GOVERNANCE AND THE EFFICIENCY
OF ECONOMIC SYSTEMS
GESY

Discussion Paper No. 284
Measuring the deterrence properties of competition policy: the Competition Policy Indexes

Paolo Buccirossi*
Lorenzo Ciari**
Tomaso Duso***
Giancarlo Spagnolo****
Cristiana Vitale*****

* LEAR
** LEAR and EUI
*** Humboldt University Berlin
**** University of Rome
***** LEAR

October 2009

Measuring the deterrence properties of competition policy: the Competition Policy Indexes[*]

Paolo Buccirossi[†], Lorenzo Ciari[‡], Tomaso Duso[^], Giancarlo Spagnolo[#], and Cristiana Vitale[•]

Abstract

The aim of this paper is to describe in detail a set of newly developed indicators of the quality of competition policy, Competition Policy Indexes, or CPIs. The CPIs measure the deterrence properties of a competition policy in a jurisdiction, where for competition policy we mean the antitrust legislation, including the merger control provisions, and its enforcement. The CPIs incorporate data on how the key features of a competition policy regime score against a benchmark of generally-agreed best practices and summarise them so as to allow cross-country and cross-time comparisons. The CPIs have been calculated for a sample of 13 OECD jurisdictions over the period 1995-2005.

Keywords: Competition Policy, Indicator, Deterrence, Competition Law

JEL classification: K21, K42, L40

[†] LEAR
[‡] LEAR and EUI
[^] Humboldt University Berlin and WZB
[#] Tor Vergata, Stockholm School of Economics, and CEPR
[•] Corresponding author – Lear, Via del Banco di S. Spirito 42 – 00186 Rome, Italy – cristiana.vitale@learlab.com

1   Introduction

The aim of this paper is to introduce the Competition Policy Indexes, from hereon "CPIs", a novel set of indicators of the quality/intensity of competition policy.[1] The CPIs measure the deterrence effect of a competition policy in a jurisdiction, where for competition policy we mean the antitrust legislation, including the merger control provisions, and its enforcement.[2] The CPIs incorporate data on how the key features of a competition policy regime score against a benchmark of generally-agreed best practices and summarise them, so as to allow cross-country and cross-time comparisons.

The CPIs are based on a bottom-up approach, in which each jurisdiction's scores can be related to specific features of its competition policy. Applying a consolidated methodology, developed by the OECD for the indicators of product market regulations (PMR) and the competition law and policy indexes (CPL), the CPIs have a pyramidal structure which encompasses a large number of sub-indicators that are progressively aggregated using a set of weights at each level of aggregation.[3][4] We first used a weighting scheme in which the weights were assigned according to the relevance that each item in our view deserves. Subsequently we adopted an alternative scheme, which aggregates the different features of a competition policy regime using factor analysis, as a robustness check.

As mentioned above, the methodology herein proposed for building the CPIs is akin to the one used by the OECD for building the PMR indicators and the CPL indexes. However, the former aim at measuring restrictions to competition due to inappropriate regulations (e.g. on entry or business activities) and the latter consider both policies that enhance the general level of competition (i.e. ex-post policies implemented by the Competition Authorities, from hereon CAs) and policies that encourage and promote competition in deregulated network industries (i.e. ex-ante policies implemented by sector regulators), whereas the CPIs focus only on the policies that enhance the general level of competition. In addition, while the PMR indicators have been calculated only for two years (1998 and 2003) and the CPL indexes only for one year (2003), the CPIs have both a

---

[1] The CPIs have been used in the recent paper by Buccirossi et. al. (2009a) to estimate the effects of competition policy on the growth of total factor productivity.

[2] A jurisdiction is the territory within which the power to interpret and apply a specific legislation can be exercised. It does not always coincide with the boundaries of a nation (e.g. the European Union).

[3] See Høj, J. (2007).

[4] See Boylaud O. G. Nicoletti and S. Scarpetta (2000); Conway, P. V. Janod and G. Nicoletti (2005); Conway, P. and G. Nicoletti (2006).

cross-country and a cross-time dimension, as we calculated them for 13 OECD jurisdictions over a period of ten years (1995-2005).[56]

The next section discusses the features of a competition policy regime that we have included in the CPIs on the grounds that we believe these are the ones that affect its effectiveness. Section 3 explains how the CPIs are structured, while sections 4, 5 and 6 explain in more detail the steps followed in their construction. Section 7 describes the data we have used to calculate the CPIs over our sample. Section 8 explains how we derived the weighting schemes based on factor analysis. Section 9 illustrates how well competition policy works in the jurisdictions in our sample by examining the pattern of some of the CPIs over the relevant period. Section 10 compares the CPIs with other indicators of a similar kind that have been developed by other economists. The last section contains some concluding remarks.

2   What makes competition policy work?

In this paper the term competition policy refers to the competition legislation (including the merger control provisions) and its enforcement. All other forms of competition-enhancing policies, such as the reduction of "red tape" that favours the entry of new firms, consumer protection, competition advocacy, state aid controls or ex-ante sectoral regulation, are not included in our definition of competition policy. Hence, for the purpose of this paper a competition policy includes a set of prohibitions and obligations that firms have to comply with to ensure that competition is not reduced or altered, together with an array of tools for policing and punishing any violation. We will generically refer to these as *the features of a competition policy regime*.

Many economists share the view that the ultimate aim of competition policy should be to maximise social welfare, where social welfare is given by the un-weighted sum of the profits of all the firms and of aggregate consumer surplus.[78] Other alternatives have been proposed, where a lower weight is given to the welfare of the firms with respect to that of the consumers, or where the welfare of society is identified only with that of the consumers.[9] The objective function of the European

---

[5] The time period has been chosen on the basis that it was difficult to obtain reliable information too far behind in the past and also so as not to excessively burden the CAs who had accepted to help us in colleting the information.

[6] The 13 jurisdictions included in our sample are: Canada, Czech Republic, European Union, France, Germany, Hungary, Italy, Japan, Netherlands, Spain, Sweden, UK, US. Originally we had planned to include also Greece and Australia but we did not manage to obtain any reply to our questionnaire from their CAs.

[7] See Buccirossi (2007) and Motta (2004) for a general discussion of the objective of competition policy.

[8] See Kaplow and Shavell (2002).

[9] See Neven and Röller (2005), who considers the political economy environment that an antitrust agency is operating

Commission, as well as those of many national CAs, incorporates a definition of social welfare that includes only the consumers' surplus.

We are not going to discuss here what should be the "right" definition of social welfare that a competition policy should protect and enhance, and we shall take as given the way in which each jurisdiction has designed, and each CA has implemented, its competition policy over the years considered in our sample.

Given the above definition, it becomes clear that the role of a CA consists of using the powers and the resources conferred on it by the law to ensure that firms operating within its jurisdiction undertake the least possible number of behaviours that reduce social welfare by impairing competition. This implies that the aim of a CA consists of deterring anticompetitive behaviours.[10]

It follows that the most effective competition policy regime is one in which the CA achieves total deterrence and, hence, never has to block a merger, never has to uncover a cartel or any other anticompetitive agreement, and never has to condemn a firm for abusing its dominant position.[11] In an ideal regime firms do not dare to propose an anticompetitive merger, do not attempt to form a cartel, never enter into an anticompetitive agreement and do not even consider using their market power with the aim of excluding rivals and reducing social welfare. In addition, in the ideal competition policy regime, firms never refrain from attempting a merger, concluding a contract or undertaking a unilateral conduct, if these actions improve social welfare.

In this paper we evaluate a competition policy regime on the basis of its ability to deter all those

---

in and considers how this impacts on the choice of the appropriate welfare standard in merger control. The authors show that, when the antitrust agency can be influenced by third parties and it is imperfectly monitored, neither a consumer surplus standard nor a welfare standard dominates, whereas, when lobbying is efficient, when accountability is low, where mergers are large and when a marginal increase in merger size is highly profitable, a consumer surplus standard is more attractive. The authors do not discuss whether their analysis can or should be extended to other competition law infringements. See Salop (2005).

[10] In order to avoid confusion we want to stress that the form of deterrence we refer to here is the one generally called ex-ante, or general, deterrence, which consists of preventing agents from undertaking illegal behaviours by threatening violators with sufficiently heavy and prompt sanctions. There is also a second form of deterrence, called specific deterrence or desistance, which takes place ex-post (i.e. after an unlawful behaviour had already taken place and was discovered or when an anticompetitive merger is blocked) and works through a corrective change in behaviour induced in the economic agents prosecuted and convicted for the detected violation (or whose merger was stopped). Specific deterrence is less important, as general deterrence should prevent all socially harmful practices, but it still plays a role for those complex behaviours where mistakes in the forecast of their effects on social welfare are likely.

[11] There is no reason to believe that the ideal competition policy regime is the one that a jurisdiction should strive for. Indeed the ideal regime, even if it were feasible, would entail very high implementation costs, and these are probably much higher than the ones society would be rationally willing to bear: the ideal competition policy regime may not be the most efficient one.

market conducts that harm social welfare.[12] To do so we have identified those features of a competition policy regime that we believe have the strongest impact on the level of deterrence it can engender. We based our choice of these features on the economic theory of the public enforcement of law. This theory originates from Becker's seminal paper, which shows that entry into illegal activities can be explained by the same model of choice that economists use to explain entry into legal activities, and which applies the economic approach to incentive design to address the legal problem of deterring unlawful behaviours.[13] This theory claims that the level of deterrence depends on: 1) the level of the punishment wrongdoers can expect to suffer if they are convicted relative to their expected gain from the violation, 2) the perceived probability of being caught and convicted, and 3) the perceived probability of errors in the investigation and evaluation of the violations.[14]

Since Becker's contribution, competition law enforcement has become a specific research subject, which has gone well beyond extending, or adapting, results in the economic theory of the public enforcement of law. Building on all this literature, we have identified the policy variables/dimensions that are most likely to affect the three key determinants of deterrence when the relevant law is the competition legislation, and, thus, make the policy more or less effective.[15] With regard to violation of antitrust rules these are: the degree of independence of the CA with respect to political or economic interests; the separation between adjudicator and prosecutor; the quality of the law on the books (i.e. how close are the rules that make the partition between legal and illegal conducts to their effect on social welfare); the scope of investigative powers the CA holds; the level of the financial loss (i.e. the overall sanction) that firms and their employees can expect to suffer as a consequence of a conviction; the level of activity of a CA, and the amount and the quality of the financial and human resources the CA can rely on when performing its tasks.[16] [17] In the case of

---

[12] The reason why our indicators measure the deterrence effect, rather than the quality of a competition policy regime, is because the latter increases with the level of deterrence up to the point when this becomes over-deterrence. However, it is very hard to say when the level of deterrence engendered by a competition policy regime has reached the point when it also starts to inhibit efficient behaviours. Hence, we consider it more appropriate to limit our analysis to the level of deterrence.

[13] Becker G. (1968).

[14] These errors weaken the level of deterrence a given sanction can induce. An enforcement agency can commit an error when it convicts someone who has not violated the law (normally referred to as a type I error) or when it acquits someone who is effectively guilty (normally referred to as a type II error). The probability that someone may be held liable even when she is adopting a legal behaviour reduces the rewards that are obtained from respecting the law, thus increasing the net gain from a breach of the law; similarly the probability of being acquitted although one is violating the law renders the probability of being investigated and convicted lower, reducing the expected sanction. Hence, both types of errors make the alternative of violating the law more attractive. See Polinsky and Shavell, (2000), Buccirossi et al. (2006c), and Schinkel and Tuinstra (2006).

[15] See also Buccirossi et al. (2009b).

[16] There are of course other determinants of deterrence that do not fall among the categories discussed above. For example, when a cartel is international in scope and leniency policies are not coordinated across countries and agencies, the risk for the first whistleblower in a country to be the second one (hence, obtaining reduced or no leniency) in other

merger control the features selected are slightly different, because investigative powers are not very relevant in merger cases (as these are ex-ante investigations which do not involve infringement of legal obligations, but rather a request for approval for a business operation) and there are no sanctions for potentially anticompetitive mergers[18].

3 The structure of the Competition Policy Indexes

Each indicator has been obtained from the linear aggregation of data on the competition policy variables discussed above. [19] This aggregation followed a series of steps, which are discussed below and summarised in Table 1.

1. Each piece of information on each policy feature was assigned a score on a scale of 0-1 against a benchmark of generally-agreed best practice (from worst to best). In order to assign scores we determined what could be considered as best practice by relying on scientific papers and books, on documents prepared by international organisations such as the International Competition Network and the OECD, and on our judgement. These references are cited below, when we discuss in more detail how each feature has been scored, and are summarised in two tables included in Appendix A.

2. All the information on a specific policy feature was summarised in a separate low level index using a set of weights to aggregate it.

