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
$CTRL_{inflation}$	-0.003	-0.003	-0.005	-0.006	-0.009	-0.010	-0.001	-0.001	-0.001	-0.0006
	(0.004)	(0.003)	(0.005)	(0.004)	(0.005)	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)
$CTRL_{patents}$	0.000*	0.000***	0.000*	0.000***	0.000	0.000***	0.000*	0.000***	0.000*	0.0000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$CTRL_{OECD}$	-0.141	-0.179	0.496	0.566*	0.171	0.147	0.152	0.046	0.191	0.136
	(0.362)	(0.260)	(0.403)	(0.279)	(0.481)	(0.474)	(0.296)	(0.284)	(0.315)	(0.290)
$CTRL_{EU}$	-0.070	-0.099	-0.155	-0.165	-0.323	-0.358	-0.246	-0.290	-0.377	-0.409
	(0.291)	(0.223)	(0.323)	(0.227)	(0.386)	(0.403)	(0.238)	(0.276)	(0.253)	(0.255)
costant	3.977***	3.940***	3.084***	2.980***	2.373***	2.197**	3.383***	3.276***	3.286***	3.202***
	(0.462)	(0.356)	(0.514)	(0.474)	(0.614)	(0.672)	(0.378)	(0.432)	(0.402)	(0.407)
R^2	0.400	0.357	0.635	0.636	0.473	0.406	0.515	0.410	0.517	0.444
SER	0.565	0.585	0.629	0.628	0.751	0.798	0.462	0.510	0.492	0.528
N	59	59	59	59	59	59	59	59	59	59

$* \ p < 0.05$, $** \ p < 0.01$, $*** \ p < 0.001$ (standard errors in parentheses)

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.

Table C.1.3.1 - *OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables*

Variables	$PERF_{local}$	$PERF_{local}$	$PERF_{dominance}$	$PERF_{dominance}$	$PERF_{antitrust}$	$PERF_{antitrust}$	$PERF_{competiton}$	$PERF_{competiton}$	$PERF_{efficiency}$	$PERF_{efficiency}$
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{law}$	1.331***	0.431	1.594***	0.245	1.785***	0.457	0.858**	0.066	1.123***	0.234
	(0.316)	(0.330)	(0.454)	(0.404)	(0.448)	(0.427)	(0.299)	(0.263)	(0.309)	(0.273)
R^2	0.189	0.458	0.140	0.622	0.173	0.585	0.098	0.589	0.148	0.608
SER	0.675	0.550	0.968	0.671	0.955	0.711	0.638	0.438	0.659	0.455
N	78	69	78	69	78	69	78	69	78	69
$COMP_{economics}$	1.068***	0.604*	1.483***	0.825*	1.725***	1.176***	0.820***	0.536*	0.988***	0.657**
	(0.235)	(0.287)	(0.321)	(0.331)	(0.299)	(0.322)	(0.217)	(0.210)	(0.225)	(0.218)
R^2	0.228	0.492	0.233	0.671	0.322	0.685	0.170	0.666	0.216	0.686
SER	0.677	0.549	0.925	0.634	0.862	0.617	0.625	0.403	0.647	0.418
N	72	63	72	63	72	63	72	63	72	63
$COMP_{dejure}$	1.452***	1.017**	1.907***	1.264**	2.334***	1.806***	1.092***	0.856***	1.324***	1.009***
	(0.309)	(0.314)	(0.434)	(0.375)	(0.400)	(0.360)	(0.289)	(0.240)	(0.298)	(0.244)
R^2	0.234	0.526	0.212	0.679	0.321	0.702	0.166	0.667	0.215	0.697
SER	0.665	0.521	0.932	0.622	0.860	0.597	0.620	0.626	0.640	0.405
N	74	65	74	65	74	65	74	65	74	65
$COMP_{defacto}$	1.163***	0.848***	1.568***	0.960***	1.818***	1.376***	0.870***	0.614**	1.060***	0.764***
	(0.206)	(0.226)	(0.288)	(0.272)	(0.259)	(0.267)	(0.200)	(0.182)	(0.203)	(0.181)
R^2	0.329	0.574	0.313	0.698	0.431	0.706	0.225	0.665	0.295	0.708
SER	0.629	0.512	0.880	0.615	0.791	0.604	0.612	0.413	0.620	0.411
N	67	59	67	59	67	59	67	59	67	59

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (standard errors in parentheses)

Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU.

Table C.1.3.2 - 2SLS and GMM Estimation of Performance Indicators on Competition Policy Indicators with Control and Instrumental Variables

Variables	$PERF_{local}$	$PERF_{local}$	$PERF_{dominance}$	$PERF_{dominance}$	$PERF_{antitrust}$	$PERF_{antitrust}$	$PERF_{competition}$	$PERF_{competition}$	$PERF_{efficiency}$	$PERF_{efficiency}$
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{law}$	1.319	1.411	1.770	2.033	1.448	1.285	0.293	-0.065	0.980	0.806
	(0.949)	(0.816)	(1.218)	(1.065)	(1.211)	(0.796)	(0.720)	(0.495)	(0.787)	(0.523)
R^2	0.394	0.377	0.534	0.499	0.549	0.545	0.583	0.580	0.561	0.574
SER	0.546	0.554	0.701	0.727	0.697	0.700	0.414	0.416	0.453	0.446
N	69	69	69	69	69	69	69	69	69	69
$COMP_{economics}$	2.265	2.434**	2.857	2.732*	3.734*	4.053*	1.486	1.778*	2.105	2.398**
	(1.407)	(0.887)	(1.660)	(1.107)	(1.824)	(1.730)	(0.952)	(0.843)	(1.132)	(0.875)
R^2	0.1828	0.116	0.4460	0.472	0.3241	0.227	0.543	0.451	0.436	0.323
SER	0.65129	0.677	0.76881	0.751	0.84442	0.903	0.441	0.483	0.524	0.574
N	63	63	63	63	63	63	63	63	63	63
$COMP_{dejure}$	2.335*	2.445	2.678*	2.636	4.689**	4.710	2.289*	2.404	2.586**	2.511
	(1.111)	(0.825)	(1.295)	(0.975)	(1.622)	(1.480)	(0.945)	(0.878)	(0.994)	(0.765)
R^2	0.380	0.354	0.599	0.603	0.367	0.361	0.458	0.495	0.475	0.495
SER	0.558	0.570	0.651	0.648	0.815	0.818	0.475	0.490	0.500	0.490
N	65	65	65	65	65	65	65	65	65	65
$COMP_{defacto}$	1.880*	1.999***	1.845*	1.823**	3.069**	3.292**	1.485*	1.747*	1.813*	1.994**
	(0.825)	(0.567)	(0.919)	(0.660)	(1.098)	(1.206)	(0.675)	(0.751)	(0.718)	(0.702)
R^2	0.400	0.357	0.635	0.636	0.473	0.406	0.515	0.410	0.517	0.444
SER	0.565	0.585	0.629	0.628	0.751	0.798	0.462	0.510	0.492	0.528
N	59	59	59	59	59	59	59	59	59	59

$* p < 0.05$, $** p < 0.01$, $*** p < 0.001$ (standard errors in parentheses)

Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU.

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.

Appendix C.2 - Estimation (Developing Countries)

Table C.2.1.1 - OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables
(Substantive Content of the Competition Law as Independent Variable)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{law}$	0.538	0.389	0.006	0.074	0.273	0.341	-0.168	-0.236	0.174	0.120
	(0.390)	(0.416)	(0.464)	(0.489)	(0.453)	(0.516)	(0.341)	(0.314)	(0.352)	(0.334)
$CTRL_{govtcons}$		-0.029		-0.033		-0.017		-0.027*		-0.031*
		(0.015)		(0.017)		(0.018)		(0.011)		(0.012)
$CTRL_{openness}$		0.002		0.004*		0.004		0.005***		0.005**
		(0.002)		(0.002)		(0.002)		(0.001)		(0.001)
$CTRL_{inflation}$		-0.004		-0.004		-0.009		0.000		-0.000
		(0.005)		(0.006)		(0.006)		(0.004)		(0.004)
$CTRL_{patents}$		0.000		0.000**		0.0002		0.000		0.000*
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
$CTRL_{EU}$		0.916*		0.723		1.241*		0.510		0.561
		(0.344)		(0.511)		(0.539)		(0.328)		(0.349)
costant	4.480***	4.935***	3.521***	3.846***	3.574***	3.550***	4.055***	4.210***	3.959***	4.199***
	(0.121)	(0.344)	(0.144)	(0.404)	(0.140)	(0.427)	(0.106)	(0.260)	(0.109)	(0.277)
R^2	0.038	0.299	0.000	0.370	0.008	0.295	0.005	0.495	0.005	0.469
SER	0.641	0.573	0.762	0.673	0.745	0.711	0.561	0.433	0.579	0.461
JB										
N	50	42	50	42	50	42	50	42	50	42

$^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$ (standard errors in parentheses)

