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MEASURING THE DETERRENCE PROPERTIES OF COMPETITION POLICY: THE COMPETITION POLICY INDEXES

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ABSTRACT

This article describes in detail a set of newly developed indicators of the quality of competition policy, the Competition Policy Indexes (CPIs). The CPIs measure the deterrence properties of a jurisdiction's competition policy—where by 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 (particularly information on the legal framework, the institutional settings, and the enforcement tools of each jurisdiction that we examine) score against a benchmark of generally agreed-upon best practices and summarize them, so as to allow cross-country and cross-time comparisons. We calculate the CPIs for a sample of 13 OECD jurisdictions over the period from 1995 to 2005.

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I. INTRODUCTION

The aim of this article is to introduce the Competition Policy Indexes (CPIs), a novel set of indicators of the quality and intensity of competition policy. The CPIs measure the deterrence properties of a jurisdiction's competition policy (where by competition policy, we mean the antitrust legislation including the merger control provisions and its enforcement).[1] The CPIs incorporate data on how the key features of a competition policy regime score against a benchmark of generally agreed-upon best practices and summarize them, so as to allow cross-country and cross-time comparisons.[2]

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. Following a consolidated methodology, similar to the one developed by the OECD for the indicators of product market regulations (PMR)[3] and the competition law and policy indexes (CPL),[4] the CPIs have a pyramidal structure that encompasses a large number of sub-indicators that are progressively aggregated using a set of weights at each level of aggregation. We first use an aggregation scheme in which the weights of the different sub-indicators are assigned according to the relevance that, in our view, each item deserves. Subsequently, as a robustness check, we adopt an alternative scheme, which aggregates the different features of a competition policy regime using factor analysis.

As mentioned above, the methodology herein employed 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 aims at measuring restrictions to

[1] 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 (for example, the European Union).

[2] Paolo Buccirossi, Lorenzo Ciari, Tomasi Duso, Giancarlo Spagnolo & Cristiana Vitale, *Competition Policy and Productivity Growth: An Empirical Assessment* (Ctr. for Econ. Policy Research, London, CEPR Discussion Paper No. 7470, 2009), estimated the effects of competition policy on total factor productivity (TFP) growth in a panel of 22 industries in 12 countries between 1995 and 2005. They found a robust, positive, and significant relationship between the CPIs and TFP growth and concluded that good competition policy institutions are beneficial to society by increasing efficiency and, hence, welfare.

[3] *See* Paul Conway, Véronique Janod & Giuseppe Nicoletti, *Product Market Regulation in OECD Countries: 1998 to 2003* (OECD Econ. Dep't, Working Paper No. 568, 2005); Paul Conway & Giuseppe Nicoletti, *Product Market Regulation in the Non-Manufacturing Sector of OECD Countries: Measurement and Highlights* (OECD Econ. Dep't, Working Paper No. 530, 2006); Giuseppe Nicoletti, Stefano Scarpetta & Olivier Boylaud, *Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation* (OECD Econ. Dep't, Working Paper No. 226, 2000); Anita Wölfl, Isabelle Wanner, Tomasz Kozluk & Giuseppe Nicoletti, *Ten Years of Product Market Reform in OECD Countries: Insights from a Revised PMR Indicator* (OECD Econ. Dep't, Working Paper No. 695, 2009).

[4] *See* Jens Høj, *Competition Law and Policy Indicators for OECD Countries* (OECD Econ. Dep't, Working Paper No. 568, 2007).

competition due to inappropriate regulations (for example, on entry or business activities), and the latter considers both policies that enhance the general level of competition (that is, *ex-post* policies implemented by the Competition Authorities (CAs) and *ex-ante* policies implemented by sectoral regulators that encourage and promote competition in deregulated network industries). The CPIs, instead, focus solely on the policies that enhance the general level of competition. In addition, while the PMR indicators have been calculated only for three years (1998, 2003, and 2008) and the CPL indexes only for one year (2003), the CPIs have both a cross-country and a cross-time dimension, as we calculated them for 13 OECD jurisdictions over a period of ten years (from 1995 to 2005).[5]

The next Part discusses the features of the competition policy regime that we have included in the CPIs because we believe them to be the most important determinants of its effectiveness. Part III explains how the CPIs are structured, while Parts IV, V, and VI explain in more detail the steps followed in their construction. Part VII describes the data we have used to calculate the CPIs over our sample. Part VIII explains how we derived the weighting schemes based on factor analysis. Part IX illustrates how well competition policy works in the jurisdictions in our sample by examining the evolution of some of the CPIs. Part X compares the CPIs with other indicators of a similar kind that have been developed in the literature. The last Part contains some concluding remarks.

II. 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 favor 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 must comply with to ensure that competition is not reduced or altered, together with an array of tools for policing and punishing any violation. We generically refer to these components as the features of a competition policy regime.

[5] The 13 jurisdictions included in our sample are: Canada, the Czech Republic, the European Union, France, Germany, Hungary, Italy, Japan, the Netherlands, Spain, Sweden, the United Kingdom, and the United States. These OECD countries have been selected to be representative of different legal systems (common law and civil law), to include both EU and non-EU countries, and, among the EU countries, to include both founding members and countries that have recently entered the European Union, namely Hungary and the Czech Republic.