3. The low-level indexes were aggregated into two medium-level indexes for each of three types of possible competition law infringements and for mergers, one which summarises the institutional features of the competition policy and one which summarises the enforcement features.

4. The medium-level indexes were then aggregated to form a number of different summary

---

countries because cartel partners reacted to your reporting the cartel by rushing to self-report elsewhere may clearly hinder the deterrence effects of leniency programs. However, in this study we are focusing on cross-country differences, hence this kind of issues, though interesting, fall outside the scope of our analysis.

[17] The expected sanctions depend on both the types and the levels of the sanctions that can be imposed and the types and the levels of the sanctions that are actually imposed.

[18] In the case of mergers, there are only sanctions for procedural violations.

[19] We are aware that there might be complementarities among different aspects of competition policy that we may miss by using this linearly additive specification. However, we believe that it would be difficult to choose a more precise approximation of the relationship that could exist between these variables, hence we have decided to select this aggregation form that has the advantage of being simple and at the same time rather complete.

indexes, which we generically refer to as the CPIs. More specifically we have calculated (for each jurisdiction and each year in the sample):

- one index that measures the deterrence effect of the competition policy with regard to all antitrust infringements (the Antitrust CPI) and one that measures its deterrence effect in the merger control process (the Mergers CPI).
- one index that assesses the deterrence effect of the institutional features (the Institutional CPI) and one that assesses the deterrence effect of the enforcement features (the Enforcement CPI).
- a single index that incorporates all the information on the overall deterrence effect of the competition policy regime in a jurisdiction (the Aggregate CPI).

4   The construction and composition of the low-level indexes

The first two steps in the construction of the CPIs consisted of calculating the low-level indexes. Each of these indexes includes information on one of the sets of policy variables discussed above (in section 2.1), which we believe affect the level of deterrence engendered by the competition policy of a jurisdiction, and hence its effectiveness. We have calculated separate indexes for each of the three possible competition law infringements (i.e. hard-core cartels, abuses of dominance and agreements other than hard-core cartels) and for mergers to take into account the differences in the legal framework and, where possible, in the enforcement.[20]

Each piece of information was assigned a score on a scale of 0-1 against a benchmark of generally agreed best practice (from worst to best). When a data entry was quantitative it was normalised by dividing it by the highest corresponding value held by any CAs in the sample, so that even quantitative information could assume a value between 0-1. More details on how the scores have been assigned can be found in the following subsections.

When an index included more than one piece of information, these (or more precisely their scores) were weighted and summed together to obtain a single value for each low-level index. The weights used for the aggregation of the scores were based on our own evaluation of the importance of the various data. Details on how the subjective weights were chosen can be found at the end of this section (in subsection 4.9).

---

[20] This was not always easy. For example the CAs rarely have separate divisions that deal with the different types of infringements, hence we could not obtain separate data on the resources employed to police each one.

In order to check whether our choice of the weights had a decisive influence on the results, we also used a different set of weights, generated by a statistical technique: the factor analysis. This robustness check has shown that the results do not significantly vary, even when an alternative set of weights is employed (see section 8 for more details).

4.1 *The structure of the low-level indexes*

Table 1 below shows the content of each one of the low-level indexes we have built. The numbers in brackets refer to the weights used to sum up the information contained in each index.

Table 1: The low-level indexes

Abuses	Hard-core Cartels	Other anti-competitive agreements	Mergers
Independence: Nature of prosecutor (1/2) Nature of adjudicator and role of government (1/2)	**Independence:** Nature of prosecutor (1/2) Nature of adjudicator and role of government (1/2)	**Independence:** Nature of prosecutor (1/2) Nature of adjudicator and role of government (1/2)	**Independence:** Nature of bodies involved in Phase 1 and 2 (1/2) Role of government in decision (1/2)
Separation of powers: Separation between adjudicator and prosecutor (2/3) Nature of appeal court (1/3)	**Separation of powers:** Separation between adjudicator and prosecutor (2/3) Nature of appeal court (1/3)	**Separation of powers:** Separation between adjudicator and prosecutor (2/3) Nature of appeal court (1/3)	**Separation of powers:** Separation between adjudicator and prosecutor (1/3) Separation between Phase 1 and 2 (1/3) Nature of appeal court (1/3)
Quality of the law: Standard of proof for predation and goals that inform decision (1/2) Standard of proof for refusal to deal and goals that inform decision (1/2)	**Quality of the law:** Standard of proof and goals that inform decision (1/2) Leniency program (1/2)	**Quality of the law:** Standard of proof for exclusive contracts and goals that inform decision	**Quality of the law:** Obligation to notify (1/2) Efficiency clause (1/2)
Powers during investigation: Combination of powers (3/4) Availability of interim measures (1/4)	**Powers during investigation:** Combination of powers	**Powers during investigation:** Combination of powers (3/4) Availability of interim measures (1/4)	
Sanction policy and damages: Sanctions to firms (1/3) Sanctions to individuals (1/3) Private actions (1/3)	**Sanction policy and damages:** Sanctions to firms (1/3) Sanctions to individuals (1/3) Private actions (1/3)	**Sanction policy and damages:** Sanctions to firms (1/3) Sanctions to individuals (1/3) Private actions (1/3)	
Resources: Budget (1/2) Staff (1/4) Staff skills (1/4)	**Resources:** Budget (1/2) Staff (1/4) Staff skills (1/4)	**Resources:** Budget (1/2) Staff (1/4) Staff skills (1/4)	**Resources:** Budget (1/2) Staff (1/4) Staff skills (1/4)
	Sanctions and cases: Number of cases opened (1/3) Max jail term imposed (2/3)		**Cases:** Number of mergers examined

4.2   Independence of the competition authorities

An important determinant of the effectiveness of a competition policy regime is the independence of the CA with respect to political or economic interests. A CA which takes into account interests that are (potentially) in contrast with those that should guide its activity is more likely to commit errors when reaching decisions.[21]

This index measures the independence of a CA by considering its institutional status, as well as the role that the government plays in the adjudication of competition infringements and in the assessment of mergers.

With respect to competition cases, in some jurisdictions separate bodies are responsible for the investigation of a case and for its adjudication. Hence, this low-level index has two components:

i) the institutional nature of the body that performs the investigation, and
ii) the institutional nature of the body that makes the decision and the role of the government in this decision-making process.

i)   A jurisdiction scores 1 when the body that **performs the investigation** has total statutory independence, because it is either a court or an independent agency. It scores 0 if it is a ministerial agency/department. An intermediate score is given to the case in which the investigation can be performed by either an independent agency or a ministerial agency/department.

ii)   A jurisdiction scores 1 when the body that **takes the decision** has total statutory independence and the government cannot over-rule a decision by the relevant CA, it scores 0.5 when the adjudicator has total statutory independence but the government can over-rule a decision, and it scores 0 if it is a ministerial agency/ department.

We have given equal weights to each piece of information.

In the case of merger control, there are jurisdictions in which one body first performs a high-level evaluation – also referred to as Phase 1 – and another one undertakes, when deemed necessary by

---

[21] See Genoud (2003), Majone (1996), Oliveira et al. (2009), OECD (2003); OECD (2005a), OECD (2005b), and Voigt (2007). Gilardi (2003 and 2002) makes a slightly different argument in that he claims that indepedent regulatory and competition agencies are more protected from political and electoral influence and thus they can adjust their regulatory policies in the long term and create a more stable and predictable regulatory environment..

the first one, a more detailed examination – also referred to as Phase 2.

Hence, in the case of mergers this index includes:

i) the institutional nature of the bodies involved in Phase 1 and Phase 2; and

ii) the role of the government.

i) A jurisdiction scores 1 when the bodies that reach a decision in Phase 1 and Phase 2 (if these are separate) are independent, 0 if both bodies are ministerial agencies/departments, and 0.5 if one is independent and the other is not. If there is only one body, the score is 1 if it is independent and 0 if it is not.

ii) The score is 1 if the government cannot over-rule a decision on a merger, and 0 if it can.

We have given equal weights to each piece of information.

4.3   Separation of powers

A second relevant characteristic is the degree of separation between the body that performs the investigation on an allegedly anticompetitive behaviour (or merger) and the one which takes the decision on whether the behaviour should be sanctioned (or the merger blocked). The stronger the separation between prosecutor and adjudicator (e.g. when the investigation is made by an independent public body and the decision by a court) the more balanced the decision is likely to be and this, in turn, lowers the probability of an error.[22]

Similarly it matters whether the appeal court is a specialised body with competence only in competition matters or whether it is the appeal body for all judicial decisions.[23][24] A specialised body will be formed by individuals that have competence in those specific subjects and are therefore better able to consider all the details and correctly evaluate all evidence when deciding on a case.

This low-level index captures information on these elements, more precisely on:

---

[22] See Block et al. (2000), Dewatripont and Tirole (1999), Neven (2006), Posner (1988) and Wils (2004).

[23] By appeal court we mean the court that is responsible for reviewing the decision of the CA.

[24] See OECD (2007).

i) the existence of a separation between the adjudicator and the prosecutor, which in our view reduces the bias in the decision,

ii) the nature of the appeal body, and

iii) only in the case of mergers, whether the body that decides if a merger should undergo a Phase 2 investigation and the body responsible for undertaking the Phase 2 investigation are separate.

i) A jurisdiction scores 0 when the same body adjudicates and prosecutes, while it scores 1 if these two activities are performed by separate bodies.

ii) A jurisdiction scores 1 when the relevant appeal court specialises in competition matters and 0 when this court deals with appeals on all kinds of decisions.[25]

iii) A jurisdiction scores 0 when the same body performs Phase 1 and Phase 2 investigations, and scores 1 when two different bodies undertake the two activities.

In the low-level indexes for the competition law infringements we have given a weight of 2/3 to the scores on the degree of separation between adjudicator and prosecutor and a weight of 1/3 to the nature of the appeal court. In the index for mergers, where we have three elements, we have given equal weight to each of them.

4.4 Quality of the law

We have defined deterrence as the prevention of conducts that reduce social welfare, however the latter may not always be the conducts that are declared illegal by the competition legislation. Rules are indeed imperfect as they can ban conducts that are competitive, or allow conducts that are anticompetitive, as they may not correctly reflect the impact that specific conducts have on social welfare. Hence, the third policy variable we need to consider is the definition of the quality of these rules, i.e. the quality of the law on the books. This is a matter of judgement, which makes measuring this policy variable extremely difficult. However, we can observe whether the competition legislation (and the soft law that disciplines its actual application, e.g. guidelines) has rules that make the partition between legal and illegal conducts closer to their effect on social welfare.

---

25 In most jurisdictions, all mergers that undergo some form of control are first subject to a general investigation, referred to as Phase 1. Those mergers that raise concerns and that may be blocked or may require remedies, are subject to a second more detailed analysis, called a Phase 2 investigation. In some jurisdictions the same body that decides on whether a merger should undergo a Phase 2 investigation, also performs on this investigation. In other jurisdictions, a separate body is responsible for undertaking the Phase 2 investigation. The decision on the outcome of each investigation can be made by the same body that investigates or from a separate one.

In the case of antitrust infringements, this index focuses on:

i) the standard of proof that is required when deciding on a specific type of violation, which can be a per se prohibition or a rule of reason approach; and

ii) the goals that inform the decision-making process.

For abuses of dominance, we have considered the standard of proof required for a price exclusionary practice, predation, a non-price exclusionary practice, refusal to deal. If in assessing each of these alleged abuses a jurisdiction applies a rule of reason standard and it considers only economic goals it scores 1, because this means that the CA decides whether there has been an abuse on the basis of the effects of the behaviour rather than by relying on set rules. On the other hand, if it imposes a per se prohibition a jurisdiction scores 0. An intermediate score applies if the CA applies a rule of reason standard, but it also considers non-economic goals when evaluating the effects of the action (e.g. the effect of the behaviour on the level of employment).[26]

For anticompetitive agreements other than hard-core cartels, we have only considered the practice of exclusive contracts, because this is very common in most markets. If in assessing such an infringement a CA requires that the actual effects of the behaviour are proved, and it considers only economic goals when evaluating the effects, it scores 1. If it also considers non-economic goals it scores 0.5, and if it imposes a per se prohibition it scores 0.[27]

For hard-core cartels, instead, a per se ban scores 1, while if the imposition of a sanction requires showing that the cartel has had an effect on the market and the CA considers only economic goals, the score is 0.5, otherwise, if it considers also non-economic goals the score is 0. The reason why the scoring is reversed in the case of cartels is the gravity of this practice and of its consequences, which, as is generally agreed, calls for a stricter rule.[28]

The index for hard-core cartels includes also a second element: the leniency program. A CA that has such a program is more likely to discover and deter a higher number of cartels.[29] Hence, a

---

[26] See Voigt (2007)

[27] See Voigt (2007)

[28] See Voigt (2007), Motta (2004) and OECD (2002b).