Table C.2.1.2 - OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables
(Degree the Competition Law incorporates an Economic Approach as Independent Variable)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competiton	PERF competiton	PERF efficiency	PERF efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{economics}$	0.321	0.382	0.320	0.758	0.677*	1.108**	0.094	0.405	0.279	0.583*
	(0.319)	(0.392)	(0.370)	(0.422)	(0.329)	(0.384)	(0.274)	(0.259)	(0.281)	(0.274)
$CTRL_{govtcons}$		-0.029		-0.042*		-0.028		-0.031**		-0.034**
		(0.016)		(0.017)		(0.015)		(0.010)		(0.011)
$CTRL_{openness}$		0.003		0.006*		0.006***		0.007***		0.006***
		(0.002)		(0.002)		(0.002)		(0.001)		(0.001)
$CTRL_{inflation}$		-0.003		-0.004		-0.007		-0.000		0.000
		(0.005)		(0.005)		(0.005)		(0.003)		(0.003)
$CTRL_{patents}$		0.000		0.000*		0.000		0.000		0.000*
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
$CTRL_{EU}$		0.729		0.278		0.605		0.310		0.267
		(0.500)		(0.537)		(0.489)		(0.330)		(0.349)
costant	4.477***	4.859***	3.453***	3.789***	3.448***	3.469***	3.982***	4.033***	3.898***	4.039***
	(0.136)	(0.384)	(0.158)	(0.413)	(0.140)	(0.377)	(0.117)	(0.254)	(0.120)	(0.268)
R^2	0.024	0.329	0.018	0.477	0.092	0.510	0.003	0.619	0.023	0.610
SER	0.673	0.599	0.780	0.645	0.693	0.587	0.578	0.396	0.593	0.419
JB										
N	44	36	44	36	44	36	44	36	44	36

$* p < 0.05, \; ** p < 0.01, \; *** p < 0.001$ (standard errors in parentheses)

Table C.2.1.3 - OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables
(Formal Independence of the Competition Authority as Independent Variable)

Variables	PERF $local$	PERF $local$	PERF $dominance$	PERF $dominance$	PERF $antitrust$	PERF $antitrust$	PERF $competiton$	PERF $competiton$	PERF $efficiency$	PERF $efficiency$
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{dejure}$	0.708	0.818	0.774	1.116	1.236**	1.664	0.347	0.649	0.580	0.839**
	(0.357)	(0.384)	(0.418)	(0.429)	(0.376)	(0.396)	(0.315)	(0.278)	(0.319)	(0.285)
$CTRL_{govtcons}$		-0.031		-0.041		-0.028		-0.029		-0.034***
		(0.015)		(0.017)		(0.015)		(0.011)		(0.011)
$CTRL_{openness}$		0.003		0.005		0.006		0.007		0.006***
		(0.002)		(0.002)		(0.002)		(0.001)		(0.001)
$CTRL_{inflation}$		-0.005		-0.006		-0.011		-0.002		-0.002
		(0.005)		(0.005)		(0.005)		(0.003)		(0.003)
$CTRL_{patents}$		0.000		0.000		0.000		0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
$CTRL_{EU}$		0.802		0.519		0.939		0.428		0.445
		(0.433)		(0.485)		(0.448)		(0.314)		(0.322)
costant	4.395***	4.801	3.339***	3.687***	3.337***	3.367	3.932***	3.971	3.839***	4.006***
	(0.137)	(0.350)	(0.160)	(0.391)	(0.144)	(0.361)	(0.121)	(0.254)	(0.122)	(0.260)
R^2	0.082	0.378	0.072	0.488	0.197	0.547	0.027	0.583	0.070	0.597
SER	0.645	0.564	0.755	0.630	0.678	0.582	0.569	0.409	0.576	0.418
JB										
N	46	38	46	38	46	38	46	38	46	38

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$ (standard errors in parentheses)

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Table C.2.1.4 - OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Control Variables (Factual Independence of the Competition Authority as Independent Variable)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{defacto}$	0.601*	0.641*	0.648	0.843*	1.076***	1.362***	0.277	0.483*	0.474	0.664**
	(0.274)	(0.298)	(0.337)	(0.355)	(0.294)	(0.318)	(0.257)	(0.228)	(0.257)	(0.228)
$CTRL_{govtcons}$		-0.033*		-0.045*		-0.034*		-0.031*		-0.036**
		(0.015)		(0.018)		(0.016)		(0.012)		(0.012)
$CTRL_{openness}$		0.003		0.006*		0.006**		0.007***		0.006***
		(0.002)		(0.002)		(0.002)		(0.0014)		(0.001)
$CTRL_{inflation}$		-0.002		-0.004		-0.008		-0.001		-0.000
		(0.005)		(0.005)		(0.005)		(0.004)		(0.003)
$CTRL_{patents}$		0.000		0.0002		0.000		0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
$CTRL_{EU}$		0.669		0.329		0.656		0.339		0.315
		(0.441)		(0.524)		(0.470)		(0.338)		(0.337)
costant	4.343***	4.741***	3.327***	3.776***	3.327***	3.480***	3.923***	3.990***	3.818***	4.004***
	(0.138)	(0.351)	(0.169)	(0.416)	(0.147)	(0.374)	(0.129)	(0.268)	(0.129)	(0.267)
R^2	0.110	0.427	0.087	0.497	0.256	0.584	0.029	0.598	0.080	0.629
SER	0.632	0.556	0.777	0.660	0.678	0.592	0.591	0.425	0.593	0.424
JB										
N	41	34	41	34	41	34	41	34	41	34

$* p < 0.05$, $** p < 0.01$, $*** p < 0.001$ (standard errors in parentheses)

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Table C.2.1 - *2SLS and GMM Estimation of Performance Indicators on Competition Policy Indicators with Control Variables*
(Substantive Content of the Competition Law as Independent Variable)

Variables	$PERF$ local	$PERF$ local	$PERF$ dominance	$PERF$ dominance	$PERF$ antitrust	$PERF$ antitrust	$PERF$ competition	$PERF$ competition	$PERF$ efficiency	$PERF$ efficiency
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{law}$	0.740	0.729	0.560	-0.114	-0.396	-0.482	-0.770	-0.861	0.025	-0.169
	(1.028)	(0.995)	(1.211)	(1.195)	(1.297)	(0.890)	(0.799)	(0.551)	(0.818)	(0.645)
$CTRL_{govtcons}$	-0.029*	-0.030*	-0.034*	-0.038**	-0.016	-0.032**	-0.027*	-0.028***	-0.030**	-0.033***
	(0.013)	(0.012)	(0.016)	(0.014)	(0.017)	(0.012)	(0.010)	(0.010)	(0.011)	(0.009)
$CTRL_{openness}$	0.002	0.002	0.005*	0.004*	0.003	0.004*	0.005***	0.005***	0.005***	0.005***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
$CTRL_{inflation}$	-0.005	-0.006	-0.006	-0.002	-0.006	-0.004	0.002	0.002	0.000	0.000
	(0.005)	(0.004)	(0.006)	(0.003)	(0.007)	(0.003)	(0.004)	(0.003)	(0.004)	(0.002)
$CTRL_{patents}$	0.000	0.000***	0.000*	0.000***	0.000*	0.000***	0.000*	0.000***	0.000*	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$CTRL_{EU}$	0.922*	1.007***	0.733	0.680***	1.227*	1.288***	0.500	0.540***	0.559	0.592***
	(0.401)	(0.207)	(0.473)	(0.196)	(0.507)	(0.155)	(0.312)	(0.153)	(0.320)	(0.088)
costant	4.849***	4.892***	3.727***	3.944***	3.730***	3.930***	4.340***	4.395***	4.222***	4.335***
	(0.394)	(0.284)	(0.464)	(0.411)	(0.497)	(0.350)	(0.306)	(0.256)	(0.314)	(0.237)
R²	0.284	0.283	0.352	0.363	0.254	0.209	0.454	0.437	0.468	0.456
SER	0.529	0.529	0.623	0.618	0.667	0.687	0.411	0.417	0.421	0.426
JB										
N	42	42	42	42	42	42	42	42	42	42

$* \ p < 0.05$, $** \ p < 0.01$, $*** \ p < 0.001$ (standard errors in parentheses)

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.

(Note: the control variable OECD is omitted since there is no developing country belonging to the OECD, i.e. it's value is 0 for all the developing countries)

Table C.2.2.2 - 2SLS and GMM Estimation of Performance Indicators on Competition Policy Indicators with Control Variables
(Degree the Competition Law incorporates an Economic Approach as Independent Variable)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{economics}$	1.972	2.004	2.624	2.463*	2.383	2.407*	-0.088	-0.138	0.872	0.883
	(1.964)	(1.034)	(2.184)	(1.167)	(1.806)	(1.130)	(1.099)	(0.676)	(1.117)	(0.668)
$CTRL_{govtcons}$	-0.031	-0.032*	-0.044*	-0.043**	-0.030	-0.036**	-0.030***	-0.031**	-0.034***	-0.037***
	(0.018)	(0.013)	(0.020)	(0.014)	(0.017)	(0.013)	(0.010)	(0.009)	(0.010)	(0.009)
$CTRL_{openness}$	0.005	0.005*	0.008*	0.008***	0.008*	0.007*	0.006**	0.005***	0.007***	0.006***
	(0.004)	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
$CTRL_{inflation}$	-0.004	-0.005	-0.005	-0.004	-0.008	-0.007***	0.000	-0.000	-0.000*	0.0001
	(0.006)	(0.003)	(0.006)	(0.004)	(0.005)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
$CTRL_{patents}$	0.000	0.000***	0.000*	0.000***	0.000	0.000***	0.000*	0.000***	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$CTRL_{EU}$	-0.089	-0.062	-0.682	-0.688	-0.051	-0.053	0.564	0.610	0.118	0.110
	(1.133)	(0.601)	(1.260)	(0.633)	(1.042)	(0.647)	(0.634)	(0.420)	(0.644)	(0.402)
costant	4.365***	4.319***	3.210***	3.251***	3.073***	3.178***	4.186***	4.315***	3.949***	4.032***
	(0.735)	(0.419)	(0.817)	(0.541)	(0.675)	(0.457)	(0.411)	(0.227)	(0.418)	(0.222)
R^2	0.125	0.182	0.125	0.182	0.324	0.309	0.571	0.550	0.595	0.591
SER	0.749	0.724	0.749	0.724	0.619	0.626	0.377	0.386	0.383	0.385
JB										
N	36	36	36	36	36	36	36	36	36	36