Many economists share the view that the ultimate aim of competition policy should be to maximize social welfare, which is given by the unweighted sum of the profits of all the firms and of aggregate consumer surplus.[6] 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.[7] Yet, in the praxis, the objective function of the European Commission, the U.S. antitrust authorities, as well as those of most national CAs, incorporates a definition of social welfare that includes only the consumer surplus. In this article, we will not discuss what should be the appropriate definition of social welfare that a competition policy should protect and enhance. Hence, we shall take as given the way in which each jurisdiction has designed, and each CA has implemented, its competition policy.

The role of a CA consists of using the powers and the resources conferred on it by law to ensure that firms operating within its jurisdiction undertake the least possible number of actions that reduce social welfare by impairing competition. This implies that the aim of a CA consists of deterring anti-competitive behaviors.[8] It follows that the most effective competition policy regime is one in which the CA achieves total deterrence and, hence, never needs to block a merger, never needs to uncover a cartel or any other

[6] LOUIS KAPLOW & STEVEN SHAVELL, FAIRNESS VERSUS EFFICIENCY (Harvard Univ. Press 2002); MASSIMO MOTTA, COMPETITION POLICY: THEORY AND PRACTICE (Cambridge Univ. Press 2004); Paolo Buccirossi, *Introduction*, *in* HANDBOOK OF ANTITRUST ECONOMICS (Paolo Buccirossi ed., MIT Press 2008).

[7] Damien Neven and Lars-Hendrik Röller consider the political economy environment that an antitrust agency is operating in and how this may affect the choice of the appropriate welfare standard in merger control. *See* Damien J. Neven & Lars-Hendrik Röller, *Consumer Surplus vs. Welfare Standard in a Political Economy Model of Merger Control*, 23 INT'L J. INDUS. ORG. 829 (2005). The authors show that, when the antitrust agency can be influenced by third parties and is monitored imperfectly, neither a consumer-surplus standard nor a welfare standard dominate. Yet, when lobbying is efficient, accountability is low, mergers are large, and 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 also* Steven C. Salop, *What Is the Real and Proper Antitrust Welfare Standard? Answer: The True Consumer Welfare Standard*, Statement Before the Antitrust Modernization Comm'n (2005), *available at* http://www.luc.edu/law/activities/publications/clr_vol22_issue3/pdfs/salop_welfare.pdf.

[8] In order to avoid confusion, we want to stress that the form of deterrence we refer to here is the one called *ex ante*, or general deterrence, which consists of preventing agents from undertaking illegal behaviors 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 only *ex post* (that is, after unlawful behavior has already taken place and is discovered, or when an anticompetitive merger is blocked or remedied) and works through a corrective change in behavior induced in the economic agents prosecuted and convicted for the detected violation (or whose merger was stopped). Specific deterrence is, of course, much less important, as it has a limited effect and involves prosecution costs, but it still plays a relevant role for the complex behaviors, where mistakes in the assessment of its effects on social welfare are likely.

anticompetitive agreement, and never needs to condemn a firm for abusing its dominant position.[9] In such an ideal regime, firms do not dare 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 those actions improve social welfare.

In this article, we evaluate a competition policy regime on the basis of its ability to deter all those market actions that harm social welfare.[10] To do so, we identify those features of a competition policy regime that we believe to have the strongest impact on the level of deterrence it can engender. We base our choice of these features on the economic theory of the public enforcement of law. This theory originates from Becker's seminal paper,[11] 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 behavior. 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.[12]

[9] 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 is in general not the most efficient one.

[10] Our indicators measure the deterrence properties, rather than the quality of a competition policy regime, 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 behavior. Hence, we consider it more appropriate to limit our analysis to the level of deterrence.

[11] Gary S. Becker, *Crime and Punishment: An Economic Approach*, 76 J. POL. ECON. 169 (1968).

[12] *See* PAOLO BUCCIROSSI, GIANCARLO SPAGNOLO & CRISTIANA VITALE, THE COST OF INAPPROPRIATE INTERVENTIONS/NON INTERVENTIONS UNDER ARTICLE 82 (2006) (report prepared for the Office of Fair Trading); A. Mitchell Polinsky & Steven Shavell, *The Economic Theory of Public Enforcement of Law*, 38 J. ECON. LITERATURE 45 (2000); Maarten Pieter Schinkel & Jan Tuinstra, *Imperfect Competition Law Enforcement*, 24 INT'L J. INDUS. ORG. 1267 (2006). 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 behavior 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 has violated the law renders the probability of

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 this literature, we identify the policy variables, or policy 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 competition policy more or less effective.[13] With regard to violation of antitrust rules, these variables are: (1) the degree of independence of the CA with respect to political or economic interests, (2) the separation between adjudicator and prosecutor, (3) the quality of the law on the books (that is, how closely are the rules that make the partition between legal and illegal conduct aligned with their effect on social welfare), (4) the scope of investigative powers that the CA holds, (5) the level of the financial loss (that is, the overall sanction) that firms and their employees can expect to suffer as a consequence of a conviction,[14] and (6) the level of activity of the CA and the amount and the quality of the financial and human resources that the CA can rely on when performing its tasks.[15] In the case of merger control, the selected features are slightly different, because investigative powers are not very relevant in merger cases (as these are *ex-ante* investigations that 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, but only (small) sanctions for procedural violations.