[29] See Aubert et al. (2005), Harrington (2008), ICN (2006), Motta and Polo (2003), Motta (2004), OECD (2002a), OECD (2002b), Spagnolo (2000), Spagnolo (2004), and Spagnolo (2008).

jurisdiction scores 1 if it has a leniency program for cartel whistleblowers and 0 if it does not.

The merger control index has a different composition as it is based on:

i) the characteristics of the notification obligation, and
ii) the criteria used for assessing concentrations.

With regard to notification, the absence of any obligation to notify is scored 0, while a score of 0.33 is given to the CAs that impose such an obligation but have no minimum threshold, since the lack of such a limit renders it more difficult for competition authorities to focus resources on important cases. Higher scores are given when there is such a threshold: 0.66 is given to a CA with a minimum threshold based on market shares, and 1 to a CA with a minimum threshold based on the firms' turnover.[30] The reason why turnover is considered to be best practice is that it is easier to apply and is less open to uncertainty.

The application of efficiency considerations in the evaluation of the possible effects of a merger is scored 1, because it allows taking into consideration all the economic consequences of the concentration on the market and on consumers, and not just its effect on competition. The absence of any efficiency defence is scored 0.

We have given equal weights to both elements.

4.5   Powers during investigations

This index, which is calculated only for competition law infringements, measures the type of powers a CA holds during the investigation phase. These include the power to impose, or request, interim measures, that allows preventing any anticompetitive behaviour from leading to serious and irreversible damages while a final decision is being reached. Furthermore, they include the powers to gather information by inspecting the premises of the firms under investigation and the private premises of their employees, as well as by wiretapping conversations. The stronger the latter powers, the more and the better the information at the CA's disposal is, and thus the higher the probability of detection and the lower the probability of errors, especially type II errors.

With respect to interim measures, a jurisdiction scores 1 if it has interim measures and 0 if it does

---

[30] See ICN (2006).

not. With regard to information gathering powers, a jurisdiction scores 1 if both business and private premises can be inspected, 0 if none of them can be inspected, and 0.5 if only business premises can be inspected, as the wider the powers the more thorough the investigation.

We have given a weight of 1/4 to the availability of interim measures and of 3/4 to the types of information gathering powers held by the CAs.

With respect to hard-core cartels, the power to impose interim measures is not relevant. Hence, this index only measures the types of powers to gather information.

The reason why we did not have this low-level index for mergers is that investigative powers are not very relevant in merger cases because these are ex-ante investigations which do not involve infringement of legal obligations, but rather a request for approval for a business operation.

4.6 Sanctions and damages

One important element in deterring anticompetitive behaviours is the credible threat of financial losses that firms (and their employees) can expect to suffer as a consequence of a conviction.[31] This low-level index considers: the range of potential sanctions that offenders (both firms and their employees) are faced with and whether affected parties can sue for damages. These losses are determined by the sum of the sanctions that can be imposed by the CA, and/or the court, (e.g. fines, imprisonment, disqualification, damages), to which it is necessary to add any damage repayment to the affected parties, because what determines the behaviour of a firm are the total losses imposed by a given course of action.

It is important to highlight that the level of the financial loss depends on two elements: the law on the books and how this is enforced. For example, the sanctions imposed by the CA (or a court) depend: on the criteria set out in the law regarding the type of sanctions and maximum level they can reach, and on how these criteria are applied (i.e. their enforcement). If the monetary fine can reach up to 10% of the turnover of a firm, but no fine of this level has ever been imposed, even when a serious breach of the law took place, firms will not expect to have to pay such a figure, despite what the law says. This index only refers to what is set out in the law. We have considered separately the level that the sanctions have effectively reached.

---

[31] Landes (1983); Simon and Werden (1987), Craycraft et al. (1994), Craycraft et al. (1997), Connor (2005), Geradin (2005), Kobayashi (2002), Buccirossi and Spagnolo (2007), Schinkel (2007).

No sanctions are imposed following merger investigations, hence there is no such index for mergers.[32]

With regard to the sanctions that can be imposed on firms, this index considers how the maximum level of the fine is set: the score is 1 if this limit is expressed as a proportion of the turnover of the offending firm or of the illicit gain obtained from the infringement, 0.66 if the level of the fine is left to the discretion of the adjudicator, 0.33 if the maximum level of the fine is set in absolute terms, and 0 if no fines are imposed.[33]

For the abuses of dominance index we have also included the types of sanctions that can be imposed. A jurisdiction scores 0 if neither monetary fines nor structural remedies can be imposed, 1 if both are allowed, and 0.75 if only monetary sanctions are possible. To obtain a single score for the sanction to firms we have given a weight of 1/3 to the type of possible sanctions and of 2/3 to the criterion for its calculation.[34]

With regard to sanctions on the employees of the offending firms, the index considers both the types of sanctions and their maximum level:

- for monetary fines, the score is 0 if no such fines can be imposed and 1 if there is no explicit limit to this type of sanctions; instead, if there is a maximum value set by law, the score is the normalisation of this value, which is obtained by dividing this value by the maximum value in the sample.
- for disqualification, the score is 1 if the employee can be disqualified from the position of director and 0 if this is not possible.
- for jail sentences, the score is 0 if the individual cannot be imprisoned; in all other cases, the score is the maximum jail term that the courts can impose, divided by the longest jail term available in any jurisdiction enclosed in the sample.

To obtain a single score for this element of the index, we have given a weight of 3/10 to monetary fines, a weight of 2/10 to disqualification and a weight of 5/10 to imprisonment.

---

[32] There are fines only for breaching procedural obligations, such as the duty to notify (when this exists), and for completing a merger that was prohibited.

[33] See OECD (2002a) and OECD (2002b).

[34] See OECD (2002a) and OECD (2002b).

With regard to private actions, the score is 0 if no private actions are possible, while it is 1 if both affected firms and affected individuals can appeal to a court for a damage payment and if class actions are possible. The intermediate scores 0.33 and 0.66 are given only if the affected firms, or both the affected individuals and the affected firms respectively, can undertake a private action, but class actions are not available.

The overall index is composed in equal parts by the scores of these three elements.

4.7   Resources

The effectiveness of the enforcement activity of a CA is likely to be affected by the financial and human resources devoted to it. This index measures both the quantity of these resources, i.e. budget and total staff of the CAs, and their quality, more specifically the number of economists with a relevant PhD and of qualified lawyers. When a jurisdiction has two CAs we have considered both their resources jointly. Since all this data is quantitative we normalised the original data between 0-1 in the following way:

- the budget was divided by the nominal GDP of the country (both expressed in US$ using PPP exchange rates), so as to allow a comparison between countries of different sizes and levels of economic development. This value was then divided by the highest corresponding value held by any CAs in the sample.
- the number of staff members was divided by the real GDP of the country, again to allow a meaningful comparison between countries. This value was then divided by the highest corresponding value held by any CAs in the sample.
- both the number of economists with a PhD and the number of qualified lawyers were divided by the number of total staff. This value was then divided by the highest corresponding value held by any CAs in the sample.

We have given a weight of 1/2 to the budget data, a weight of 1/4 to the data on the total staff and a weight of 1/4 to the data on the composition of this staff.

This index has the same value for all the three possible infringements, as well as for merger control, because we do not have separate data on the resources devoted to each type of practices. This is due to many CAs not having separate divisions that deal with different types of behaviours and/or not keeping a record of the personnel and resources of different divisions.

4.8 Sanctions and cases

How effective sanctions are as a deterrent depends not just on their type and level as set in the law, but also on the strictness of sanctions that have actually been issued. Unfortunately, data on this subject are scarce.[35] We managed to obtain only some data for hard-core cartels. These refer to the maximum jail term imposed on the employees of the offending firms (for those countries in which such a sanction is possible). In order to score this data we have divided the relevant figure by the highest one imposed by any CAs in the sample.

The credibility of a CA in preventing anticompetitive behaviours/mergers also depends on how active it is in assessing mergers and investigating complaints of infringements. This level of activity has been proxied with the number of cartels investigations opened and the number of mergers examined, each divided by the real GDP of the relevant country, as the size of the economy can have an impact on the absolute number of anticompetitive behaviours. We have normalised this ratio by dividing it by the highest one in the sample.[36] When a country has two CAs we have considered the number of cartel investigations performed by both of them.

For hard-core cartels we have given a weight of 2/3 to the data on the jail term and 1/3 to the number of cases investigated.

4.9 Rationale behind the subjective weights

Above, we have indicated the weights that we used to aggregate the single pieces of information to construct the low-level indexes. We now explain how we selected them.

The general rule we have followed is a sort of "*Principle of insufficient reason*", whereby whenever we had no specific reasons to believe that one feature mattered more than others, we gave equal weights to all elements in the low-level index.[37] There are six cases in which this neutrality rule was not applied. These are explained below.

---

[35] CAs do not keep easily accessible records of fines and other sanctions, especially if one wants to relate them to seriousness and the duration of the infringement or to the magnitude of the affected commerce. In addition, in most instances, the CAs' decisions have been appealed and it is difficult to track down the outcome of the appeal, which is the one that really matters. This element of the indicator could benefit from further work.

[36] The reason why we have not also included the number of cases of other types of antitrust infringements is that, unfortunately, it has proved impossible to collect consistent data on the number of investigations carried out on abuses and agreements other than cartels.

[37] For a discussion of this principle in statistics in a historical perspective see Stigler (1966). The principle of insufficient reason was renamed the "principle of indifference" by Keynes (1921). A succinct source is http://en.wikipedia.org/wiki/Principle_of_indifference

1) In the low-level indexes on the separation of powers for all antitrust infringements, "Separation between adjudicator and prosecutor" is weighted 2/3, while "Nature of appeal court" is weighted only 1/3. The rationale behind this choice is that the appeal court does not intervene in all cases, as the undertaking may not appeal. In addition the appeal decision is taken much later, with respect to the decision of the CA. Hence, the nature of an appeal court should have a weaker and less certain influence on the effectiveness of a competition policy regime.

2) In the low-level indexes on the powers to investigate for abuses of dominance and for agreements other than cartels, "Availability of interim measures" has been given a weight 1/4, while "Combination of powers" has been given a weight of 3/4. This choice rests on the fact that, while the latter is crucial for the CAs intervention since it affects how thorough an investigation can be, the former only affects the timeliness of the intervention, but does not alter the probability of errors.

3) In the low-level indexes on sanctions and damages for abuses of dominance, the sanctions on firms include two elements: the types of sanctions that can be imposed and their level. To obtain a single score we have given a weight of 1/3 to the type of possible sanctions and of 2/3 to the criterion for its calculation, because we believe that the latter has a stronger impact on deterrence.[38]

4) In the low-level indexes on sanctions and damages, we have different types of sanctions that can be imposed on offending individuals. To obtain a single score we have given a weight of 3/10 to monetary fines, a weight of 2/10 to disqualification and a weight of 5/10 to imprisonment. These weights are based on our view that monetary fines can be paid by the companies the individuals work for, while prison sentences have to be undergone by the individuals found guilty.

5) In the low-level indexes on resources we have given a weight of 1/2 to the budget data, a weight of 1/4 to the data on the total staff and a weight of 1/4 to the data on the composition of this staff. The reason is that we believe that the monetary resources are those that affect the most the means that a CA has to undertake its investigative and enforcement activities.

---

[38] The reason why we believe that the criterion for setting the level of the fine is so important is that this affects the most the incentives faced by a firm in the course of its decision process.

6) In the low-level indexes on cases for hard-core cartels we have given a weight of 2/3 to the data on the maximum jail term and 1/3 to the number of cases investigated, because we believe that the former data is more important in signalling the toughness of a competition regime.

5   The construction of the medium-level indexes

The next step in the construction of the CPIs consisted of vertically aggregating the low-level indexes to obtain, for each type of infringement and for mergers, a medium-level index that encompasses all the information on the institutional features as well as a medium-level index that encompasses all the information on the enforcement features.

The value of each of these eight medium-level indexes is given by the weighted average of the low-level indexes they comprise. These weights are shown in Table 2 below.

Table 2: The medium-level indexes

	Abuses	**Hard-core Cartels**	**Other agreements**	**Mergers**
Institutional features	Independence (1/6) Separation of powers (1/6) Quality of the law (1/6) Powers during investigation (1/6) Sanctions and damages (1/3)	Independence (1/6) Separation of powers (1/6) Quality of the law (1/6) Powers during investigation (1/6) Sanctions and damages (1/3)	Independence (1/6) Separation of powers (1/6) Quality of the law (1/6) Powers during investigation (1/6) Sanctions and damages (1/3)	Independence (1/3) Separation of powers (1/3) Quality of the law (1/3)
Enforcement features	Resources	Resources (2/3) Cases (1/3)	Resources	Resources (2/3) Cases (1/3)

The weights have been chosen so as to attribute greater importance to the low-level indexes that incorporate the most important policy features. Hence, in the institutional feature index for all three antitrust infringements "sanctions and damages" has been given a weight of 1/3, while the other

features have a weight of 1/6. This is due to the fact that sanctions seem to have a stronger impact on deterrence[39]. Whereas in the enforcement feature index, the data on the number of cases, where available, has been given a lower weight because we believe that the resources are better indicators of how active a CA is in its competition enforcement activities.