$* \ p < 0.05$, $** \ p < 0.01$, $*** \ p < 0.001$ (standard errors in parentheses)

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.
(Note: the control variable OECD is omitted since there is no developing country belonging to the OECD, i.e. it's value is 0 for all the developing countries)

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Table C.2.3 - *2SLS Estimation of Performance Indicators on Competition Policy Indicators with Control Variables*
(Formal Independence of the Competition Authority as Independent Variable)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{dejure}$	1.438	1.746***	2.149*	2.127**	3.192**	3.097***	1.144	0.946	1.369*	1.296**
	(0.899)	(0.466)	(1.051)	(0.675)	(1.084)	(0.892)	(0.657)	(0.604)	(0.675)	(0.453)
$CTRL_{govtcons}$	-0.035*	-0.038**	-0.047**	-0.045***	-0.037*	-0.039**	-0.032**	-0.038***	-0.037***	-0.040***
	(0.015)	(0.013)	(0.017)	(0.013)	(0.018)	(0.013)	(0.011)	(0.009)	(0.011)	(0.009)
$CTRL_{openness}$	0.004	0.004**	0.007**	0.007***	0.008**	0.007***	0.007***	0.006***	0.007***	0.006***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
$CTRL_{inflation}$	-0.006	-0.008*	-0.008	-0.007	-0.014*	-0.014**	-0.003	-0.002	-0.003	-0.003
	(0.005)	(0.003)	(0.006)	(0.004)	(0.006)	(0.004)	(0.003)	(0.002)	(0.004)	(0.002)
$CTRL_{patents}$	0.000	0.000*	0.000	0.000***	0.000	0.000	0.000	0.000*	0.000	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$CTRL_{EU}$	0.712	0.784**	0.369	0.276	0.717	0.776*	0.356***	0.359	0.368	0.413*
	(0.425)	(0.238)	(0.497)	(0.290)	(0.513)	(0.307)	(0.310)	(0.190)	(0.319)	(0.173)
costant	4.663***	4.589***	3.458***	3.429***	3.028***	3.108***	3.862	4.117***	3.889***	4.014***
	(0.376)	(0.258)	(0.440)	(0.380)	(0.454)	(0.326)	(0.275)	(0.206)	(0.283)	(0.191)
R²	0.325	0.257	0.392	0.394	0.330	0.557	0.540	0.557	0.552	0.561
SER	0.530	0.557	0.620	0.619	0.640	0.380	0.387	0.380	0.398	0.395
JB										
N	38	38	38	38	38	38	38	38	38	38

$* \ p < 0.05$, $** \ p < 0.01$, $*** \ p < 0.001$ (standard errors in parentheses)

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.
(Note: the control variable OECD is omitted since there is no developing country belonging to the OECD, i.e. it's value is 0 for all the developing countries)

Table C.2.2.4 - *2SLS Estimation of Performance Indicators on Competition Policy Indicators with Control Variables (Factual Independence of the Competition Authority as Independent Variable)*

Variables	$PERF_{local}$	$PERF_{local}$	$PERF_{dominance}$	$PERF_{dominance}$	$PERF_{antitrust}$	$PERF_{antitrust}$	$PERF_{competition}$	$PERF_{competition}$	$PERF_{efficiency}$	$PERF_{efficiency}$
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{defacto}$	1.282*	1.279***	1.458*	1.499***	2.087**	1.880*	0.826	0.620	1.040*	0.944*
	(0.618)	(0.274)	(0.715)	(0.437)	(0.665)	(0.877)	(0.455)	(0.491)	(0.457)	(0.409)
$CTRL_{govtcons}$	-0.040*	-0.040***	-0.052**	-0.054***	-0.042*	-0.043***	-0.035**	-0.041***	-0.040***	-0.044***
	(0.016)	(0.011)	(0.018)	(0.012)	(0.017)	(0.013)	(0.012)	(0.009)	(0.012)	(0.009)
$CTRL_{openness}$	0.004*	0.004**	0.007**	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
$CTRL_{inflation}$	-0.003	-0.003**	-0.004	-0.003	-0.009	-0.008*	-0.000	0.000	-0.000	0.001
	(0.004)	(0.003)	(0.005)	(0.003)	(0.005)	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)
$CTRL_{patents}$	0.000	0.000**	0.000	0.0001***	0.000	0.000	0.000	0.000*	0.000	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$CTRL_{EU}$	0.408	0.416	0.079	-0.037	0.360	0.446	0.199	0.232	0.162	0.193
	(0.480)	(0.238)	(0.556)	(0.268)	(0.517)	(0.442)	(0.353)	(0.258)	(0.355)	(0.223)
costant	4.605***	4.598***	3.646***	3.662***	3.327***	3.355***	3.918***	4.139***	3.924***	4.004***
	(0.357)	(0.244)	(0.413)	(0.347)	(0.384)	(0.311)	(0.263)	(0.206)	(0.264)	(0.201)
R^2	0.329	0.330	0.440	0.431	0.503	0.535	0.565	0.581	0.591	0.604
SER	0.536	0.536	0.620	0.625	0.576	0.558	0.394	0.387	0.396	0.390
JB										
N	34	34	34	34	34	34	34	34	34	34

$* p < 0.05$, $** p < 0.01$, $*** p < 0.001$ (standard errors in parentheses)

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.

(Note: the control variable OECD is omitted since there is no developing country belonging to the OECD, i.e. it's value is 0 for all the developing countries)

Table C.2.3.1 - OLS Estimation of Performance Indicators on Competition Policy Indicators without/with Controls Variables

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competiton	PERF competiton	PERF efficiency	PERF efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{law}$	0.538	0.389	0.006	0.074	0.273	0.341	-0.168	-0.236	0.174	0.120
	(0.390)	(0.416)	(0.464)	(0.489)	(0.453)	(0.516)	(0.341)	(0.314)	(0.352)	(0.334)
R^2	0.038	0.299	0.000	0.370	0.008	0.295	0.005	0.495	0.005	0.469
SER	0.641	0.573	0.762	0.673	0.745	0.711	0.561	0.433	0.579	0.461
N	50	42	50	42	50	42	50	42	50	42
$COMP_{economics}$	0.321	0.382	0.320	0.758	0.677*	1.108**	0.094	0.405	0.279	0.583*
	(0.319)	(0.392)	(0.370)	(0.422)	(0.329)	(0.384)	(0.274)	(0.259)	(0.281)	(0.274)
R^2	0.024	0.329	0.018	0.477	0.092	0.510	0.003	0.619	0.023	0.610
SER	0.673	0.599	0.780	0.645	0.693	0.587	0.578	0.396	0.593	0.419
N	44	36	44	36	44	36	44	36	44	36
$COMP_{dejure}$	0.708	0.818	0.774	1.116	1.236**	1.664	0.347	0.649	0.580	0.839**
	(0.357)	(0.384)	(0.418)	(0.429)	(0.376)	(0.396)	(0.315)	(0.278)	(0.319)	(0.285)
R^2	0.082	0.378	0.072	0.488	0.197	0.547	0.027	0.583	0.070	0.597
SER	0.645	0.564	0.755	0.630	0.678	0.582	0.569	0.409	0.576	0.418
N	46	38	46	38	46	38	46	38	46	38
$COMP_{defacto}$	0.601*	0.641*	0.648	0.843*	1.076***	1.362***	0.277	0.483*	0.474	0.664**
	(0.274)	(0.298)	(0.337)	(0.355)	(0.294)	(0.318)	(0.257)	(0.228)	(0.257)	(0.228)
R^2	0.110	0.427	0.087	0.497	0.256	0.584	0.029	0.598	0.080	0.629
SER	0.632	0.556	0.777	0.660	0.678	0.592	0.591	0.425	0.593	0.424
N	41	34	41	34	41	34	41	34	41	34

$^*p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$ (standard errors in parentheses)

Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU.

Table C.2.3.2 - *2SLS and GMM Estimation of Performance Indicators on Competition Policy Indicators with Controls Variables*

Variables	$PERF$ local	$PERF$ local	$PERF$ dominance	$PERF$ dominance	$PERF$ antitrust	$PERF$ antitrust	$PERF$ competition	$PERF$ competition	$PERF$ efficiency	$PERF$ efficiency
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{law}$	0.740	0.729	0.560	-0.114	-0.396	-0.482	-0.770	-0.861	0.025	-0.169
	(1.028)	(0.995)	(1.211)	(1.195)	(1.297)	(0.890)	(0.799)	(0.551)	(0.818)	(0.645)
R^2	0.284	0.283	0.352	0.363	0.254	0.209	0.4535	0.437	0.468	0.456
SER	0.529	0.529	0.623	0.618	0.667	0.687	0.41112	0.417	0.421	0.426
N	42	42	42	42	42	42	42	42	42	42
$COMP_{economics}$	1.972	2.004	2.624	2.463*	2.383	2.407*	-0.088	-0.138	0.872	0.883
	(1.964)	(1.034)	(2.184)	(1.167)	(1.806)	(1.130)	(1.099)	(0.676)	(1.117)	(0.668)
R^2	0.125	0.182	0.125	0.182	0.324	0.309	0.571	0.550	0.595	0.591
SER	0.749	0.724	0.749	0.724	0.619	0.626	0.377	0.386	0.383	0.385
N	36	36	36	36	36	36	36	36	36	36
$COMP_{dejure}$	1.438	1.746***	2.149*	2.127**	3.192**	3.097***	1.438	1.746***	2.149*	2.127**
	(0.899)	(0.466)	(1.051)	(0.675)	(1.084)	(0.892)	(0.899)	(0.466)	(1.051)	(0.675)
R^2	0.325	0.257	0.392	0.394	0.330	0.557	0.325	0.257	0.392	0.394
SER	0.530	0.557	0.620	0.619	0.640	0.380	0.530	0.557	0.620	0.619
N	38	38	38	38	38	38	38	38	38	38
$COMP_{defacto}$	1.282*	1.279***	1.458*	1.499***	2.087**	1.880*	0.826	0.620	1.040*	0.944*
	(0.618)	(0.274)	(0.715)	(0.437)	(0.665)	(0.877)	(0.455)	(0.491)	(0.457)	(0.409)
R^2	0.329	0.330	0.440	0.431	0.503	0.535	0.565	0.581	0.591	0.604
SER	0.536	0.536	0.620	0.625	0.576	0.558	0.394	0.387	0.396	0.390
N	34	34	34	34	34	34	34	34	34	34

$* \ p < 0.05, \ ** \ p < 0.01, \ *** \ p < 0.001$ (standard errors in parentheses)

Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU.

Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization.

Cartel Detection and Collusion Screening:
An Empirical Analysis of the London Metal Exchange *

Danilo Samà

Abstract

In order to fight collusive behaviors, the best scenario for competition authorities would be the possibility to analyze detailed information on firms' costs and prices, being the price-cost margin a robust indicator of market power. However, information on firms' costs is rarely available. In this context, a fascinating technique to detect data manipulation and rigged prices is offered by an odd phenomenon called Benford's Law, otherwise known as First-Digit Law, which has been successfully employed to discover the "Libor Scandal" much time before the opening of the cartel settlement procedure. Thus, the main objective of the present paper is to apply a such useful instrument to track the price of the aluminium traded on the London Metal Exchange, following the allegations according to which there would be an aluminium cartel behind. As a result, quick tests such as Benford's Law can only be helpful to inspect markets where price patterns show signs of collusion. Given the budget constraints to which antitrust watchdogs are commonly subject to, a such price screen could be set up, just exploiting the data available, as warning system to identify cases that require further investigations.

Keywords: Benford's Law, Cartel Detection, Collusion Screening, Competition Authorities, Data Manipulation, Monopolization, Oligopolistic Markets, Price Fixing, Variance Screen.

JEL Classification: C10; D40; L13; L41

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1   Libor Scandal

In 2013, the European Commission imposed an administrative fine of 1.7 billion euro to some of the world's largest banking companies involved in what has been described by the mass media as "Libor Scandal"[1]. The record sanction, being the highest ever levied by the officials of Brussels for a cartel infringement, was issued to 8 international financial institutions for participating in illegal agreements relating to interest rate derivatives. As it is common knowledge, interest rate derivatives are financial products, such as futures, options, swaps, which are both employed as insurance tools for managing the risk of interest rate fluctuations and traded worldwide as investment assets by financial intermediaries. The value of these financial derivatives comes from the level of a benchmark interest rate, such as the Euro Interbank Offered Rate (Euribor), which is used for the euro area, or the London Interbank Offered Rate (Libor), which is used for several currencies including the Japanese Yen. In turn, the value of these benchmarks reflects the averaged interest rate at which, respectively, a selected panel of Eurozone and London banks offer to lend funds in a given currency to other banks on the daily interbank market.

In a nutshell, the cartel aimed at manipulating the pricing process of the Euribor and the Libor, distorting the competition in the underlying trading of interest rate derivatives. Since at least $800 trillion in derivatives, loans, securities and other financial products are tied to the Euribor and the Libor, such was the dimension of the scandal, which *inter alia* has highlighted the urgency of a regulatory reform of the banking sector, the largest one to have been rigged so far.

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[1]Commission Decision of 4 December 2013, *Euro Interest Rate Derivatives*, Case AT.39914; Commission Decision of 4 December 2013, *Yen Interest Rate Derivatives*, Case AT.39861; European Commission, *Antitrust: Commission fines banks € 1.71 billion for participating in cartels in the interest rate derivatives industry*, Press Release, IP/13/1208, 4 December 2013, Brussels, Belgium.

2 Benford's Law

A crucial expedient for revealing the "Libor Scandal" has been the leniency program, joined by a member of the cartel at issue providing an active cooperation in the investigation of the Commission in exchange of full immunity. Beyond the success of the cartel settlement procedure and the relevant dimension of the market involved, from a competition policy standpoint, the Libor case offers another interesting food for thought, being an excellent example of how antitrust authorities can employ screening instruments to identify collusive behaviors.

A fascinating technique to detect rigged prices is offered by an odd phenomenon called Benford's Law, otherwise known as First-Digit Law. Although a primordial statement must be attributed to Newcomb (1881)[2], in a 1938 paper, the father of the law, a physicist working at General Electric, recognized the existence of a specific pattern that often occurs in vast datasets[3]. In particular, the law consists in a frequency distribution which describes the probability according to which a number present in a random dataset starts with a certain digit.

Theoretically, if a set of numbers were truly random, each leading digit would appear about 11% of the time. On the contrary, Benford's Law predicts a logarithmic weakly monotonic distribution, according to which the digit 1 occurs as leading digit about 30% of the time, while larger digits occur in that position less and less frequently (cf. Formula 1). In other terms, the leading digits are not distributed evenly, as it would be natural to expect, but following a distribution where 1 is the most frequent and 9 is the less common. The law, which has also been generalized to digits beyond the first, tends to be more precise in datasets which exhibit multiple orders of magnitude and for types of values which grow exponentially.

Formula 1 - *Benford's Law Logarithmic Probability Distribution Function*
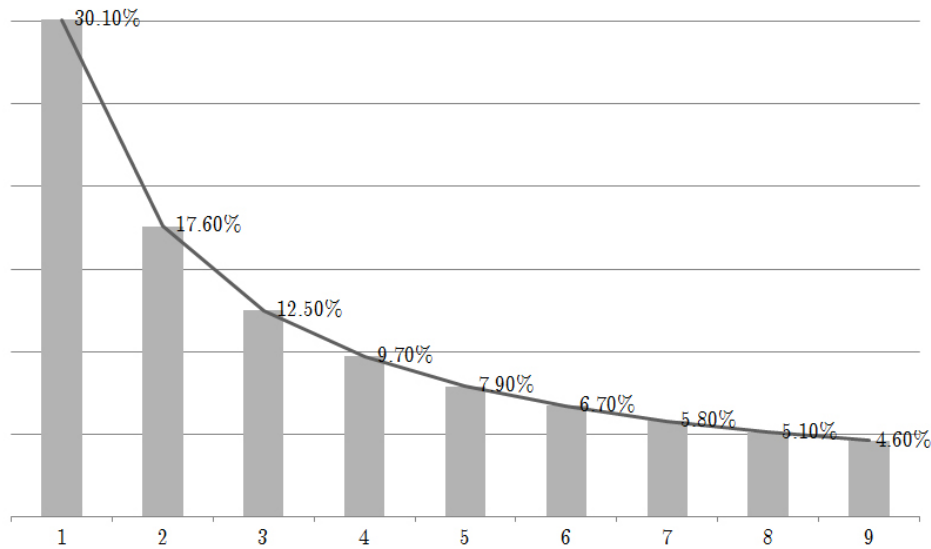
$$P(d) = log_{10}(d+1) \text{ - } log_{10}(d) = log_{10}\left(\frac{d+1}{d}\right) = log_{10}\left(1+\frac{1}{d}\right)$$

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[2]Newcomb, S. (1881), *Note on the Frequency of Use of the Different Digits in Natural Numbers*, American Journal of Mathematics, Vol. 4, No. 1, The Johns Hopkins University Press, Baltimore, United States, pp. 39-40.

[3]Benford, F. (1938), *The Law of Anomalous Numbers*, Proceedings of the American Philosophical Society, Vol. 78, No. 4, American Philosophical Society, Philadelphia, United States, pp. 551-572.

A brief and intuitive explanation of why the law naturally occurs is that usually we start counting from the digit 1 until the digit 9. It is obvious that if we think to the digits from 1 to 9, we have the same probability that a random number starts with any of these digits. But if we consider a range of numbers, for example from 1 to 20, we count more numbers starting with the digit 1. The same happens if we consider the range of numbers from 1 to 30, where we count many numbers starting with the digit 1, but also many others starting with the digit 2. In any case, what matters is that, in order to have many numbers starting with the digit 9, it is necessary to examine a large dataset. As a result, analyzing for instance distributions of numbers related to populations or surfaces, the probability to have a number starting with the digit 1 will be higher than that to have a number with 9 as leading digit. Accordingly, Benford showed that, for several types of distributions, the probability that a number starts with a certain digit tends to be always the same (cf. Figure 1).

Figure 1 - *Probability Distribution of Leading Digits according to Benford's Law*

3   Literature Review

The predictive power of Benford's Law has been ascertained valid in several situations normally observable in the real world. Death rates, election votes, financial transitions, government spendings, income distributions, physical and mathematical constants, population numbers and stock prices are just few examples over which

the law applies. It is not a case that auditors have successfully employed it to detect frauds and manipulations in accounting data since the 1970s. At that time also Varian (1972)[4] suggested the possibility to use the law to uncover falsifications in socio-economic data collected for public purposes, under the assumption that who aims at rigging datasets tends to provide numbers distributed according to a uniform pattern. Nigrini (1999)[5] as well showed that the law can be exploited for taxation controls, after having tested it with success on real cases of fiscal scams.