III. THE STRUCTURE OF THE COMPETITION POLICY INDEXES

Each indicator is obtained from the linear aggregation of data on the competition policy variables discussed above.[16] This aggregation follows a series of steps, which are discussed below and summarized in Table 1. First, each

being investigated and convicted lower, reducing the expected sanction. Hence, both types of errors make the alternative of breaking the law more attractive.

[13] *See* Paolo Buccirossi, Lorenzo Ciari, Tomaso Duso, Giancarlo Spagnolo & Cristiana Vitale, *Deterrence in Competition Law* (GESY, Discussion Paper No. 285, 2009).

[14] The expected sanction depends 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.

[15] There are of course other potential 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 only the second one (hence, obtaining reduced or no leniency) in other countries, because cartel partners react 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 these issues, though interesting, fall outside the scope of our analysis.

[16] 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

piece of information on each policy feature is assigned a score on a scale of 0 to 1 against a benchmark of generally agreed-upon best practice (from worst to best). To assign scores, we determine what could be considered as best practice by relying on scientific papers and books, on documents prepared by international organizations (such as the International Competition Network and the OECD), and on our judgment. These references are cited below, when we discuss in more detail how each feature is scored, and are summarized in two tables included in the Appendix.

Second, all the information on a specific policy feature is summarized in a separate low-level index using a set of weights to aggregate it. Third, the low-level indexes are aggregated into two medium-level indexes for each of the three types of possible competition law infringements and for mergers. The first one summarizes the institutional features of the competition policy and the second one summarizes the enforcement features.

Fourth, the medium-level indexes are then aggregated to form a number of different summary indexes, which we generically refer to as the CPIs. More specifically, we calculate (for each jurisdiction and each year in the sample) the following: 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);[17] and a single index that incorporates all the information on the overall deterrence effect of the competition policy regime in a jurisdiction (the Aggregate CPI).

IV. THE CONSTRUCTION AND COMPOSITION OF THE LOW-LEVEL INDEXES

The first two steps in the construction of the CPIs consist of calculating the low-level indexes. Each of these indexes includes information on one of the policy variables discussed in Part II, which we believe affect the level of deterrence engendered by the competition policy of a jurisdiction, and hence its effectiveness. We calculate separate indexes for each of the three possible competition law infringements (hardcore cartels, abuses of dominance, and agreements other than hardcore cartels) and one for mergers to

exist between these variables. Hence, we have decided to select this aggregation form that has the advantage of being simple, transparent, and at the same time, rather complete.

[17] The Enforcement CPI summarizes information about the quality and quantity of resources available to CAs, together with information about the level of activity and the criminal sanctions imposed. The possibility to include further enforcement information in our index was limited by data availability problems.

Table 1. The low-level indexes

Abuses	Hardcore cartels	Other anticompetitive 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)
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) **Sanctions and cases:** Number of cases opened (1/3) Max jail term imposed (2/3)	**Resources:** Budget (1/2) Staff (1/4) Staff skills (1/4)	**Resources:** Budget (1/2) Staff (1/4) Staff skills (1/4) **Cases:** Number of mergers examined

take into account the differences in the legal framework and, where possible, in its enforcement.[18]

As we mentioned earlier, each piece of information is assigned a score on a scale from 0 to 1 against a benchmark of generally agreed-upon best practice (from worst to best). When a data entry is quantitative, it is normalized by dividing it by the highest corresponding value held by any CAs in the sample, so that even quantitative information assumes a value between 0 and 1. More details on how we assigned the scores can be found in Parts IV.A to IV.G.

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

In order to check whether our choice of the weights has a significant influence on the results, we also use a different set of weights, generated by a statistical technique: the factor analysis. This robustness check shows that the results do not vary significantly, when this alternative set of weights is employed.

Table 1 shows the content of each of the low-level indexes. The numbers in parentheses refer to the weights used to sum up the information contained in each index. Below we describe each one of them.

A. 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 that 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.[19] Thus, this first index measures the independence

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

[19] There is a widespread and consistent literature which discusses the importance of having an independent competition authority. *See, e.g.*, GIANDOMENICO MAJONE, REGULATING EUROPE (Jeremy Richardson ed., Routledge 1996); OECD, OPTIMAL DESIGN OF A COMPETITION AGENCY (2003), *available at* http://www.oecd.org/dataoecd/58/29/2485827.pdf; OECD, DESIGNING INDEPENDENT AND ACCOUNTABLE REGULATORY AUTHORITIES FOR HIGH QUALITY REGULATION (2005), *available at* http://www.oecd.org/dataoecd/15/28/35028836.pdf; OECD, EUROPEAN COMMISSION–PEER REVIEW OF COMPETITION LAW AND POLICY (2005), *available at* http://www.oecd.org/dataoecd/7/41/35908641.pdf; G. Oliveira, E.L. Machado & L.M. Novaes, *Aspect of the Independence of Regulatory Agency and Competition Advocacy*, *in* POLITICS TRIUMPH ECONOMICS? POLITICAL ECONOMIC REGULATION AND THE IMPLEMENTATION OF COMPETITION LAW AND ECONOMIC REGULATION IN DEVELOPING COUNTRIES _ (Pradeep S. Mehta & Simon J. Evenett eds.,

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: (1) the institutional nature of the body that performs the investigation and (2) the institutional nature of the body that makes the decision and the role of the government in this decision-making process.