6   The construction of the high-level indexes

The last step consisted of aggregating the medium-level indexes in a set of high-level indexes, the CPIs, that incorporate all the information on the deterrence effect of the competition policy regime in a jurisdiction in a specific year.

We have calculated one index, the Antitrust CPI, that measures the deterrence effect of the competition policy with regard to all antitrust infringement, which is given by the weighted average of all the medium-level indexes relative to antitrust infringements, and one, the Mergers CPI, that measures the deterrence effect of the competition policy with regard to the mergers, which is given by the weighted average of two medium-level indexes relative to merger control.

We have also calculated one index, the Institutional CPI, which measures the deterrence effect of the institutional features of a competition policy regime, which is given by the weighted average of the four medium-level indexes relative to the institutional features. Further, we calculated one index, the Enforcement CPI, which measures the deterrence effect of the enforcement features of a competition policy regime, which is given by the weighted average of four medium-level indexes relative to the enforcement features.

Finally, we calculated an index that incorporates all the information on the deterrence effect of the competition policy regime in a jurisdiction in a specific year (the Aggregate CPI).

Table 3 below shows these CPIs and the weights (in brackets) used in the aggregation process.

---

[39] See Levitt (2001), Levitt (1998) and Levitt and Miles (2006).

Table 3: the CPIs

	Antitrust CPI (3/4)			Merger CPI (1/4)
Aggregate CPI				
	Hard-core Cartels (1/3)	**Abuses (1/3)**	**Other agreements (1/3)**	
Institutional CPI (2/3)	Institutional features of hard-core cartels	Institutional features of abuses	Institutional features of other agreements	Institutional features of mergers
Enforcement CPI (1/3)	Enforcement features of hard-core cartels	Enforcement features of abuses	Enforcement features of other agreements	Enforcement features of mergers

7   The data

In the previous sections (from section 3 to 6) we described the structure of the CPIs and the methodology we used for building them. In this section we explain how we collected the data on the relevant competition policy features that we have employed to calculate the CPIs.

Most of the data were obtained directly from the CAs operating in the 13 jurisdiction included in our sample.[40] We submitted a tailored questionnaire to each of them with questions on the institutional framework of their competition policy regime and on how this evolved over time (to capture any changes that happened over the ten year period 1995-2005). In addition, we asked them about the quantity and quality of the resources they employed to enforce the competition legislation over that time period, as well as about the sanctions imposed on firms and their employees and the cases/mergers they have investigated. The data from this survey were integrated with information derived from the country studies carried out by the OECD in the context of its reviews of regulatory reforms, from the chapters on competition and economic performance in the OECD Economic Surveys and from the CAs' own websites.

---

[40] We surveyed only the CAs which are either independent public bodies or ministerial agencies/departments, and did not survey the courts (though we collected data on their powers and activities). The bodies surveyed are: Competition Bureau (Canada); Urad pro ochranu hospodarske souteze (Czech Republic); Directorate General for Competition Affairs (European Union); Conseil de la Concurrence (France); Direction Générale de la Concurrence (France); Bundeskartellaamt (Germany); Gazdasági Versenyhivatal (Hungary); Autorità Garante della Concorrenza e del Mercato (Italy); Japan Fair Trade Commission (Japan); Nederlandse Mededingingsautoriteit (Netherlands); Servicio de Defensa de la Competencia (Spain); Tribunal de Defensa de la Competencia (Spain); Konkurrensverket (Sweden); Office of Fair trading (UK); Competition Commission (UK), Federal Trade Commission (US); Antitrust Division - Department of Justice (US).

7.1   Missing data

Despite the active collaboration of most CAs, it was not possible to collect all data on the enforcement characteristics of the competition policy necessary to build the CPIs for the period considered (1995-2005). Hence our database had some missing observations.

In order to fill them in, we asked the CAs to provide us with an imputation of the missing observations based either on other data at their disposal or on their historical knowledge of the trends. When this was not possible, we performed some limited imputation of the missing data, whenever this was allowed by the characteristics of the other available data on that specific feature.

More specifically we performed two types of imputation. The first consisted of extending a series of data over time, if we had enough data (at least five observations) and if it was possible to trace a clear trend in them. For example, if we had data on the level of a CA's budget from 1996 to 2000 (i.e. 5 years) and this was constantly growing, we could calculate the budget for 2001 and 2002 using the average growth rate observed in the available data. We would calculate only two of the missing data because we believe that our imputation should not exceed 50% (i.e. since we had 5 observations we could calculate 2 more, whereas if we had had 7 observations we could have calculated 3 missing ones). The second consisted of exploiting the information from other data to impute a different, unavailable, series of data. We used this imputation criterion only for two specific variables: the level of a CA's budget for competition activities and the number of its staff devoted to competition activities. Where we only had data on the budget for competition activities, but not on the staff and had data on the overall budget of the CA and on the total staff employed by the CA, we used the ratio between the budget in competition activities and the total budget to impute the fraction of the staff employed in competition activity.

Despite this work, we were not able to fill all the existing gaps. This means that in some cases we did not have all the information necessary to calculate a specific index. To avoid calculating indexes whose value could be altered by the lack of information, we decided not to calculate an index (both at the low, medium and high level of the pyramid) if 50% or more of the relevant information content was missing. For example, the low-level index on resources includes information on the CA's budget with a weight of 1/2, on quality of its staff with a weight of 1/4, and on the composition of its staff with a weight of 1/4. If for a given country in a given year we did not have the data on the level of the budget we would not calculate this index because half of the information content was missing, whereas, if we had no information on the composition of the staff, we would

still calculate the index as only a quarter of the information content would be missing, i.e. we would be above the 50% threshold.

We have accepted only one exception to this rule, in that we did not calculate the Aggregate CPI if we could not calculate the relevant Enforcement CPI, even if this just accounted for 1/3 of the overall information content of the Aggregate one. We decided that in the case of the Aggregate CPI it was important to have data on both institutional and enforcement features.

7.2   *The EU*

Our sample includes 9 European countries, which are part of the European Union.[41] Hence, in these countries the EU competition policy works alongside their national competition policy. This means that, in order to correctly evaluate the effectiveness of the competition policy regime in each Member State it is necessary to consider both the national and the EU regime. Therefore for these countries, we have also built a set of CPIs, which incorporate information on both the national and the EU competition policy.

However, since we have no information on the EU enforcement features, we have only been able to calculate this set of index for the institutional features. These indexes have been calculated as the simple average of the country's Institutional CPI and the EU's Institutional CPI.

8   Robustness of the indexes

The construction of the CPIs contains a crucial element of subjective evaluation, which consists of the set of weights employed to combine the information gathered at each level of aggregation. There is thus a risk that the value of the CPIs may be driven by the subjective weighting scheme adopted.

In the previous sections we justified our choice of weights (see section 4.9). Nonetheless, to verify if the CPIs are sensitive to the weighting scheme adopted, we have employed a statistical technique, the factor analysis, to derive a new set of CPIs where the weights assigned to each piece of information are totally driven by the characteristics of the data themselves. The factor analysis is a statistical method which groups together variables that are highly correlated (and thus, to some extent, redundant) into a number of latent factors. The most important output of the factor analysis

---

[41] These jurisdictions are France, Germany, Italy, the Netherlands, Spain, Sweden, the UK and since 2004 also Czech Republic and Hungary.

is the matrix of loadings. The loadings measure the correlation between the variables and the factors, and allow the assignment of each variable to a given factor based on the strength of their correlation. Different techniques can be used within the framework of factor analysis to compute the loadings and to estimate factors. Our analysis is based on the methodology employed by the OECD when calculating the PMR indicators.[42]

This methodology involves a number of steps:

1. The first step consists of grouping the variables according to different areas of the competition policy: hard-core cartels, abuses, other agreements, and mergers, with no distinction between institutional and enforcement features.

2. The second step consists of extracting the factors – i.e. identifying the number of factors necessary to represent the original data – using the principal component method. With this method, the factors are chosen so that the first one explains as much information contained in the original data as possible; the second factor is orthogonal to the first and explains as much residual information as possible, and so on. The exact number of factors that should be retained can be decided by the researcher. Yet, usually one keeps adding factors until the explanatory power of the last factor included remains above a certain threshold[43].

3. The third step consists of the rotation of the factors, which permits a better interpretation of the results. The rotation allows us to get loadings that are closer to 1 or 0, thus allowing us to more easily assign a selected variable to a unique factor. We have used the varimax rotation technique, which preserves the orthogonality between the factors.

4. The fourth step consists of the construction of the factors. We have constructed the factors as the weighted average of the original variables, where the weights are the normalised squared factor loadings of each variables.

5. The fifth step consists of the aggregation of the factors in order to have a single indicator for each of the areas of the competition policy (hard-core cartels, abuses, other agreements, and

---

[42] Nicoletti et. al (2005)

[43] The threshold is set with reference to the value of the eigenvalue associated to each factor. The level of threshold is set by default in most applications and statistical packages (e.g. STATA, which we used) that perform factor analyses to the value of 1.

merger control). The factors are weighted according to the proportion of the overall variance of the data explained by each one and summed one to the other..

6. Finally, we run the factor analysis on these four indicators again (repeating the procedure described above) to calculate the aggregate CPI.

The following table shows the output of the factor analysis for one of the areas of competition policy: hard-core cartels.

Table 4: The output of the factor analysis for features relative to one competition policy area: hard-core cartels

Variable	Factor 1		Factor 2		Factor 3		Factor 4	
	Factor Loadings	Weights of variables in factor (2)	Factor Loadings	Weights of variables in factor (2)	Factor Loadings	Weights of variables in factor (2)	Factor Loadings	Weights of variables in factor (2)
Nature of prosecutor	-0.7047	0.1593	0.0749	0.0023	-0.0284	0.0004	0.5633	0.1704
Nature of adjudicator and role of government	-0.2838	0.0258	0.8378	0.2873	-0.0046	0.0000	0.1088	0.0064
Standard of proof and goals that inform decision	0.0586	0.0011	0.0230	0.0002	-0.1206	0.0071	0.92	0.4546
Leniency program	0.3018	0.0292	0.4393	0.0790	0.5802	0.1648	0.1506	0.0122
Combination of powers	0.2794	0.0250	0.8177	0.2736	0.0708	0.0025	-0.1996	0.0214
Sanctions to firms	-0.2737	0.0240	0.5991	0.1469	-0.3618	0.0641	0.1013	0.0055
Sanctions to individuals-monetary	0.3896	0.0487	0.3527	0.0509	0.2585	0.0327	-0.6135	0.2022
Sanctions to individuals-Jail	0.6711	0.1444	0.4951	0.1003	-0.0414	0.0008	-0.2531	0.0344
Sanction to individuals-Private actions	0.9083	0.2646	-0.0011	0.0000	-0.0968	0.0046	0.0724	0.0028
Nature of appeal court	-0.6444	0.1332	0.2780	0.0316	0.3240	0.0514	-0.0972	0.0051
Separation between adjudicator and prosecutor	0.5056	0.0820	-0.2446	0.0245	0.5020	0.1234	-0.2603	0.0364
Budget	-0.1888	0.0114	-0.0740	0.0022	0.8484	0.3524	-0.1684	0.0152
Staff	-0.4	0.0513	0.0519	0.0011	0.6323	0.1958	-0.2493	0.0334
Weight of Factors in Summary indicators (3)		0.3294		0.2581		0.2158		0.1967
Total variance explained by the factors					0.7281			

1) Based on rotated component matrix
2) Normalised squared factor loadings
3) Normalised sum of squared loadings

In the first column of Table 4, we report the entire list of variables on which the factor analysis has been performed. All the institutional and the enforcement variables have been included. The principal component method allows us to identify four separate factors that capture 73% of the variability in the original data. The columns called factor loading show the loadings for each factor, which measure the correlation between each variable and that specific factor, while the third columns, called weights of variables, show the weights that each variable gets in the computation of the factor, based on the normalised squared of the factor loadings. The four factors are then aggregated as a weighted sum, where the weight is proportional to the explanatory power of the factor with respect to the original data, captured by the normalised sum of the squared factor loadings.

A similar procedure is used for the other areas of competition policy: abuses, other agreements and mergers. Then, we run the factor analysis on the results again to obtain the aggregate CPI.