Thus, given its regularity, the law can be adopted to test economic data in several cases. It's application is rather straightforward: even though a dataset has been artificially ordered in such a way to preserve randomness, the distribution of the digits will definitely violate the pattern predicted by the law. Within the present framework, in a seminal paper by Abrantes-Metz *et al.* (2011)[6], the authors considered worthwhile to test the theory over Libor data, using the second digit distribution variant of the law. The surprising result was that the benchmark interest rate at issue departed significantly from the Benford's Law pattern over an extended period of time, signaling the possibility of a rate manipulation. As a result, through a quick application of the test, the Libor cartel could have been discovered much time before the opening of the settlement procedure.

In Brähler *et al.* (2011)[7], a Benford's Law test was applied to investigate the quality of macroeconomic data reported by the EU member states to Eurostat in order to comply with the Stability and Growth Pact criteria. Since government statistics are comparable in nature to financial accounting, governments, like firms towards auditors, might be tempted to adjust the national account balances, given the strict obligations to which are subject to. The authors of the study found that the official statistics submitted by Greece registred the greatest deviation from the expected Benford's Law distribution in comparison to all the other EU countries.

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[4]Varian, H.R. (1972), *Benford's Law (Letters to the Editor)*, The American Statistician, Vol. 26, Issue 3, Taylor & Francis Journals, London, United Kingdom, pp. 62-65.

[5]Nigrini, M.J. (1999), *I've Got Your Number: How a Mathematical Phenomenon Can Help CPAs Uncover Fraud and Other Irregularities*, Journal of Accountancy, Vol. 187, Issue 5, American Institute of Certified Public Accountants, New York, United States, pp. 15-27.

[6]Abrantes-Metz, R.M., Judge, G., Villas-Boas, S. (2011), *Tracking the Libor Rate*, Applied Economics Letters, Vol. 10, Issue 10, Taylor & Francis Journals, London, United Kingdom, pp. 893-899.

[7]Brähler, G., Engel, S., Göttsche, M., Rauch, B. (2011), *Fact and Fiction in EU-Governmental Economic Data*, German Economic Review, Vol. 12, Issue 3, John Wiley & Sons, New York, United States, pp. 243-255.

The manipulation of financial data by the Greek institutions has officially been certified by the Commission at a later stage.

4 Empirical Analysis of the London Metal Exchange
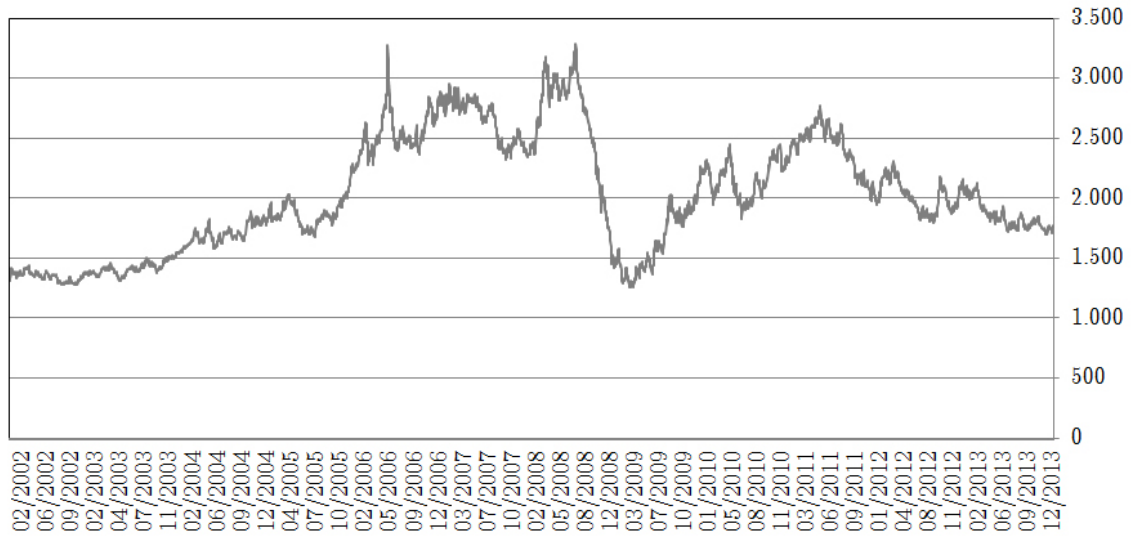
As well as for the "Libor Scandal", the Wall Street Journal has launched in 2011 an investigation about possible anti-competitive practices on the London Metal Exchange (LME), allegedly resulting in artificially high prices for a category of commodities, above all aluminium, whose hoarding is managed by a group of international banking corporations[8]. In the last years, in fact, the metals industry has been invested by a huge wave of acquisitions by major investment banks of metals warehouses located around the world. According to the allegations, the "too big to fail banks" at issue, being owners of large aluminium warehouses able to hoard massive supply in excess, despite the record levels of production registred since 2011, would have deliberately delayed the market distribution of aluminium products, inflating so its final price and gathering in the meantime exorbitant rents and other fees for the storage operations (cf. Figure 2). As a matter of fact, aluminium is the only commodity for which prompt delivery is not guaranteed, requiring instead its distribution several months. In the past, an analogous supply bottleneck strategy was used by De Beers to obstruct the market clearing and to maintain the price of diamonds extremely high.

The group of bank holding companies owners of the aluminium warehouses has replied to the allegations asserting that it merely follows the guidelines established by the LME (although, it is worth to notice, the investment banks in question are members and shareholders of the LME itself). However, in the United States, three class-action lawsuits were filed in 2013 against the alleged aluminium cartel for its presumed control over the LME. According to the plaintiffs, 5 billion dollars has been the total cost of the cartel at the expense of consumers for the period 2011-2013.[9]

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[8]Hotter, A., Shumsky. T. (2011), *Wall Street Gets Eyed in Metal Squeeze. Some Say Warehousing Inflates Prices*, The Wall Street Journal, 17 June 2001, New York, United States.

[9]Master Screens Inc., *et al.* v. Goldman Sachs Group Inc., *et al.*, Case No. 13-CV-00431, United States District Court for the Northern District of Florida, Tallahassee Division; Superior Extrusion Inc., *et al.* v. Goldman Sachs Group Inc., *et al.*, Case No. 13-CV-13315, United States

Figure 2 - *LME Aluminium Price (US\$ per Tonne) (2002-2013)*

As a result, the main objective of the present paper is to apply Benford's Law to track the daily LME aluminium price over the period 2011-2013, in order to verify possible data manipulations which would suggest the existence of a cartel. We analyze this time period for two basic reasons: firstly, because after the collapse of aluminum prices due to the global financial crisis, 2011 is the year when the commodity at issue began to reach very high prices, apparently not justified by the record levels of production touched; secondly, because the suspect of a possible collusion started to be felt at that time.

For what concerns the application of Benford's Law, since the nominal value of the aluminium price does not change very much over short periods of time, an analysis of the first digit distribution would be meaningless since the pattern predicted by the law would be definitely violated. On the contrary, in Table 2 and 3, as well as in Figure 3 and Figure 4, we can observe how the empirical second digit distribution and in particular the empirical third digit distribution of the LME aluminium price for the period 2002-2013 follow the expected pattern. This confirms the fact that the price spans the nine digit space only if we consider the second and the third digit.

District Court for the Eastern District of Michigan, Detroit Division; River Parish Contractors Inc., *et al.* v. Goldman Sachs Group Inc., *et al.*, Case No. 13-CV-05267, United States District Court for the Eastern District of Louisiana, New Orleans Division.

Table 1 - *Bendord's Law Second Digit Test: LME Aluminium (US$ per Tonne) (2002-2013)*

Digit	LME Frequency	Benford Rate	LME Rate	Δ
0	226	11.97%	7.48%	-4.49%
1	157	11.39%	5.20%	-6.19%
2	191	10.82%	6.32%	-4.50%
3	447	10.43%	14.80%	4.36%
4	445	10.03%	14.73%	4.70%
5	209	9.67%	6.92%	-2.75%
6	239	9.34%	7.91%	-1.43%
7	377	9.04%	12.48%	3.44%
8	451	8.76%	14.93%	6.17%
9	2	8.50%	9.24%	0.74%
Total	3,021			

Table 2 - *Bendord's Law Third Digit Test: LME Aluminium (US$ per Tonne) (2002-2013)*[10]

Digit	LME Frequency	Benford Rate	LME Rate	Δ
0	338	11.97%	11.19%	-0.78%
1	298	11.39%	9.86%	-1.52%
2	294	10.82%	9.73%	-1.09%
3	333	10.43%	11.02%	0.59%
4	313	10.03%	10.36%	0.33%
5	269	9.67%	8.90%	-0.76%
6	291	9.34%	9.63%	0.30%
7	312	9.04%	10.33%	1.29%
8	285	8.76%	9.43%	0.68%
9	288	8.50%	9.53%	1.03%
Total	3,021			

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[10]In Table 2, Benfor's Law second digit rates, rather than third digit ones, are reported since, for the sake of simplicity of computations, we deleted first digits from the entire dataset when we dealt with the third digit distribution. Thus, we can treat third digits as they were second digits. Of course, this expedient does not alter the value of Benford's Law analysis. Furthermore, this allow us to better and equally compare the two LME Aluminium sets of rates, reported in Table 1 and Table 2, respect to Benford's Law one.