Regarding the body performing the investigation, 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 or 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 or department. As for the body making the decision and the role of the government, a jurisdiction scores 1 when the body that *makes the decision* has total statutory independence and the government cannot overrule a decision by the relevant CA. It scores 0.5 when the adjudicator has total statutory independence but the government can overrule a decision, and it scores 0 if it is a ministerial agency or department.

We give 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 body undertakes, when deemed necessary by the first one, a more detailed examination (also referred to as Phase 2). Hence, in the case of mergers this index includes (1) the institutional nature of the bodies involved in Phase 1 and Phase 2 and (2) the role of the government.

Regarding the first component, a jurisdiction scores 1 when the bodies that reach a decision in Phase 1 and Phase 2 (if they are separate) are independent, 0 if both bodies are ministerial agencies or 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. Regarding the role of the government, the

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Academic Found. 2009) Chapter 6, pp. 240–278; Stefan Voigt, *The Economic Effects of Competition Policy on Development–Cross-Country Evidence Using Four New Indicators*, 45 J. DEV STUD 1225 (2009); Christophe Genoud, Toward a Content and Contextual Approach of Delegation, or "How and Why We Should Open the Regulation Black Box," (ECPR Joint Session of Workshops, Edinburgh 2003). Fabrizio Gilardi makes a slightly different argument in that he claims that independent 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. *See* Fabrizio Gilardi, *Policy Credibility and Delegation to Independent Regulatory Agencies: A Comparative Empirical*, 9 J. EUR. PUB. POL'Y 873 (2002); Fabrizio Gilardi, Delegation to Independent Regulatory Agencies in Western Europe: A Cross-Sectional Comparison (ECPR Joint Session of Workshops, Edinburgh 2003).

score is 1 if the government cannot overrule a decision on a merger, and 0 if it can overrule a decision on a merger. Also in this case, we give equal weights to each piece of information.

B. Separation of Powers

A second relevant characteristic is the degree of separation between the body that performs the investigation on an allegedly anticompetitive behavior (or merger) and the one that makes the decision on whether the behavior should be sanctioned (or the merger blocked). The stronger the separation between prosecutor and adjudicator (such as 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 error.[20]

Similarly it matters whether the appellate court—that is, the court that is responsible for reviewing the CA's decision—is a specialized body with competence only in competition matters or whether it is the appellate body for all judicial decisions.[21] A specialized body is formed by individuals that have expertise in those specific subjects and are therefore better able to consider all the details and correctly evaluate all the evidence when deciding on a case.

This low-level index captures information on these elements, specifically on (1) the existence of a separation between the adjudicator and the prosecutor, which, in our view, reduces the bias in the decision; (2) the nature of the appellate body; and, only in the case of mergers, (3) whether the body that decides whether a merger should undergo a Phase 2 investigation and the body responsible for undertaking the Phase 2 investigation are separate.

For the first element, a jurisdiction scores 0 when the same body adjudicates and prosecutes, whereas it scores 1 if these two activities are performed by separate bodies. For the second element, a jurisdiction scores 1 when the relevant appellate court specializes in competition matters and 0 when this court deals with appeals on all kinds of decisions.[22] As for the third

[20] For an in-depth discussion of the role of the separation of powers in the context of institutions, see Michael K. Block, Jeffrey S. Parker, Olga Vyborna & Libor Dusek, *An Experimental Comparison of Adversarial and Inquisitorial Procedural Regimes*, 2 AM. L. & ECON. REV. 170 (2000); Mathias Dewatripont & Jean Tirole, *Advocates*, 107 J. POL. ECON. 1 (1999); Richard A. Posner, *Comment: Responding to Gordon Tullock*, *in* 2 RESEARCH IN LAW AND POLICY STUDIES 29 (Stuart S. Nagel ed., JAI Press 1988). For a discussion of the importance of separation of powers with regard to competition and regulatory institutions, see Damien J. Neven, *Competition Economics and Antitrust in Europe*, 21 ECON. POL'Y 741 (2006); Wouter Wils, *The Combination of the Investigative and Prosecutorial Function and the Adjudicative Function in EC Antitrust Enforcement: A Legal and Economic Analysis*, 27 WORLD COMPETITION 201 (2004).

[21] *See, e.g.*, OECD, POLICY ROUNDTABLES: PRIVATE REMEDIES 50–51 (2007).

[22] 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

element, 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 give 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 appellate court. In the index for mergers, where we have three elements, we give equal weight to each of them.

C. Quality of the Law

We define deterrence as the prevention of conduct that reduces social welfare. However, this may not always be the conduct declared illegal by the competition legislation. Rules are indeed imperfect, as they can ban conduct that is competitive or allow conduct that are anticompetitive. Hence, the third policy variable we need to consider is the quality of these rules—that is, the quality of the law on the books. This is a matter of judgment, 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, for example, guidelines) has rules that make the partition between legal and illegal conduct better reflect their effect on social welfare.