9   Results

In the previous sections we analysed in some detail the structure of the CPIs. Here we present the

results we obtained when applying this methodology to our database.

We start by showing, in Figures 1 to 6, the values of the Institutional CPIs and of the Enforcement CPIs for the jurisdictions in our sample over the period 1995-2005. [44] To allow a clearer interpretation of the results we have included only a limited number of jurisdictions in each figure. Yet, to allow readers to easily perform comparisons among them, we have reported the simple average in each figure.

Figure 1 shows the Institutional CPIs for the three OECD countries in our sample that are not part of the EU.

Figure 1: The Institutional CPIs for the non-EU countries in our sample: Canada, Japan and the US
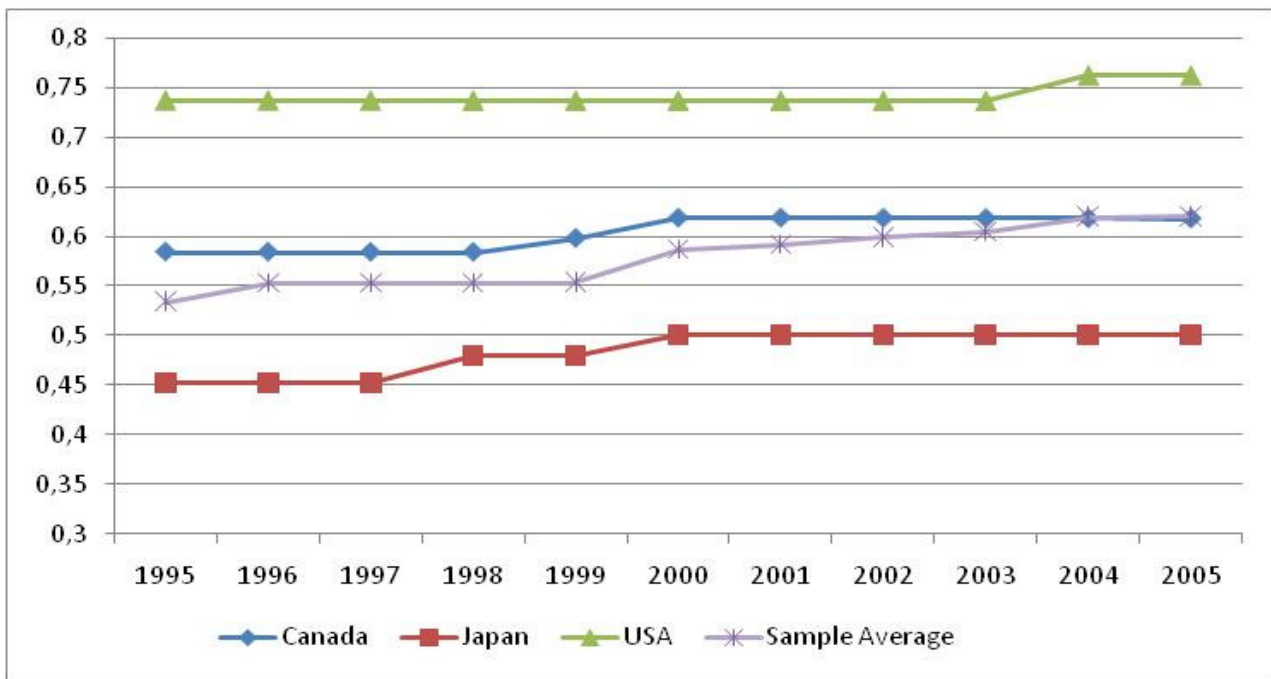
The Institutional CPIs of the non-EU countries in our sample remained relatively stable over the period under exam, but they differ considerably among each other: the one for the US has very high values, which are constantly among the highest in the sample and well above the sample average; the values for Canada are also above the sample average, while Japan's values are very low.

Japan consistently has the lowest Institutional CPIs for the entire sample period. The reason behind

---

[44] We were not able to collect any data on the enforcement features for the European Union, hence we could not calculate the Enforcement CPI for this jurisdiction.

Japan's low performance is manifold. First, Japan suffers from the lack of a leniency program for cartels' whistleblowers. Second, in Japan there is no separation between the body that prosecutes violators of the antitrust law and the body that adjudicates such cases. Further elements are the absence of the possibility to start a class action and the fact that the Japanese competition legislation envisages the consideration of non strictly-economic goals when assessing the effects of abuses of dominance.

The index for Canada shows a rise between 1998 and 2000. This improvement in the institutional features of the competition policy can be attributed to two major policy changes: the introduction in 1999 of the power to wiretap during investigations on alleged antitrust infringements and the introduction of a leniency program in 2000.

Figure 2 shows the Enforcement CPIs for the same countries.

Figure 2: The Enforcement CPIs for the non-EU countries in our sample: Canada, Japan and the US
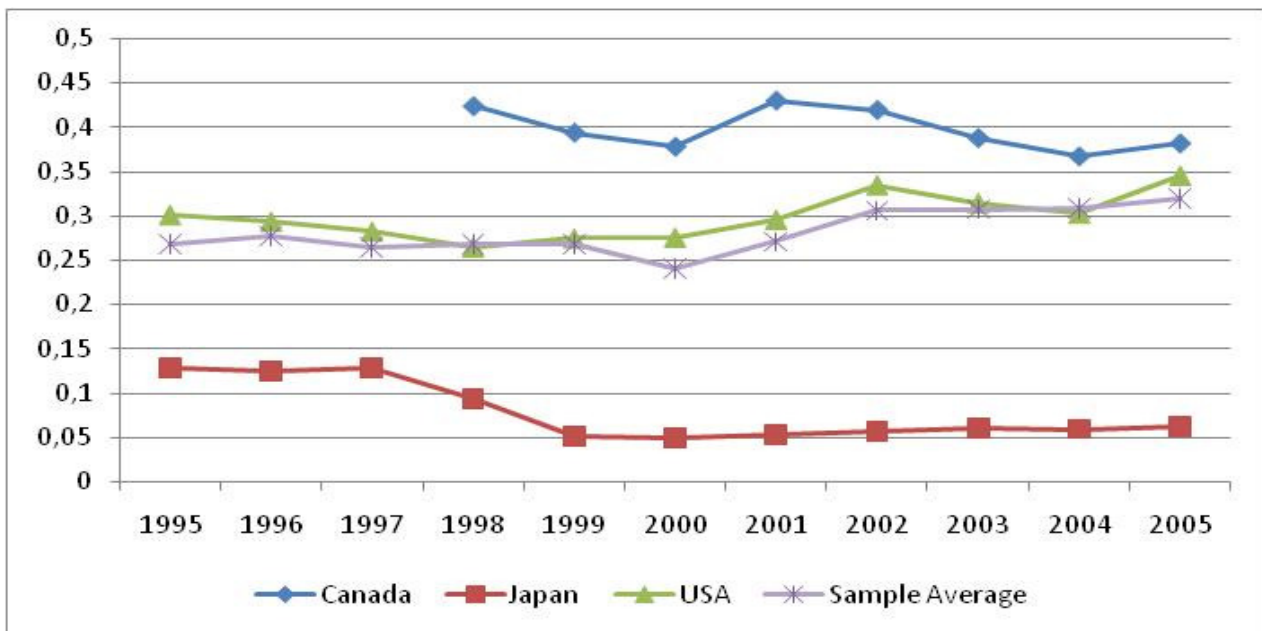
While the Institutional CPIs tend to be stable over time, because institutional changes are less frequent, the evolution of the Enforcement CPIs for the three non-EU countries exhibits more cross-time variation.

In addition the ranking is different, with respect to Figure 1, as Canada is now the country with the

highest values. The main reason why Canada has higher values than the US is due to the size of the annual budget for competition activities (relative to the country's GDP) and the number of the CA's employees (relative to the country's GDP). However, this gap tends to shrink over time and, by the end of our sample period, is almost closed.

Japan also shows very low values for the Enforcement CPIs. This is due to the low level of the human and financial resources available to the CA. The drop that can be observed between 1997 and 1999 is due to a strong reduction in the number of mergers examined by the Japanese CA, due to a change in legislation that modified the criteria for the notification of mergers.

Figure 3 depicts the Institutional CPIs for the large EU member states in our sample and for the EU itself.

Figure 3: The Institutional CPIs for the large EU countries in our sample: France, EU, Italy, Germany, Spain and the UK
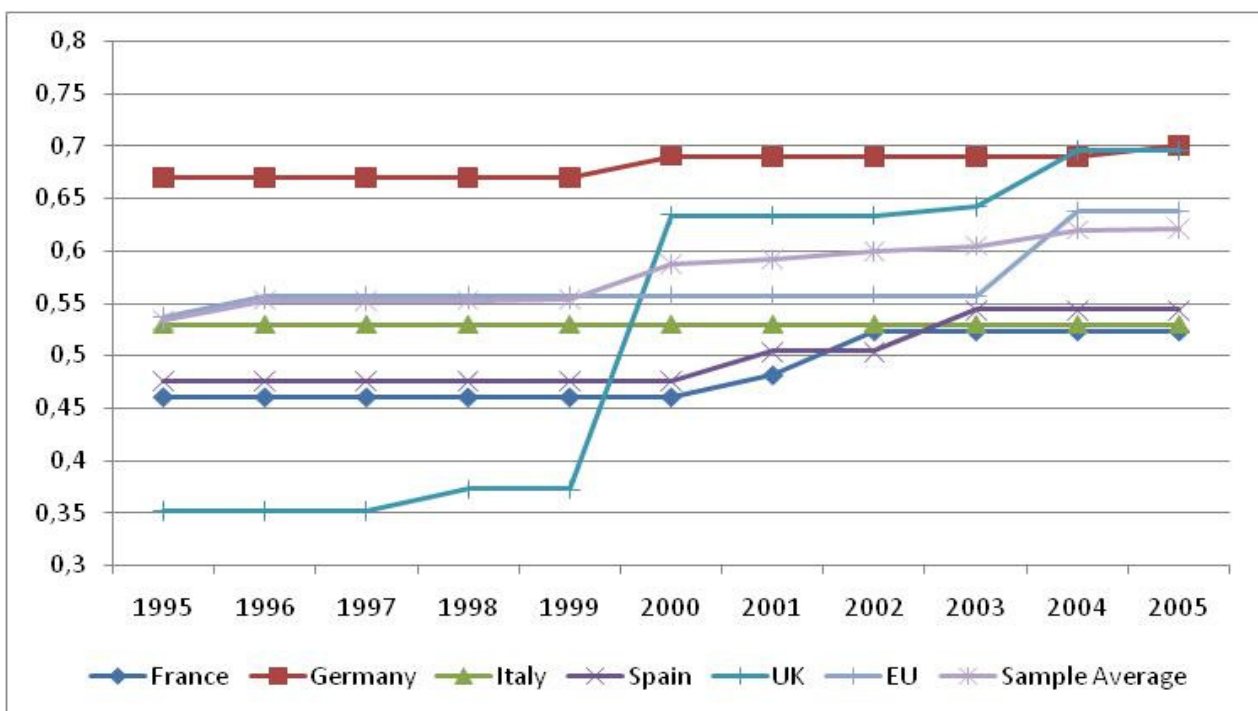
As we can see, the CPIs for Spain, France and Italy are consistently below the sample average, while Germany shows a much better performance. The CPIs for the EU and the UK start below the average, but over time grow enough to overcome it.

The most interesting features of this picture are the changes that characterise three of the

jurisdictions. The CPI for the UK jumps from the lowest level to a level well above the sample average. This is due to the major changes that accompanied the introduction of the Competition Act in 2000. Both Spain and France experience a substantial improvement between 2000 and 2003. The former benefited from the introduction of class action in 2001 and of the powers to investigate business premises in 2003. In the latter, the quality of the institutional CPI improved because of the introduction of a leniency program for cartels' whistleblowers and because of the obligation to notify mergers.

Finally, the Institution CPIs for the EU shows two upward jumps in 1996 and in 2004. The first one in 1996 is due to the introduction of a leniency programme for cartels' whistleblowers, while the second in 2004 is the result of the introduction of the power to inspect private premises in the investigation of hard-core cartels and abuses.

Figure 4 depicts the Enforcement CPIs for the same subset of jurisdictions. The figure does not include the EU, as we were not able to collect data on its enforcement features.