Figure 3 - *Bendord's Law Second Digit Test: LME Aluminium (US$ per Tonne) (2002-2013)*
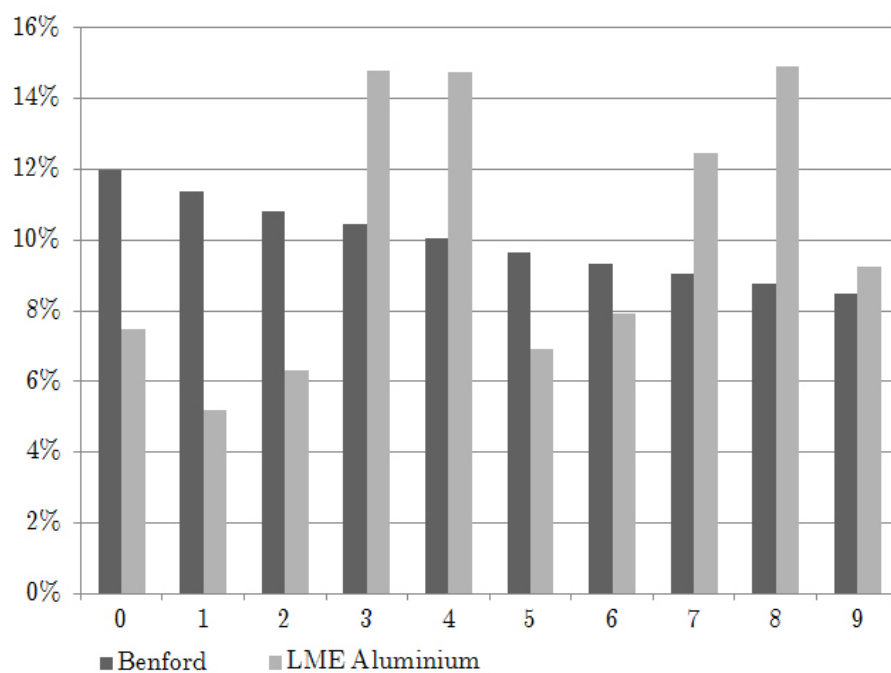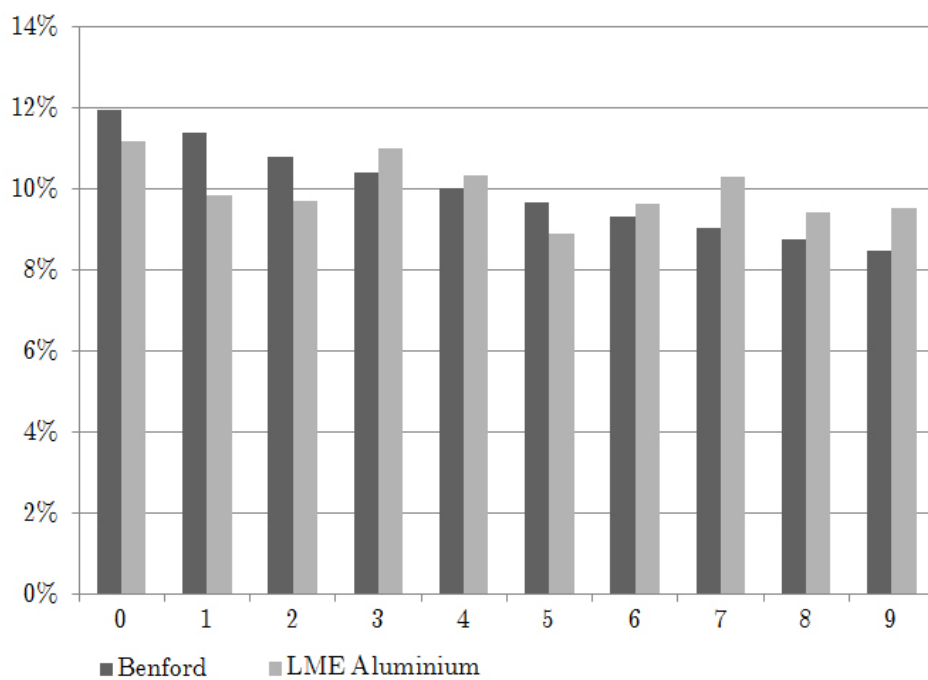
Figure 4 - *Bendord's Law Third Digit Test: LME Aluminium (US$ per Tonne) (2002-2013)*

Since our main concern is with the aluminium price trend registred in the last 3 years, following the methodology adopted to detect the "Libor Scandal", we now proceed to test the closeness to the Benford's Law pattern of the empirical distributions of both the second and third digits of the daily LME aluminium price. Our assessment is based on rolling six month periods, starting from 2011 until 2013. In particular, in Table 3, we present the empirical frequencies of the second digit distribution, whilst in Table 4 we present the empirical frequencies of the third digit distribution. The two tables at issue, given the size, are reported at the end of the current work.

Two are the main results. As for the second digit distribution, we register empirical frequencies which depart significantly from the expected Benford's Law pattern. This raises potential concerns relative to the data integrity of the aluminium price. Only the empirical frequencies of the third digit distribution, which we decided to compute for a more conservative analysis, are in line with the pattern predicted by the law. In this regard, it is important to remind that for the Libor cartel, it was enough to find departures similar to those we found in the empirical second digit distribution of the LME aluminium price to raise alert about possible rigged prices. Furthermore, in the Libor case, several periods of time where Benford's Law was respected were found in any case. Here, instead, at least for the period 2011-2013, the deviation from the expected pattern is costant. Moreover, the deviation of both the second and third digit distributions from the Benford's Law pattern tends to increase over time, reaching the maximum levels in 2013. The opening of an investigation to further examine the aluminium industry, according to the price screen at issue, seems therefore worthwhile.

5   Policy Conclusions

In order to detect and fight cartel conducts, the best scenario for competition agencies would be of course the possibility to analyze detailed information on firms' costs and prices, being the price-cost margin a robust indicator of market power. However, information on firms' costs is rarely available. In this context, as pointed out by our analysis of the London Metal Exchange, quick tests such as Benford's Law can only be helpful to inspect markets where price patterns show signs of collusion. Given the budget constraints to which antitrust watchdogs are commonly subject to, a such price screen could be set up, just exploiting the data available, as warning system to identify cases that require the opening of an investigation.

Nevertheless, it is important to underline that Benford's Law, as any other statistical test, cannot be adopted as investigative tool in any circumstance, since not all real data are expected to obey the law at issue. The risk otherwise is to fall into false-positive assessments. In any case, what seems certain is the fact that such a useful instrument, if not employed by competition authorities, will be surely used by firms to further disguise and mystify cartel activities.

Table 3 - *Bendord's Law and LME Aluminium Second Digit Frequencies over rolling 6-Month Periods from 2011 to 2013*

Digit	Benford Rate	01/2011 06/2011 (1)	Δ	02/2011 07/2011 (2)	Δ	03/2011 08/2011 (3)	Δ	04/2011 09/2011 (4)	Δ	05/2011 10/2011 (5)	Δ	06/2011 11/2011 (6)	Δ
0	11.97%	0.00%	-11.97%	0.00%	-11.97%	0.00%	-11.97%	0.00%	-11.97%	0.00%	-11.97%	6.92%	-5.04%
1	11.39%	0.00%	-11.39%	0.00%	-11.39%	0.00%	-11.39%	3.20%	-8.19%	16.41%	5.02%	23.08%	11.69%
2	10.82%	0.00%	-10.82%	0.00%	-10.82%	0.00%	-10.82%	3.20%	-7.62%	6.25%	-4.57%	6.15%	-4.67%
3	10.43%	4.88%	-5.55%	0.00%	-10.43%	11.11%	0.68%	20.80%	10.37%	20.31%	9.88%	20.00%	9.57%
4	10.03%	27.64%	17.61%	25.00%	14.97%	22.22%	12.19%	20.80%	10.77%	20.31%	10.28%	18.46%	8.43%
5	9.67%	37.40%	27.73%	42.74%	33.07%	34.13%	24.46%	21.60%	11.93%	19.53%	9.86%	13.08%	3.41%
6	9.34%	24.39%	15.05%	26.61%	17.28%	26.98%	17.65%	24.80%	15.46%	15.63%	6.29%	9.23%	-0.11%
7	9.04%	5.69%	-3.34%	5.65%	-3.39%	5.56%	-3.48%	5.60%	-3.44%	1.56%	-7.47%	0.00%	-9.04%
8	8.76%	0.00%	-8.76%	0.00%	-8.76%	0.00%	-8.76%	0.00%	-8.76%	0.00%	-8.76%	0.00%	-8.76%
9	8.50%	0.00%	-8.50%	0.00%	-8.50%	0.00%	-8.50%	0.00%	-8.50%	0.00%	-8.50%	3.08%	-5.42%

Digit	Benford Rate	07/2011 12/2011 (7)	Δ	08/2011 01/2012 (8)	Δ	09/2011 02/2012 (9)	Δ	10/2011 03/2012 (10)	Δ	11/2011 04/2012 (11)	Δ	12/2011 05/2012 (12)	Δ
0	11.97%	10.94%	-1.03%	14.84%	2.88%	14.96%	2.99%	15.75%	3.78%	15.75%	3.78%	30.40%	18.43%
1	11.39%	27.34%	15.95%	36.72%	25.33%	44.09%	32.71%	51.97%	40.58%	51.97%	40.58%	32.00%	20.61%
2	10.82%	6.25%	-4.57%	9.38%	-1.45%	17.32%	6.50%	19.69%	8.86%	19.69%	8.86%	16.80%	5.98%
3	10.43%	20.31%	9.88%	20.31%	9.88%	11.02%	0.59%	1.57%	-8.86%	1.57%	-8.86%	1.60%	-8.83%
4	10.03%	14.06%	4.03%	5.47%	-4.56%	1.57%	-8.46%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%
5	9.67%	7.03%	-2.64%	1.56%	-8.11%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%
6	9.34%	3.13%	-6.21%	0.78%	-8.56%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%
7	9.04%	0.00%	-9.04%	0.00%	-9.04%	0.00%	-9.04%	0.00%	-9.04%	0.00%	-9.04%	0.00%	-9.04%
8	8.76%	0.00%	-8.76%	0.00%	-8.76%	0.00%	-8.76%	0.00%	-8.76%	0.00%	-8.76%	0.00%	-8.76%
9	8.50%	10.94%	2.44%	10.94%	2.44%	11.02%	2.52%	11.02%	2.52%	11.02%	2.52%	19.20%	10.70%