In the case of antitrust infringements, this index focuses on 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 the goals that inform the decision-making process.

For abuses of dominance, we consider the standard of proof required for a price-exclusionary practice, predation, a non-price exclusionary practice, and 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. The reason is that, in this case, the CA decides whether there has been an abuse on the basis of the effects of the behavior rather than by relying on set rules. On the other hand, if the jurisdiction imposes a *per-se* prohibition, it scores 0. An intermediate score applies if the CA applies a *rule-of-reason* standard, but also considers non-economic goals when evaluating the effects of the action (for example, the effect of the behavior on the level of employment).[23]

Phase 2 investigation. In some jurisdictions, the same body that decides on whether a merger should undergo a Phase 2 investigation also performs 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 by a different one.

[23] *See* Voigt, *supra* note 19, at 1231–1232.

For anticompetitive agreements other than hardcore cartels, we only consider 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 behavior are proven and it considers only economic goals when evaluating the effects, it scores 1. If the CA also considers non-economic goals it scores 0.5, and if it imposes a *per-se* prohibition, it scores 0.[24]

In contrast, for hardcore cartels, a *per-se* ban scores 1. If the imposition of a sanction requires showing that the cartel had an effect on the market and the CA considers only economic goals, the score is 0.5; otherwise, if it also considers non-economic goals, the score is 0. The scoring is reversed in the case of hardcore cartels because of the gravity of this practice and of its consequences, which, as is generally agreed, calls for a stricter rule.[25]

The index for hardcore 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.[26] Hence, a 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 the characteristics of the notification obligation, and on the criteria used for assessing concentrations. First, with regard to notification, the absence of any obligation to notify is scored 0, whereas a score of 0.33 is given to the CAs that impose such an obligation but have no minimum threshold, because the lack of such a limit renders it more difficult for CAs to focus resources on important cases.[27] 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'

[24] *See id.* at 1231–1232.

[25] *See* MOTTA, *supra* note 6, at 190-91; OECD, REPORT ON THE NATURE AND IMPACT OF HARD CORE CARTELS AND SANCTIONS AGAINST CARTELS UNDER NATIONAL COMPETITION LAWS 9-12 (2002) [hereinafter OECD, REPORT ON THE NATURE AND IMPACT OF HARD CORE CARTELS].

[26] There exists a number of theoretical, empirical, and policy studies suggesting that leniency programs are one of the most successful policy tools for fighting hardcore cartels. *See* MOTTA, *supra* note 6, at 193-202; OECD, FIGHTING HARD CORE CARTELS: HARM, EFFECTIVE SANCTION AND LENIENCY PROGRAMMES 7-34 (2002) [hereinafter OECD, FIGHTING HARD CORE CARTELS]; OECD, REPORT ON THE NATURE AND IMPACT OF HARD CORE CARTELS, *supra* note 25, at 16; Cécil Aubert, William E. Kovacic & Patrick Rey, *The Impact of Leniency and Whistleblowers Program on Cartel*, 24 INT'L J. INDUS. ORG. 1241 (2006); Joseph E. Harrington, *Optimal Corporate Leniency Program*, 56 J. INDUS. ECON. 215, 215-16 (2008); Massimo Motta & Michele Polo, *Leniency Program and Cartel Prosecution*, 21 INT'L J. INDUS. ORG. 347 (2003); Giancarlo Spagnolo, *Leniency and Whistleblowers in Antitrust*, *in* HANDBOOK OF ANTITRUST ECONOMICS 259 (Paulo Buccirossi ed., MIT Press 2008); Giancarlo Spagnolo, *Divide and Imperia: Optimal Leniency Programs* (CEPR, Discussion Paper No. 4840 2004).

[27] *See* INT'L COMPETITION NETWORK, RECOMMENDED PRACTICES FOR MERGER NOTIFICATION PROCEDURES AND REVIEW, http://internationalcompetitionnetwork.org/uploads/library/doc588.pdf (last visited Oct. 13, 2010).

turnover. The reason why turnover is considered to be best practice is that it is easier to apply and is less open to uncertainty.

Second, the application of an efficiency defense in the competitive assessment of mergers is scored 1, because it allows one to take into consideration all the economic consequences of the concentration on the market and on consumers. The absence of any efficiency defense is scored 0. In the aggregation process, we give equal weights to both elements.

D. 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 (1) the power to impose, or request, interim measures, which prevents any anticompetitive behavior from leading to serious and irreversible damages while a final decision is being reached, and (2) 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 employees' conversations. The stronger the latter powers, the more and the better the information at the CAs' disposal, and thus the higher the probability of detection and the lower the probability of errors, especially type II errors.

First, with respect to interim measures, a jurisdiction scores 1 if it has them and 0 if it does not. Second, 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 give 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 hardcore cartels, the power to impose interim measures is not relevant. Hence, the index for cartels only measures the types of powers to gather information. Moreover, we do not build this low-level index for mergers 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.