Figure 4: The Enforcement CPIs for the large EU countries in our sample: France, Italy, Germany, Spain and the UK
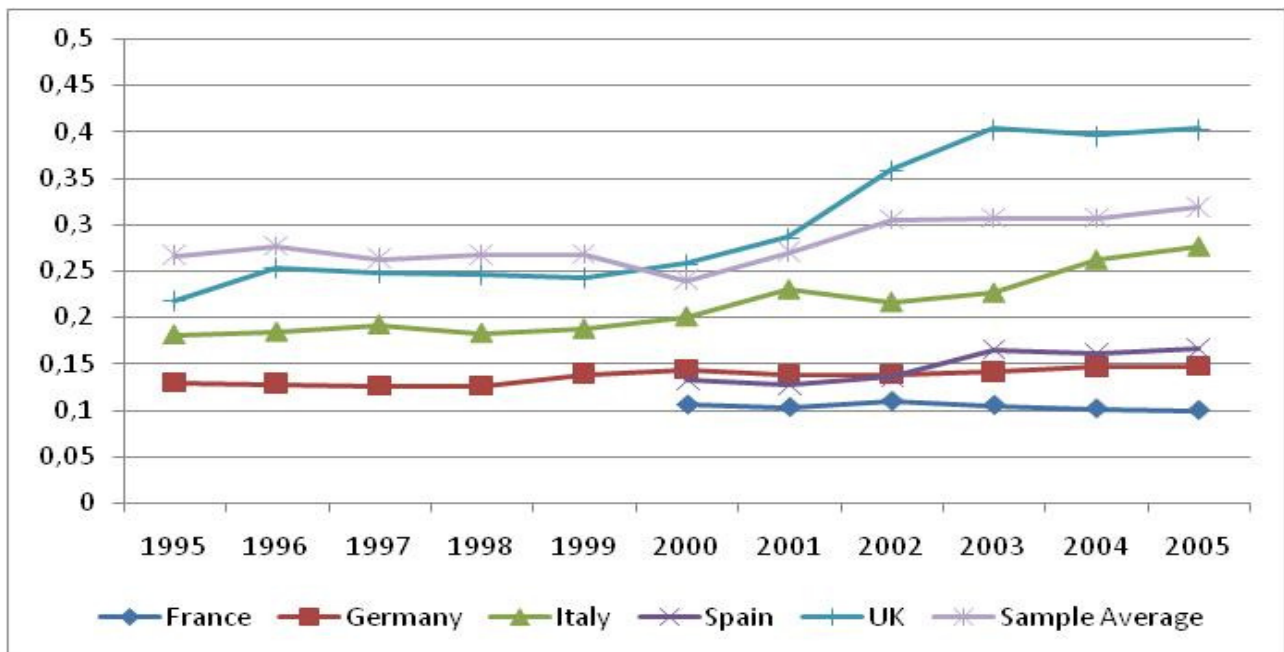

The first element to notice in this figure is that the data for the first five years in the sample are missing for Spain and France. This lack of information does not allow to have a clear picture of the trend for these two jurisdictions. The second is that, with respect to the enforcement characteristics

of the competition policy, Germany now ranks well below Italy and the UK. This is partially due to the fact that less financial resources are available to the German CA, and also to its limited number of employees (with respect to the UK) and their lower level of skills (with respect to Italy). A final relevant aspect to notice is the consistent improvement in the overall deterrence effect of the enforcement features of the competition policy in the UK, as the introduction of the Competition Act in 2000 was accompanied by a steady growth in the financial and human resources available to the two CAs.

Figure 5 depicts the Institutions CPIs for the small EU countries in our sample.

Figure 5: The Institutional CPIs for the small EU countries in our sample: the Czech Republic, Hungary, the Netherlands and Sweden
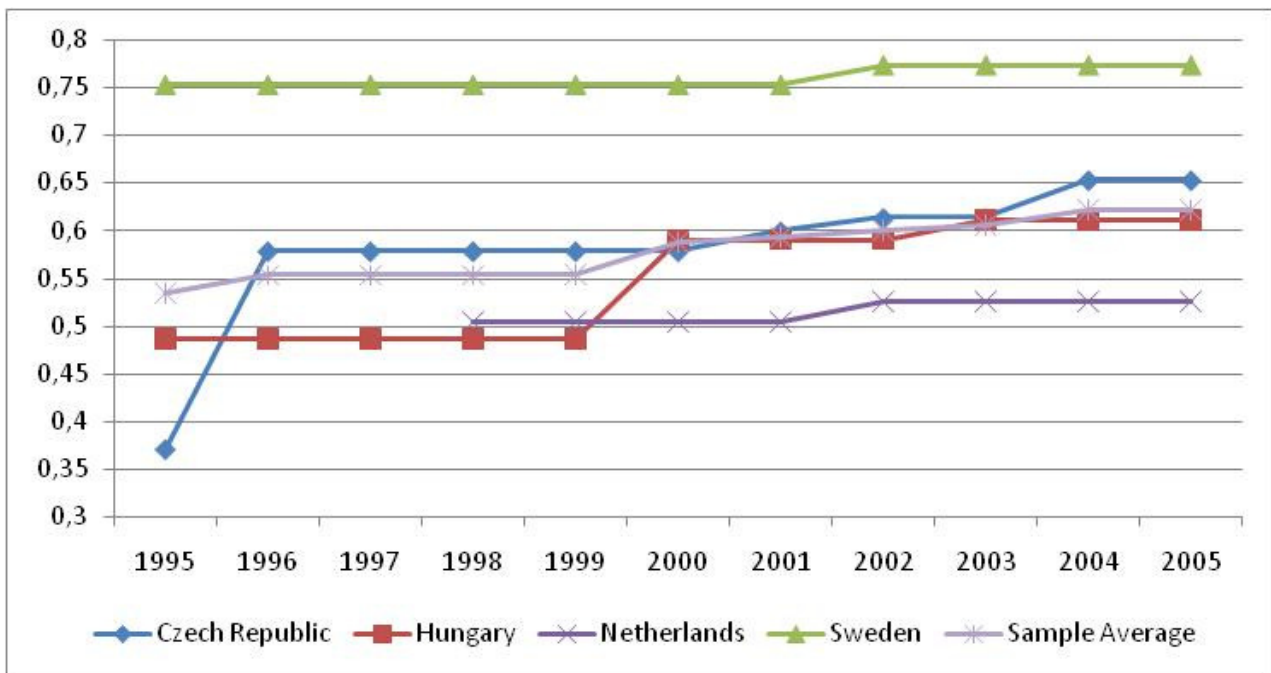

Sweden is consistently the country with the highest Institutional CPI values not just in this group but in the whole sample. The institutional CPIs for the other jurisdictions start below the sample average. However, both the Czech Republic and Hungary improve over time and move above the average. The Czech Republic experiences a first, considerable shift in 1996, due to the CA acquiring independence from the government – previously all decisions were taken by a ministerial department. A further improvement takes place in 2004, when the power to investigate business premises is introduced. In Hungary the major increase happens in 2000, and can be attributed to an increase in the investigative powers of the CA and to a shift in the criterion used to set the sanctions for antitrust infringements, which changed from a discretionary decision left to the adjudicator to an

approach based on the firm's turnover.

The Netherlands did not have a CA before 1998. Hence, it was not possible to calculate a CPI until that year. In subsequent years the index has been substantially stable. It experiences only a small jump in 2002, due to the introduction of a leniency program for cartels' whistleblowers.
Figure 6 depicts the Enforcement CPIs for the same subset of jurisdictions.

Figure 6: The Enforcement CPIs for the small EU countries in our sample: the Czech Republic, Hungary, the Netherlands and Sweden
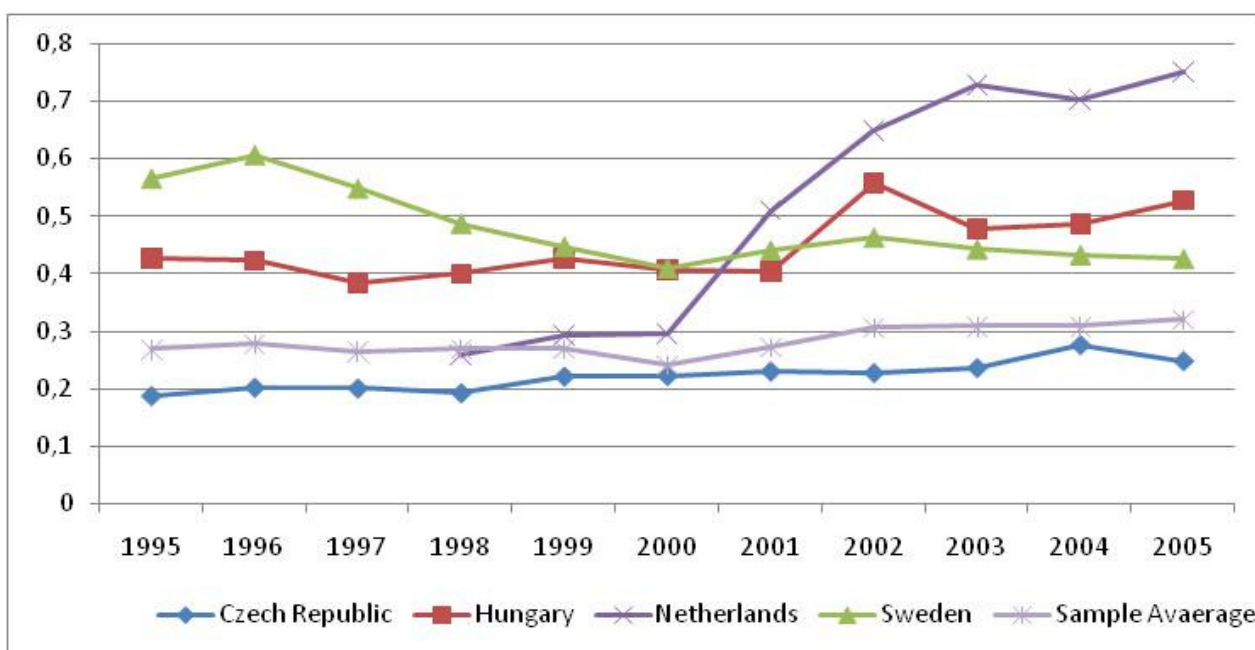

Again, Sweden shows the highest values of the Enforcement CPI in the first half of the sample period, yet these consistently decline over time. The main reason behind this decline is a reduction, in real terms, of the financial and human resources available to its CA. The Czech Republic shows a constant pattern over the entire sample period, and its Enforcement CPI is always below the sample average, while Hungary shows high values and exhibits a substantial improvement in 2002, due to an increase in the budget of the CA. The continuous upward trend for the Dutch Enforcement CPI is related to a constant increase in the amount and the quality of its CA's resources.

Figures 1 to 6 give a general idea of the deterrence effect of the competition policy in the jurisdictions included in our sample and of the relevant changes occurred over time. It is evident from them that there is substantial cross-sectional and cross-time variation in both the Institutional and Enforcement CPIs.

In Figures 7, 8 and 9 below we show the values of the Aggregate CPIs for the same group of countries. We do not comment on these figures, as from the description above it should be clear why the indexes follow the patterns observed. However, it should be stressed that the institutional component of the aggregate index takes a greater weight (2/3), hence the evolution of the Aggregate CPIs is mostly explained by the institutional features of the competition policy. It should once more be stressed that we could not calculate the Aggregate CPI for the European Union, as we have not been able to collect any data on the enforcement features of this jurisdiction.