Digit	Benford Rate	01/2012 06/2012 (13)	Δ	02/2012 07/2012 (14)	Δ	03/2012 08/2012 (15)	Δ	04/2012 09/2012 (16)	Δ	05/2012 10/2012 (17)	Δ	06/2012 11/2012 (18)	Δ
0	11.97%	26.61%	14.64%	22.40%	10.43%	22.22%	10.25%	30.65%	18.68%	19.53%	7.56%	15.63%	3.66%
1	11.39%	28.23%	16.84%	18.40%	7.01%	11.11%	-0.28%	3.23%	-8.16%	3.91%	-7.48%	3.91%	-7.48%
2	10.82%	16.94%	6.11%	13.60%	2.78%	5.56%	-5.27%	0.00%	-10.82%	0.00%	-10.82%	0.00%	-10.82%
3	10.43%	1.61%	-8.82%	1.60%	-8.83%	0.00%	-10.43%	0.00%	-10.43%	0.00%	-10.43%	0.00%	-10.43%
4	10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%
5	9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%
6	9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%
7	9.04%	0.00%	-9.04%	0.00%	-9.04%	1.59%	-7.45%	1.61%	-7.42%	1.56%	-7.47%	1.56%	-7.47%
8	8.76%	8.06%	-0.69%	22.40%	13.64%	38.10%	29.34%	39.52%	30.76%	41.41%	32.65%	44.53%	35.77%
9	8.50%	18.55%	10.05%	21.60%	13.10%	21.43%	12.93%	25.00%	16.50%	33.59%	25.09%	34.38%	25.88%

Digit	Benford Rate	07/2012 12/2012 (19)	Δ	08/2012 01/2013 (20)	Δ	09/2012 02/2013 (21)	Δ	10/2012 03/2013 (22)	Δ	11/2012 04/2013 (23)	Δ	12/2012 05/2013 (24)	Δ
0	11.97%	24.22%	12.25%	39.06%	27.09%	51.59%	39.62%	42.86%	30.89%	38.71%	26.74%	36.59%	24.62%
1	11.39%	10.16%	-1.23%	10.94%	-0.45%	12.70%	1.31%	9.52%	-1.87%	8.87%	-2.52%	8.94%	-2.45%
2	10.82%	0.00%	-10.82%	0.00%	-10.82%	0.00%	-10.82%	0.00%	-10.82%	0.00%	-10.82%	0.00%	-10.82%
3	10.43%	0.00%	-10.43%	0.00%	-10.43%	0.00%	-10.43%	0.00%	-10.43%	0.00%	-10.43%	0.00%	-10.43%
4	10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%
5	9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%
6	9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%
7	9.04%	1.56%	-7.47%	1.56%	-7.47%	0.00%	-9.04%	0.00%	-9.04%	0.00%	-9.04%	0.81%	-8.22%
8	8.76%	36.72%	27.96%	22.66%	13.90%	7.14%	-1.61%	11.11%	2.35%	25.00%	16.24%	38.21%	29.45%
9	8.50%	27.34%	18.84%	25.78%	17.28%	28.57%	20.07%	36.51%	28.01%	27.42%	18.92%	15.45%	6.95%

Digit	Benford Rate	01/2013 06/2013 (25)	Δ	02/2013 07/2013 (26)	Δ	03/2013 08/2013 (27)	Δ	04/2013 09/2013 (28)	Δ
0	11.97%	27.42%	15.45%	12.00%	0.03%	0.00%	11.97%	0.00%	-11.97%
1	11.39%	2.42%	-8.97%	1.60%	-9.79%	0.00%	-11.39%	0.00%	-11.39%
2	10.82%	0.00%	-10.82%	0.00%	-10.82%	0.00%	-10.82%	0.00%	-10.82%
3	10.43%	0.00%	-10.43%	0.00%	-10.43%	0.00%	-10.43%	0.00%	-10.43%
4	10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%
5	9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%
6	9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%	0.00%	-9.34%
7	9.04%	8.87%	-0.16%	24.80%	15.77%	30.95%	21.92%	46.46%	37.42%
8	8.76%	42.74%	33.98%	44.80%	36.04%	54.76%	46.00%	50.39%	41.64%
9	8.50%	18.55%	10.05%	16.80%	8.30%	14.29%	5.79%	3.15%	-5.35%

Digit	Benford Rate	05/2013 10/2013 (29)	Δ	06/2013 11/2013 (30)	Δ	07/2013 12/2013 (31)	Δ
0	11.97%	0.00%	-11.97%	0.00%	-11.97%	0.00%	-11.97%
1	11.39%	0.00%	-11.39%	0.00%	-11.39%	0.00%	-11.39%
2	10.82%	0.00%	-10.82%	0.00%	-10.82%	0.00%	-10.82%
3	10.43%	0.00%	-10.43%	0.00%	-10.43%	0.00%	-10.43%
4	10.03%	0.00%	-10.03%	0.00%	-10.03%	0.00%	-10.03%
5	9.67%	0.00%	-9.67%	0.00%	-9.67%	0.00%	-9.67%
6	9.34%	0.00%	-9.34%	0.00%	-9.34%	1.55%	-7.79%
7	9.04%	51.16%	42.13%	65.89%	56.86%	72.09%	63.06%
8	8.76%	45.74%	36.98%	31.01%	22.25%	26.36%	17.60%
9	8.50%	3.10%	-5.40%	3.10%	-5.40%	0.00%	-8.50%

Table 4 - Bendord's Law and LME Aluminium Third Digit Frequencies over rolling 6-Month Periods from 2011 to 2013

Digit	Benford Rate	01/2011 06/2011 (32)	Δ	02/2011 07/2011 (33)	Δ	03/2011 08/2011 (34)	Δ	04/2011 09/2011 (35)	Δ	05/2011 10/2011 (36)	Δ	06/2011 11/2011 (37)	Δ
0	11.97%	11.38%	-0.59%	12.10%	0.13%	14.29%	2.32%	14.40%	2.43%	14.84%	2.88%	15.38%	3.42%
1	11.39%	7.32%	-4.07%	9.68%	-1.71%	8.73%	-2.66%	10.40%	-0.99%	9.38%	-2.01%	10.00%	-1.39%
2	10.82%	8.13%	-2.69%	9.68%	-1.14%	10.32%	-0.50%	12.00%	1.18%	12.50%	1.68%	11.54%	0.72%
3	10.43%	11.38%	0.95%	10.48%	0.05%	8.73%	-1.70%	8.00%	-2.43%	7.03%	-3.40%	7.69%	-2.74%
4	10.03%	9.76%	-0.27%	10.48%	0.45%	12.70%	2.67%	13.60%	3.57%	12.50%	2.47%	9.23%	-0.80%
5	9.67%	6.50%	-3.16%	7.26%	-2.41%	7.14%	-2.53%	8.00%	-1.67%	7.81%	-1.86%	6.92%	-2.74%
6	9.34%	9.76%	0.42%	8.06%	-1.27%	9.52%	0.19%	10.40%	1.06%	8.59%	-0.74%	7.69%	-1.64%
7	9.04%	13.82%	4.79%	12.90%	3.87%	12.70%	3.66%	10.40%	1.37%	12.50%	3.47%	13.08%	4.04%
8	8.76%	9.76%	1.00%	10.48%	1.73%	7.94%	-0.82%	6.40%	-2.36%	7.81%	-0.94%	9.23%	0.47%
9	8.50%	12.20%	3.70%	8.87%	0.37%	7.94%	-0.56%	6.40%	-2.10%	7.03%	-1.47%	9.23%	0.73%

Digit	Benford Rate	07/2011 12/2011 (38)	Δ	08/2011 01/2012 (39)	Δ	09/2011 02/2012 (40)	Δ	10/2011 03/2012 (41)	Δ	11/2011 04/2012 (42)	Δ	12/2011 05/2012 (43)	Δ
0	11.97%	16.41%	4.44%	17.19%	5.22%	16.54%	4.57%	15.27%	3.30%	14.40%	2.43%	12.80%	0.83%
1	11.39%	8.59%	-2.80%	7.81%	-3.58%	11.02%	-0.37%	9.45%	-1.93%	10.40%	-0.99%	8.00%	-3.39%
2	10.82%	10.94%	0.12%	10.94%	0.12%	9.45%	-1.37%	9.45%	-1.37%	8.00%	-2.82%	8.00%	-2.82%
3	10.43%	7.03%	-3.40%	9.38%	-1.06%	8.66%	-1.77%	9.82%	-0.61%	12.00%	1.57%	11.20%	0.77%
4	10.03%	10.16%	0.13%	7.81%	-2.22%	5.51%	-4.52%	8.36%	-1.67%	6.40%	-3.63%	7.20%	-2.83%
5	9.67%	7.81%	-1.86%	7.81%	-1.86%	9.45%	-0.22%	8.00%	-1.67%	10.40%	0.73%	10.40%	0.73%
6	9.34%	6.25%	-3.09%	6.25%	-3.09%	6.30%	-3.04%	7.64%	-1.70%	5.60%	-3.74%	8.00%	-1.34%
7	9.04%	14.84%	5.81%	14.06%	5.03%	14.96%	5.93%	13.82%	4.78%	13.60%	4.57%	16.00%	6.97%
8	8.76%	9.38%	0.62%	8.59%	-0.16%	8.66%	-0.10%	8.36%	-0.39%	8.00%	-0.76%	8.80%	0.04%
9	8.50%	8.59%	0.09%	10.16%	1.66%	9.45%	0.95%	9.82%	1.32%	11.20%	2.70%	9.60%	1.10%