E. Sanctions and Damages Written on the Books

One important element in deterring anticompetitive behaviors is the credible threat of financial losses that firms (and their employees) can expect to suffer as a consequence of a conviction.[28] This low-level index considers

[28] For a theoretical analysis of the role of the sanctions in achieving deterrence, see Becker, *supra* note 11; Paolo Buccirossi & Giancarlo Spagnolo, *Optimal Fines in the Era of Whistleblowers: Should Price Fixers Still Go to Prison*?, *in* THE POLITICAL ECONOMY OF ANTITRUST 81 (Vivek Ghosal & Johan Stennek eds., Elvesier 2007); Damien Geradin & David Henry, *The EC Fining Policy for Violation of Competition Law: An Empirical Review of*

(1) the range of potential sanctions that offending firms may face, (2) the range of potential sanctions that employees of offending firms may face, and (3) whether affected parties can sue for damages. The overall index is composed in equal parts by the scores of these three elements.

These losses are determined by the sum of the sanctions that can be imposed by the CA and/or the court (for example, fines, imprisonment, disqualification, or damages), to which it is necessary to add any monetary repayment to the affected parties, as what determines the behavior of a firm is 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 the law 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 *intended* sanctions and maximum level those sanctions can reach, and on how these criteria are applied (that is, their enforcement). If the monetary fine can reach up to 10 percent of the turnover of a firm, but no fine of this level has ever been imposed, firms will not except to pay such a figure, even when a serious breach of the law took place, despite what the law says. This index only refers to what is set out in the law. We consider separately the level of sanctions actually imposed. Since no sanctions are imposed following merger investigations, there is no such index for mergers.[29]

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.[30] For the abuses of

Commission Decisional Practice and the Community Court's Judgement, *GCLC Working Paper 03/05 (2005)*; Bruce H. Kobayashi, *Antitrust, Agency and Amnesty: An Economic Analysis of the Criminal Enforcement of the Antitrust Laws Against Corporations*, 69 GEO. WASH. L. REV. 715 (2001); William M. Landes, *Optimal Sanctions for Antitrust Violation*, 50 U. CHI. L. REV. 625 (1983); Maarten Pieter Schinkel, *Effective Cartel Enforcement in Europe*, 30 WORLD COMPETITION 539 (2007); Marylin J. Simon & Gregory J. Werden, *Why Price Fixers Should Go to Prison*, 32 ANTITRUST BULL. 917 (1987). Empirical analyses can be found in Catherine Craycraft, *Antitrust Sanctions and Firm Ability to Pay*, 12 REV. INDUS. ORG. 171 (1994); Joseph Craycraft, Joseph Gallo, Kenneth Glenn Dau-Schmidt & Charles Parker, *Criminal Penalties Under the Sherman Act: A Study of Law and Economics*, 16 RES. L. & ECON. 25 (1997); J.M. Connor, Optimal Deterrence and Private Antitrust Enforcement (2005) (mimeo on file at Purdue University).

[29] 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. These circumstances, however, are very limited.

[30] These weights are based on the discussion and the conclusions reached by the OECD. *See* OECD, FIGHTING HARD CORE CARTELS, *supra* note 26, at 11; OECD, REPORT ON THE NATURE AND IMPACT OF HARD CORE CARTELS, *supra* note 25, at 9-12.

dominance the index also includes the *types* of sanctions that can be imposed. A jurisdiction scores 0 if neither monetary fines nor structural remedies can be imposed, 0.75 if only monetary sanctions are possible, and 1 if both are allowed. To obtain a single score, we give a weight of 1/3 to the type of possible sanctions and of 2/3 to the criterion for its calculation.[31]

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 sanction; instead, if there is a maximum value set by law, the score is the normalization 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 give a weight of 3/10 to monetary fines, a weight of 2/10 to disqualification, and a weight of 5/10 to imprisonment.

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.

F. 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 (that is, (1) budget and (2) total staff of the CAs) and the quality of the staff, more specifically (3) the number of economists with a relevant Ph.D and the number of qualified lawyers. When a jurisdiction has two CAs, we consider their resources jointly. Because all this data is quantitative, we normalize the original data between 0 and 1 in the following way.

First, the budget is divided by the nominal GDP of the country (both expressed in U.S. dollars using PPP exchange rates), so as to allow a comparison between countries of different sizes and levels of economic development. This value is then divided by the highest corresponding value held by any CAs in the sample. Second, the number of staff members is divided by the real GDP of the country to allow a meaningful comparison between countries. This value is then divided by the highest corresponding value held by any CAs in the sample. Third, the sum of the number of economists

[31] Again, these insights are based on the considerations expressed by OECD.

with a Ph.D and the number of qualified lawyers is divided by the number of total staff. This value is then divided by the highest corresponding value held by any CAs in the sample.

We give 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 three possible infringements, as well as for merger control, because we do not have separate data on the resources devoted to each type of practice. Many CAs do not have separate divisions that deal with different types of behavior and/or the CAs do not keep a record of the personnel and resources of different divisions.

G. Actually Imposed Sanctions and Cases

How effective sanctions are as a deterrent depends not only on their type and level, as set in the law, but also on the strictness of the sanctions that have actually been issued. Unfortunately, data on this subject are scarce.[32] We obtained only limited data for hardcore cartels. These data 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 divide the relevant figure by the highest one imposed by any CAs in the sample.