Figure 7: The Aggregate CPIs for the non-EU countries in our sample: Canada, Japan and the US
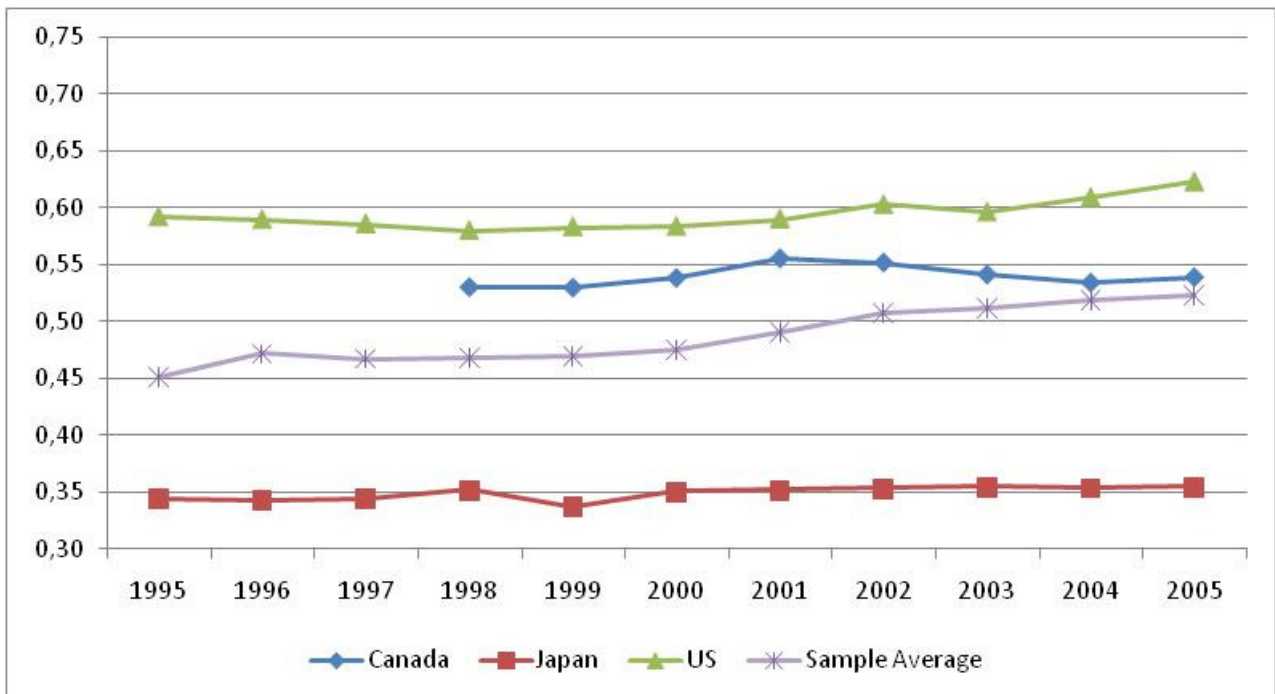
Figure 8: The Aggregate CPIs of the large EU member states in our sample: France, Italy, Germany, Spain and the UK
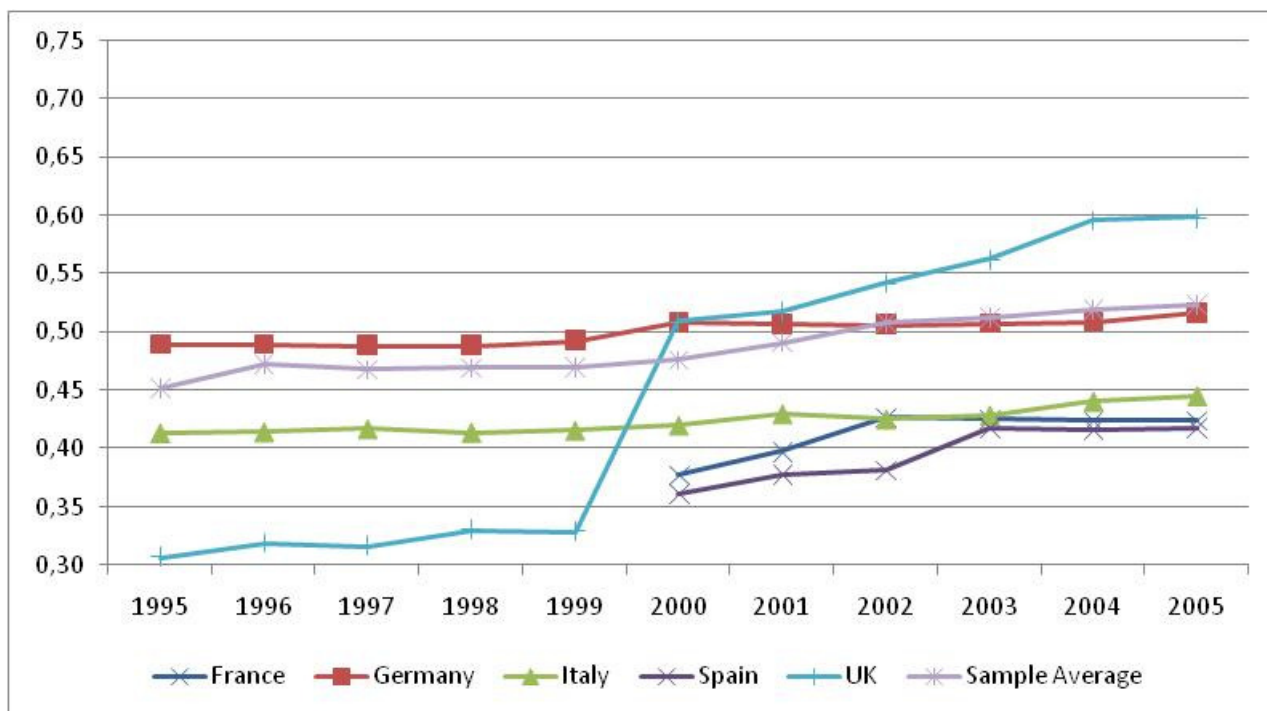
Figure 9: The Aggregate CPIs of the small EU member states in our sample: Czech Republic, Hungary, the Netherlands and Sweden
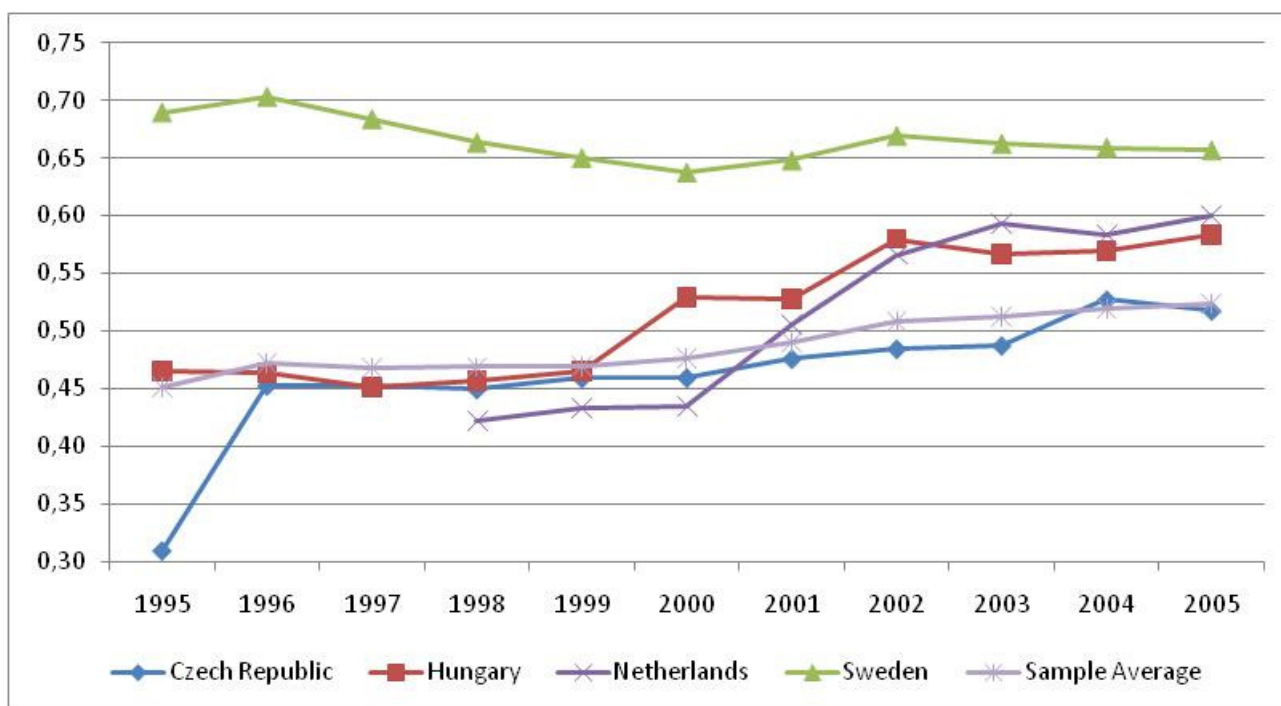
Table 5 below shows the ranking of the 12 countries in our sample based on the average value of their Aggregate CPIs over the years 1995 to 2005 and on its value in 2005. Sweden and the US are the best-scoring countries and this is true for each year in the sample, similarly France, Spain and Japan constantly have the lowest scores. The UK and Canada are the countries that experience the most marked change. Table 6 shows the ranking obtained when the Aggregate CPIs is calculated using the weights obtained through the factor analysis.

Table 5 : The ranking of the countries on the basis of the Aggregate CPIs

Country	Ranking based on average score	Ranking based on 2005 score
Sweden	1	1
US	2	2
Canada	3	6
Netherlands	4	3
Hungary	5	5
Germany	6	8
Czech Republic	7	7
UK	8	4
Spain	9	11
Italy	10	9
France	11	10
Japan	12	12

Table 6 : The ranking of the countries on the basis of the factor analysis Aggregate CPIs

Country	Ranking based on average score	Ranking based on 2005 score
Sweden	1	1
US	2	2
Germany	3	4
Canada	4	5
Hungary	5	6
UK	6	3
Czech Republic	7	7
Netherlands	8	8
Italy	9	9
France	10	10
Spain	11	11
Japan	12	12

The rankings resulting from the use of the two weighting schemes are broadly consistent. Sweden and the US rank at the top while France, Spain and Japan lie at the bottom in both tables. Only Germany and the Netherlands have a different ranking.

As a further check we have calculated the correlation coefficient between the values of the aggregate CPIs built with our weights and the one built with the weights obtained from the factor analysis. This coefficient is very high (equal to 0.96) and it is significantly different from zero at the 1% level.

10   Comparisons with other similar indicators

In the literature, few indicators exist that, like the CPIs, try to measure the strength of competition regimes.

The OECD, as mentioned in the introduction, has developed a set of CPL indicators (only for the year 2003) that try to measure the strength of a country's policies aimed at preserving and promoting competition. These indicators measure both the competition policy, as we have defined it in this paper, and the sectoral regulatory policies.

The ranking of the CPL indicators, with respect only to the competition policy, differ from the one of the aggregate CPIs. Several factors may determine these differences. First, the CPL indicators do not include information on some institutional characteristics which are included in the Aggregate CPI, namely the extent of powers available for the CAs during the investigations and the separation of powers between the prosecutor and the adjudicator. In addition, the CPL indexes attribute a relatively greater importance to the independence of the CA. Further, the CPL indexes do not rigidly separate the institutional features of a competition policy regime from the enforcement ones. For example, potential sanctions, that is, the sanctions envisaged by the national legislation, are included among the enforcement features of a competition policy regime together with the actual sanctions, whereas in the CPIs these data are kept separate. Another element that might contribute to the different rankings of the Aggregate CPIs and the CPL Indexes is the inclusion in the latter of more detailed information on the enforcement features of the competition policy regime. This is due to the CPL indexes being constructed for a single year, which makes the collection of enforcement data substantially easier.

Another set of indicators that has same similarities with the CPIs are the four indicators developed by Voigt.[45] These indicators focus on the institutional and enforcement features of competition regimes, but they are less comprehensive than the CPIs. In addition they do not attempt to summarise the key features of a regime in a single index, but are more akin to the low-level indexes discussed in section 4 in that each one includes information on a limited aspect of a competition regime.[46]

Also Hilton and Deng have tried to provide a quantitative summary measure of competition law. Their objective has been to gauge the size of the overall "competition law net" by collecting information on the breadth of the law and on its penalty and defence provisions in 102 countries over the time period January 2001 to December 2004.[47] Their scope index differs from the CPI in that it tries to provide a summary description of the areas covered by competition law rather than an evaluation of its quality. Indeed, the scope index does not attempt to measure how the law is effectively enforced, nor the degree of independence of the CA or the quality of the law. [48]

---

[45] See Voigt (2007).

[46] One indicator evaluates the substantive content of the competition legislation, a second indicator evaluates to what degree this legislation adopts an economic – as opposed to a legal – approach, a third indicator reflects the level of the formal independence of the CA and a fourth one measures its factual independence.

[47] See Hylton and Deng (2006).

[48] The information collected concerns the geographical scope of competition law, the remedies it allows, the type of private enforcement available to the damaged parties, the merger notification and assessment procedure, and the type of

In addition to these indicators, which try to measure the strength of competition regimes in an objective manner by relying on hard data on the competition policy characteristics of a country, there also exist other indicators which are based on subjective assessment of the effectiveness of these policies. The best example of these subjective indexes is the one published every year by the World Economic Forum (WEF) in its Global Competitiveness Report. The WEF indicators score the competition policies of 80 countries on the basis of the results of a survey of top business executives, who are asked to rank their country's antimonopoly policy between 1 (lax and not effective at promoting competition) and 6 (effective and promotes competition). The strong drawback of this type of indicators is that they are not easily comparable among each other, as they are built on subjective survey answers. Indeed, local businesspeople may not be familiar with competition regimes in other countries and may have difficulties performing a meaningful comparison. As a consequence the scores are likely to depend on people's expectations with regard to their country.

11 Conclusions

This paper presents a newly-designed set of indicators for measuring the deterrence effect of a competition policy regime, the CPI. These indicators embody both formal and practical aspects of such a regime by combining key information on the legal framework, the institutional settings, and the enforcement tools. This information is evaluated against a benchmark of best practices and then aggregated. The weights used for the aggregation are based on our own evaluation of the importance of the various features of the competition policy, as well as on the completeness of the data we have managed to collect. We have assessed the sensitivity the CPIs by recalculating them using a set of weights generated by a purely statistical technique, the factor analysis.