Digit	Benford Rate	01/2012 06/2012 (44)	Δ	02/2012 07/2012 (45)	Δ	03/2012 08/2012 (46)	Δ	04/2012 09/2012 (47)	Δ	05/2012 10/2012 (48)	Δ	06/2012 11/2012 (49)	Δ
0	11.97%	8.87%	-3.10%	8.00%	-3.97%	6.35%	-5.62%	4.03%	-7.94%	6.25%	-5.72%	7.03%	-4.94%
1	11.39%	11.29%	-0.10%	11.20%	-0.19%	9.52%	-1.87%	8.87%	-2.52%	7.81%	-3.58%	7.81%	-3.58%
2	10.82%	9.68%	-1.14%	8.00%	-2.82%	10.32%	-0.50%	12.10%	1.27%	10.16%	-0.67%	13.28%	2.46%
3	10.43%	14.52%	4.08%	14.40%	3.97%	12.70%	2.27%	9.68%	-0.76%	9.38%	-1.06%	10.94%	0.50%
4	10.03%	8.87%	-1.16%	9.60%	-0.43%	11.11%	1.08%	12.10%	2.07%	10.16%	0.13%	10.16%	0.13%
5	9.67%	8.87%	-0.80%	7.20%	-2.47%	5.56%	-4.11%	7.26%	-2.41%	4.69%	-4.98%	4.69%	-4.98%
6	9.34%	6.45%	-2.89%	11.20%	1.86%	12.70%	3.36%	15.32%	5.99%	14.84%	5.51%	13.28%	3.94%
7	9.04%	13.71%	4.67%	13.60%	4.57%	12.70%	3.66%	12.10%	3.06%	14.84%	5.81%	12.50%	3.47%
8	8.76%	8.87%	0.11%	8.00%	-0.76%	8.73%	-0.03%	9.68%	0.92%	11.72%	2.96%	10.94%	2.18%
9	8.50%	8.87%	0.37%	8.00%	0.30%	10.32%	1.82%	8.87%	0.37%	10.16%	1.66%	9.38%	0.87%

Digit	Benford Rate	07/2012 12/2012 (50)	Δ	08/2012 01/2013 (51)	Δ	09/2012 02/2013 (52)	Δ	10/2012 03/2013 (53)	Δ	11/2012 04/2013 (54)	Δ	12/2012 05/2013 (55)	Δ
0	11.97%	9.38%	-2.59%	14.06%	2.09%	13.49%	1.52%	16.67%	4.70%	15.32%	3.35%	16.26%	4.29%
1	11.39%	4.69%	-6.70%	3.13%	-8.26%	2.38%	-9.01%	3.97%	-7.42%	3.23%	-8.16%	4.07%	-7.32%
2	10.82%	10.94%	0.12%	13.28%	2.46%	11.11%	0.29%	11.11%	0.29%	11.29%	0.47%	11.38%	0.56%
3	10.43%	12.50%	2.07%	10.16%	-0.28%	9.52%	-0.91%	10.32%	-0.12%	8.87%	-1.56%	8.94%	-1.49%
4	10.03%	9.38%	-0.66%	10.16%	0.13%	9.52%	-0.51%	11.11%	1.08%	14.52%	4.49%	15.45%	5.42%
5	9.67%	4.69%	-4.98%	4.69%	-4.98%	7.14%	-2.53%	4.76%	-4.91%	7.26%	-2.41%	7.32%	-2.35%
6	9.34%	14.06%	4.73%	10.16%	0.82%	10.32%	0.98%	7.94%	-1.40%	9.68%	0.34%	9.76%	0.42%
7	9.04%	12.50%	3.47%	13.28%	4.25%	15.87%	6.84%	14.29%	5.25%	13.71%	4.67%	13.01%	3.97%
8	8.76%	10.94%	2.18%	9.38%	0.62%	10.32%	1.56%	8.73%	-0.03%	6.45%	-2.31%	5.69%	-3.07%
9	8.50%	10.94%	2.44%	11.72%	3.22%	10.32%	1.82%	11.11%	2.61%	9.68%	1.18%	8.13%	-0.37%

Digit	Benford Rate	01/2013 06/2013 (56)	Δ	02/2013 07/2013 (57)	Δ	03/2013 08/2013 (58)	Δ	04/2013 09/2013 (59)	Δ	05/2013 10/2013 (60)	Δ	06/2013 11/2013 (61)	Δ	07/2013 12/2013 (62)	Δ
0	11.97%	14.52%	2.55%	11.20%	-0.77%	10.32%	-1.65%	7.87%	-4.09%	10.85%	-1.12%	8.53%	-3.44%	8.53%	-3.44%
1	11.39%	6.45%	-4.94%	6.40%	-4.99%	5.56%	-5.83%	3.94%	-7.45%	5.43%	-5.96%	5.43%	-5.96%	4.65%	-6.74%
2	10.82%	12.10%	1.27%	9.60%	-1.22%	10.32%	-0.50%	7.87%	-2.95%	10.08%	-0.74%	6.98%	-3.85%	6.98%	-3.85%
3	10.43%	7.26%	-3.17%	8.80%	-1.63%	12.70%	2.27%	12.60%	2.17%	14.73%	4.30%	17.83%	7.40%	16.28%	5.85%
4	10.03%	16.94%	6.90%	16.80%	6.77%	17.46%	7.43%	18.11%	8.08%	14.73%	4.70%	15.50%	5.47%	14.73%	4.70%
5	9.67%	7.26%	-2.41%	8.80%	-0.87%	9.52%	-0.14%	14.17%	4.51%	10.85%	1.18%	10.85%	1.18%	13.18%	3.51%
6	9.34%	8.87%	-0.47%	11.20%	1.86%	7.94%	-1.40%	9.45%	0.11%	6.98%	-2.36%	8.53%	-0.81%	10.85%	1.52%
7	9.04%	11.29%	2.26%	11.20%	2.17%	10.32%	1.28%	11.81%	2.78%	9.30%	0.27%	9.30%	0.27%	10.08%	1.04%
8	8.76%	7.26%	-1.50%	8.00%	-0.76%	7.14%	-1.61%	8.66%	-0.10%	10.85%	2.10%	10.85%	2.10%	8.53%	-0.23%
9	8.50%	8.06%	-0.44%	8.00%	-0.50%	8.73%	0.23%	5.51%	-2.99%	6.20%	-2.30%	6.20%	-2.30%	6.20%	-2.30%

In Table 4, Benfor's Law second digit rates, rather than third digit ones, are reported since, for the sake of simplicity of computations, we deleted first digits from the entire dataset when we dealt with the empirical third digit distribution. Thus, we can treat third digits as they were second digits. Of course, this expedient does not alter the value of Benford's Law analysis. Furthermore, this allow us to better and equally compare the two LME Aluminium sets of rates, reported in Table 3 and Table 4, respect to Benford's Law one.

References

[1] Abrantes-Metz, R.M., Judge, G., Villas-Boas, S. (2011), *Tracking the Libor Rate*, Applied Economics Letters, Vol. 10, Issue 10, Taylor & Francis Journals, London, United Kingdom, pp. 893-899.

[2] Benford, F. (1938), *The Law of Anomalous Numbers*, Proceedings of the American Philosophical Society, Vol. 78, No. 4, American Philosophical Society, Philadelphia, United States, pp. 551-572.

[3] Brähler, G., Engel, S., Göttsche, M., Rauch, B. (2011), *Fact and Fiction in EU-Governmental Economic Data*, German Economic Review, Vol. 12, Issue 3, John Wiley & Sons, New York, United States, pp. 243-255.

[4] Commission Decision of 4 December 2013, *Euro Interest Rate Derivatives*, Case AT.39914.

[5] Commission Decision of 4 December 2013, *Yen Interest Rate Derivatives*, Case AT.39861.

[6] European Commission, *Antitrust: Commission fines banks € 1.71 billion for participating in cartels in the interest rate derivatives industry*, Press Release, IP/13/1208, 4 December 2013, Brussels, Belgium.

[7] Hotter, A., Shumsky. T. (2011), *Wall Street Gets Eyed in Metal Squeeze. Some Say Warehousing Inflates Prices*, The Wall Street Journal, 17 June 2001, New York, United States.

[8] Master Screens Inc., *et al.* v. Goldman Sachs Group Inc., *et al.*, Case No. 13-CV-00431, United States District Court for the Northern District of Florida, Tallahassee Division.

[9] Newcomb, S. (1881), *Note on the Frequency of Use of the Different Digits in Natural Numbers*, American Journal of Mathematics, Vol. 4, No. 1, The Johns Hopkins University Press, Baltimore, United States, pp. 39-40.

[10] Nigrini, M.J. (1999), *I've Got Your Number: How a Mathematical Phenomenon Can Help CPAs Uncover Fraud and Other Irregularities*, Journal of Accountancy, Vol. 187, Issue 5, American Institute of Certified Public Accountants, New York, United States, pp. 15-27.

[11] River Parish Contractors Inc., *et al.* v. Goldman Sachs Group Inc., *et al.*, Case No. 13-CV-05267, United States District Court for the Eastern District of Louisiana, New Orleans Division.

[12] Superior Extrusion Inc., *et al.* v. Goldman Sachs Group Inc., *et al.*, Case No. 13-CV-13315, United States District Court for the Eastern District of Michigan, Detroit Division.

[13] Varian, H.R. (1972), *Benford's Law (Letters to the Editor)*, The American Statistician, Vol. 26, Issue 3, Taylor & Francis Journals, London, United Kingdom, pp. 62-65.

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