The credibility of a CA in preventing anticompetitive behaviors or mergers also depends on how active it is in assessing mergers and investigating complaints of infringements. We proxy this level of activity by the number of cartel investigations initiated 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 violations. We then normalize this ratio by dividing it by the highest one in the sample.[33] When a country has two CAs, we consider the number of cartel investigations performed by both of them. For hardcore cartels we give a weight of 2/3 to the data on the jail term and 1/3 to the number of cases investigated.

H. Rationale Behind the Subjective Weights

In the preceding sections, we have indicated the weights that we use to aggregate the single pieces of information to construct the low-level indexes.

[32] CAs do not keep easily accessible records of fines and other sanctions, especially if one wants to relate the records to the seriousness and the duration of the relevant 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 would benefit from further research.

[33] We have not included the number of cases of other types of antitrust infringements because, unfortunately, it has proved impossible to collect consistent data on the number of investigations carried out on abuses and agreements other than cartels.

We now explain how we have selected the weights. The general rule we followed is a sort of "principle of insufficient reason," whereby whenever we do not have specific reasons to believe that one feature matters more than others, we give equal weights to all elements in the low-level index.[34] There are six cases in which this neutrality rule is not applied. These are explained below.

First, 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 appellate court does not intervene in all cases, as the undertaking party 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 appellate court should have a weaker and less certain influence on the effectiveness of a competition policy regime.

Second, in the low-level indexes on the powers to investigate for abuses of dominance and for agreements other than cartels, we give a weight of 1/4 to "availability of interim measures", while we give a weight of 3/4 for "combination of powers". This choice rests on the fact that, while the latter is crucial for the CAs' intervention, because it affects how thorough an investigation can be, the former affects only the timeliness of the intervention, but does not alter the probability of errors.

Third, 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 give a weight of 1/3 to the type of possible sanctions and a weight of of 2/3 to the criterion for its calculation, because we believe that the latter has a stronger impact on deterrence.[35]

Fourth, in the low-level indexes on sanctions and damages, there are different types of sanctions that can be imposed on offending individuals. To obtain a single score, we give 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 must be undergone by the individuals found guilty.

Fifth, in the low-level indexes on resources, we give 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

[34] For a discussion of this principle in a historical perspective, see STEPHEN S. STIGLER, THE HISTORY OF STATISTICS: THE MEASUREMENT OF UNCERTAINTY BEFORE 1900 (Harvard Univ. Press 1986). The principle of insufficient reason was renamed the "principle of indifference" by Keynes. *See* JOHN MAYNARD KEYNES, A TREATISE ON PROBABILITY (MacMillan & Co. 1921).

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

1/4 to the data on the composition of this staff. The reason is that we believe that the monetary resources are those that most affect the means that a CA has to undertake its investigative and enforcement activities.

Sixth, in the low-level indexes on cases for hardcore cartels, we give 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.

V. THE CONSTRUCTION OF THE MEDIUM-LEVEL INDEXES

The next step in the construction of the CPIs consists 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 and one 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 in parantheses.

The weights are 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, in the case of the antitrust infringements, we give a weight of 1/3 to "sanctions and damages," whereas we give a weight of 1/6 to all the other features. This is due to the fact that sanctions seem to have a stronger impact on deterrence.[36] In the enforcement feature index, we give a lower weight to the data on the number of cases (if at all available), because we believe that the resources are a better indicator of how active a CA is in its competition enforcement activities.

VI. THE CONSTRUCTION OF THE HIGH-LEVEL INDEXES

The last step consists of aggregating the medium-level indexes in a set of high-level indexes, the CPIs, which incorporate all the information on the deterrent effect of the competition policy regime in a jurisdiction in a specific year. Table 3 shows these CPIs and the weights (in parentheses) used in the aggregation process.

First, we calculate the Antitrust CPI as the weighted average of all the medium-level indexes relative to antitrust infringements, and the Mergers CPI as the weighted average of the two medium-level indexes relative to merger control. We then calculate the Institutional CPI as the weighted average of the four medium-level indexes relative to the institutional features, and the Enforcement CPI as the weighted average of the four medium-level

[36] *See* Steven D. Levitt, *Deterrence*, *in* CRIME _ (James Q. Wilson & Joan Petersilia eds., ICS Press 2001), pp. 132–157; Steven D. Levitt, *Juvenile Crime and Punishment*, 106 J. POL. ECON. 1156 (1998); Steven D. Levitt & Thomas Miles, *Economic Contribution to the Understanding of Crime*, 2 ANN. REV. L. & SOC. SCI. 147 (2006).

Table 2. The medium-level indexes

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

Table 3. The CPIs

	Aggregate CPI			
	Antitrust CPI (3/4)			Merger CPI (1/4)
	Hardcore cartels (1/3)	Abuses (1/3)	Other agreements (1/3)	
Institutional CPI (2/3)	Institutional features of hardcore cartels	Institutional features of abuses	Institutional features of other agreements	Institutional features of mergers
Enforcement CPI (1/3)	Enforcement features of hardcore cartels	Enforcement features of abuses	Enforcement features of other agreements	Enforcement features of mergers

indexes relative to the enforcement features. Finally, we calculate 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).