There is scope for further research and refinement of the CPIs. Firstly, the exercise could be repeated so as to cover a longer time period, as well as more countries. Secondly there remains room for expanding the database to include more detailed data on the enforcement features, in particular the indicators would benefit from the inclusion of more extensive information on the level of the sanctions that are effectively imposed on offending firms and on the extent to which offending firms are sued for damages.

---

abuses of dominance and restrictive trade practices prohibited.

Appendix A

Tables A.1 and A.2 summarise the scores given to each feature of a competition policy regime in building the low-level indexes (see section 4) and provides reference to the sources on which we have based our evaluation. For those variables that could be measured on a meaningful quantitative scale, e.g. those dealing with the amount of resources or with the powers of the CAs, our scoring approach was based on the simple assumption "the more, the better".[49] Hence, a jurisdiction obtains a higher score if the relevant CA is endowed with more investigative powers or resources.

---

[49] This assumption reflects the view that the more powers and resources a CA has, the more accurate the decisions it makes so that errors are less likely. It is apparent that, if too much resources and powers are employed to reach a given level of deterrence, some issue on the efficiency of the CA may arise. However, in this paper we are only interested in measuring the effectiveness of competition policy, and not in its efficiency.

Table A.1: References for questions relative to antitrust features.

ANTITRUST INFRINGEMENTS	SCORES	REFERENCES
Independence		
Body that performs the investigation:		
Independent agency	1	Voigt (2006), Section 3
Investigation splits between an independent and a ministerial agency/department	0.5	Oliveira. et al. (2009)
Ministerial agency/department	0	OECD (2005a, 2005b)
Body that takes the decision		
Independent agency/Court and Gov. cannot over-rule decisions	1	
Independent agency/Court and Gov. can over-rule decisions	0.5	Voigt (2007), p. 16
Ministerial agency/department	0	
Quality of the law		
Standard of proof for hard-core cartels and goals that inform the decision		Voigt (2007), p. 10 - 14
Per se prohibition	1	Motta (2004), p. 191
Rule of reason and only economic goals	0.5	OECD (2002b)
Rule of reason and economic and other goals	0	
Standard of proof for abuses and other agreements and goals pursued		
Per se prohibition	0	
Rule of reason and only economic goals	1	Voigt (2007), p. 10 -14
Rule of reason and economic and other goals	0.5	
Leniency program		OECD (2002a, 2002b)
There is	1	ICN, (2006)
There is not	0	Motta (2004), p. 193
		Spagnolo (2000)
Sanctions and damages		
Sanction to firms and criterion for maximum fine		
Illicit gain/ turnover	1	
Discretionary decision by adjudicator	0.66	OECD (2002a, 2002b)
Maximum value	0.33	
No fine can be imposed	0	
Separation of powers		
Nature of appeal court		
Specialised	1	OECD (2007)
Non-specialised	0	
Separation between prosecutor and adjudicator		Posner (1988)
There is	1	Wils (2004)
There is not	0	Neven (2006)

Table A.2: References for questions relative to merger control features.

MERGER CONTROL	SCORES	REFERENCES
Independence		
The adjudicator is		
Independent in phase 1 and in phase 2	1	Oliveira et al. (2009)
Independent in phase 1 (or 2) but not independent in phase 2 (or 1)	0.5	OECD (2005)
Not independent in phase 1 and in phase 2	0	
Role of government in decision		
Government cannot over-rule decision regarding a merger	1	ICN (2006)
Government can over-rule decision regarding a merger	0	
Quality of the law		
Obligation to notify		
Threshold is based on turnover	1	
Threshold is based on market share	0.66	ICN (2006)
There is no threshold	0.33	
There is no obligation to notify	0	
Efficiency clause defence		Motta (2004), p. 238
There is	1	Williamson (1968)
There is not	0	Farrell et al. (1990)
		ICN (2006)
Separation of powers		
Nature of appeal court		
Specialized	1	OECD (2007)
Not specialized	0	
Separation between prosecutor and adjudicator		Posner (1988)
There is	1	Wils (2004)
There is not	0	Neven (2006)
Separation between bodies that decide in phase 1 and in phase 2		
There is	1	
There is not	0	

References

Aubert C., Kovacic W., Rey P., (2005), The Impact of Leniency and Whistleblowers Programs on Cartels. Forthcoming in the *International Journal of Industrial Organization*

Becker G., (1968), Crime and Punishment an economic approach, *Journal of Political Economy,* 76(2): 169-217.

Block, M., J. Parker, O. Vyborna and L. Dusek (2000), An experimental comparison of adversarial versus inquisitorial procedural regimes, *American Law and Economics Review*, 2(1), 170–94.

Boylaud O. G. Nicoletti and S. Scarpetta (2000), Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation, *OECD Economics Department Working Papers* , No. 226, OECD Publishing;

Buccirossi et. al (2009a), Competition Policy and Productivity Growth: An Empirical Assessment, *Mimeo*

Buccirossi et. al (2009b), Deterrence in Competition Law, *Mimeo*

Buccirossi, P. (2007), "Introduction", in Buccirossi P. (ed.), *Handbook of Antitrust Economics*, Boston: MIT Press.

Buccirossi P., and G. Spagnolo, (2007), Optimal Fines in the Era of Whistleblowers: Should Price Fixers Still Go To Prison?, in V. Goshal and J. Stennek (Eds.), The Political Economy of Antitrust, Elsevier, North Holland.

Buccirossi P, G. Spagnolo, and C. Vitale, (2006), The Cost of Inappropriate Interventions/non Interventions under Article 82, *OFT 864*.

Conway, P. V. Janod and G. Nicoletti (2005), Product Market Regulation in OECD Countries: 1998 to 2003, *OECD Economics Department Working Papers*, No. 568, OECD Publishing;

Conway, P. and G. Nicoletti (2006), Product Market Regulation in the Non-Manufacturing Sectors of OECD Countries: Measurement and Highlights, *OECD Economics Department Working Papers*, No. 530, OECD Publishing.

Connor J.M., (2005), Optimal Deterrence and Private Antitrust Enforcement, Manuscript, Purdue University;

Craycraft C. et al (1997) Antitrust Sanctions and Firm Ability to Pay, *Review of Industrial Organization*, 12, 171-183;

Craycraft J.L., Gallo J.C., Dau Schmidt K.G. and Parker C. J., (1994) Criminal Penalties Under the Sherman Act: A Study of Law and Economics, *Research in Law and Economics*, 16, 25-71;

Dewatripont, M. and J. Tirole (1999), Advocates, *Journal of Political Economy*, 107(1), 1–39.

Genoud C. (2003), Toward a content and contextual approach of delegation, or "how and why we should open the regulation black box", Paper prepared for the workshop "Delegation in Contemporary Democracies", *ECPR Joint Sessions of Workshops*, Edinburgh 2003

Geradin D. and Henry, D., (2005), The EC Fining Policy for Violations of Competition Law: An empirical Review of the Commission Decisional Practice and the Community Courts' Judgments. Forthcoming in Cseres K.J., Schinkel M.P. and Vogelaar F.O.W. (Eds.), "Remedies and Sanctions in Competition Policy: Economic and Legal Implications of the Tendency to Criminalize Antitrust Enforcement in the EU Member States", Edwar Elgar, London;

Gilardi F. (2002), Policy credibility and delegation to independent regulatory agencies: a comparative empirical, *Journal of European Public Policy*, 9 (6), 873-893

Gilardi F. (2003), Delegation to Independent Regulatory Agencies in Western Europe: a Cross-Sectional Comparison, Paper prepared for the workshop "Delegation in Contemporary Democracies", *ECPR Joint Sessions of Workshops*, Edinburgh 2003

Harrington J., (2008), Optimal Corporate Leniency Programs, *Journal of Industrial Economics*, 56 (2), 215 - 246

Hylton K. and Deng F., (2006), Antitrust around the World: An empirical analysis of the scope of competition law and their effects, *Boston University School of Law Working Paper Law and Economics*, N. 06-47

Høj, J. (2007), Competition Law and Policy Indicators for the OECD countries, *OECD Economics Department Working Papers*, No. 568, OECD Publishing.

ICN, (2006), Recommended Practices For Merger Notification Procedures and Reviews (available at www.internationalcompetitionnetwork.org/media/archive0611/mnprecpractices.pdf).

Kaplow L. and S. Shavell, (2002), Fairness versus Efficiency, Harvard University Press.

Keynes J.M., (1921), A Treatise on Probability, MacMillan.

Kobayashi B., (2002), Antitrust, Agency and Amnesty: An Economic Analysis of the Criminal Enforcement of the Antitrust Laws Against Corporations, George Mason University School of Law, Working Paper No. 02-04.

Landes W.M., (1983), Optimal Sanctions for Antitrust Violations, *The University of Chicago Law Review*, 50,652-678.

Levitt S. D., (2001), Deterrence, in Wilson J. Q. and Petersilia J. (Eds.), Crime, ICS press
Levitt S. D., (1998), Juvenile Crime and Punishment, *Journal of Political Economy*, 106 (6), 1156-1185

Levitt S. D. and Miles T.J., (2006), Economic Contributions to the Understanding of Crime, *Annual Review of Law and Social Sciences*, 2, 147–64

Majone, D. (1996), Regulating Europe, Routledge,

Motta, M., Polo, M., (2003), Leniency Programs and Cartel Prosecution, *International Journal of Industrial Organization*, 21, 347-379.

Motta M. (2004), Competition Policy: Theory and Practice, Cambridge University Press.

Neven, D. J., (2006), Competition Economics and Antitrust in Europe, *Economic Policy*, October, 741–791.

Neven D. J. and L. H. Röller, (2005), Consumer Surplus vs. Welfare Standard in a Political Economy Model of Merger Control, *International Journal of Industrial Organization*, 23, Issues 9-10, 829-848.

Nicoletti G., and S. Scarpetta, (2005), Product Market Reforms and Employment in OECD Countries, *OECD Economics Department Working Papers, 472*.

OECD, (2002a), Fighting Hard Core Cartels: Harm, Effective Sanctions and Leniency Programmes

OECD, (2002b), Report on the Nature and Impact of Hard Core Cartels and Sanctions Against Cartels Under National Competition Laws.

OECD (2003), Optimal Design of a Competition Agency. Note by the Secretariat (CCNM/GF/COMP(2003)2)

OECD (2005a), Designing Independent and Accountable Regulatory Authorities for High Quality Regulation.

OECD (2005b), European Commission - Peer Review of Competition Law and Policy.

OECD (2007), Private Remedies

Oliveira G., Machado E. L. and Novaes L.M., (2009), Aspects of the Independence of Regulatory Agencies and Competition Advocacy, in Mehta S. P. and S. J. Evenett (Eds.), "Politics Triumphs Economics? Political Economy and the Implementation of Competition Law and Economic

Regulation in Developing Countries", Academic Foundation.

Polinsky A. M. and S. Shavell , (2000), The Economic Theory of Public Enforcement of Law, Stanford Law School, *John M. Olin Program in Law and Economics,* Working Paper No. 159.

Posner, R., (1988), "Comment: Responding to Gordon Tullock", *Research in Law and Policy Studies*, 2, 29.

Salop S., (2005), What is the real and proper antitrust welfare standard? Answer: The true consumer welfare standard, *Statement before the Antitrust Modernization Commission*

Schinkel, M.P. and J. Tuinstra, (2006), Imperfect competition law enforcement, *International Journal of Industrial Organization*, Elsevier, 24(6), 1267-1297.

Schinkel, M.P. (2007). Effective Cartel Enforcement in Europe, *World Competition*, 30 , (4), 539-572.

Simon, M.J and G.J.Werden, (1987), Why Price Fixers Should Go to Prison, *Antitrust Bulletin*, 32, 917-937

Spagnolo G., (2000), Optimal Leniency Programs, *Fondazione Eni Enrico Mattei*, Note di Lavoro, 42/2000.

Spagnolo G., (2004), Divide et Impera: Optimal Leniency Programs, CEPR Discussion Paper No. 4840. http://www.ssrn.com

Spagnolo G., (2008) Leniency and Whistleblowers in Antitrust, in Buccirossi P. (Ed.), "Handbook of Antitrust Economics", MIT Press, Cambridge, MA.

Stigler G., (1966), The Economic Effects of the Antitrust Laws, *Journal of Law and Economics* 9: 225-258.

Voigt S., (2007), The Economic Effects of Competition Policy – Cross-Country Evidence Using Four New Indicators, *mimeo*.

Wils, W., (2004), "The combination of the investigative and prosecutorial function and the adjudicative function in EC antitrust enforcement: a legal and economic analysis", *World Competition*, 27(2), 201–24.