VII. THE DATA

In this Part, we explain how we have collected the data on the relevant competition policy features that we have employed to calculate the CPIs. Most of the data were directly obtained from the CAs operating in the 13 jurisdictions included in our sample.[37] 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 from 1995 to 2005). In addition, we asked 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 on the cases and 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.

A. Missing Data

Despite the active collaboration of most CAs, it was not possible to collect all the data on the enforcement characteristics of the competition policy necessary to build the CPIs for the period considered (from 1995 to 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 very limited imputation of the missing data, whenever this was allowed by the characteristics of the

[37] We surveyed only the CAs that are either independent public bodies, or ministerial agencies and departments and we did not survey the courts (though we collected data on their powers and activities). The bodies that we 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 (United Kingdom), Competition Commission (United Kingdom), Federal Trade Commission (United States), and Antitrust Division–Department of Justice (United States).

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 that data. For example, if we had data on the level of a CAs' budget from 1996 to 2000 (5 years) and this level was constantly growing, we calculated the budget for 2001 and 2002 using the average growth rate observed in the available data. We calculated only two of the missing data because we believe that our imputation should not exceed 50 percent (that is, because we had 5 observations, we calculated 2 more, whereas if we had had 7 observations, we could have calculated the 3 missing ones).

The second imputation 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 had only data on the budget for competition activities but not on the staff, and where we 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 chose not to calculate an index (both at the low, medium, and high level of the pyramid) if 50 percent or more of the relevant information content was missing. For example, the low-level index on resources includes information on the CAs' 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 we did not have the data on the level of the budget for a given country in a given year, then we did not calculate this index because half of the information content was missing. In contrast, if we had no information on the composition of the staff, we could still calculate the index, as only a quarter of the information content would be missing; that is, we would be above the 50 percent threshold. In cases like these, however, we adjusted the weights to account for this missing observation. In our example, the budget was given a weight of 2/3 and the quality of the staff a weight of 1/3.

We made 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 only accounted for 1/3 of the overall information content of the Aggregate index. We decided that, in the case of the Aggregate CPI, it was important to have data on both the institutional and the enforcement features.

B. The European Union

Our sample includes nine European countries, which are part of the European Union.[38] In these countries, the EU competition policy works alongside the 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 also built a set of CPIs, which incorporate information on both the national and the EU competition policy. However, because we have no information on the EU enforcement features, we have only been able to calculate this set of indexes for the institutional features. These indexes have been calculated as the sample average of the country's Institutional CPI and the EU's Institutional CPI.

VIII. 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 adopted subjective weighting scheme. In the previous sections, we justified our choice of weights. Nonetheless, to verify whether the CPIs are sensitive to the adopted weighting scheme, we employed a statistical technique, the factor analysis, to derive a new set of CPIs where the weights assigned to each piece of information are completely driven by the characteristics of the data themselves. The factor analysis is a statistical method that 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 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 the factor analysis to compute the loadings and to estimate the factors. Our analysis is based on the methodology employed by the OECD when calculating the PMR indicators.[39] This methodology involves a number of steps.

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

The second step consists of extracting the factors (that is, identifying the number of factors necessary to represent the original data) using the

[38] These are France, Germany, Italy, the Netherlands, Spain, Sweden, the United Kingdom, and, since 2004, also the Czech Republic and Hungary.

[39] *See* Conway, Janod & Nicoletti, *supra* note 3, at 4-10.

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.[40]

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 to 0, thus allowing us to more easily assign a selected variable to a unique factor. We use the varimax rotation technique, which preserves the orthogonality between the factors.

The fourth step consists of the construction of the factors. We construct the factors as the weighted average of the original variables, where the weights are the normalized squared factor loadings of each variable.

The fifth step consists of the aggregation of the factors to have a single indicator for each of the areas of the competition policy (hardcore cartels, abuses, other agreements, and 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.

Finally, we run the factor analysis on these four indicators again (repeating the procedure described above) to calculate the aggregate CPI. Table 4 shows the output of the factor analysis for one of the areas of competition policy: hardcore cartels. In the first column, 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 percent of the variability in the original data. The columns labelled "factor loading" show the loadings for each factor, which measure the correlation between each variable and that specific factor, while the third column, "weights of variables," shows the weights of each variable in the computation of the factor, based on the normalized 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 normalized 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.

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

Table 4. The output of the factor analysis for features relative to one competition policy area: hardcore 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

IX. RESULTS

In this Part we present the results. We start by showing in Figures 1 to 6 the values of the Institutional CPIs and the Enforcement CPIs for the jurisdictions in our sample over the period from 1995 to 2005.[41] To allow for a clearer interpretation of the results, we include only a limited number of jurisdictions in each figure. Yet, to allow readers to easily perform comparisons among them, we also report the sample 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. They remain relatively stable over the period under examination, but they differ considerably among each other. The Institutional CPI for the United States takes very high values (ranging between 0.74 and 0.76), which are constantly among the highest in the sample and well above the sample average (which ranges between 0.54 and 0.62). The values for Canada (ranging between 0.58 and 0.62) are also above the sample average, whereas Japan's values are very low (between 0.46 and 0.5).

Japan consistently has the lowest Institutional CPIs for the entire sample period. The reason behind Japan's low performance is manifold. First, Japan suffers from the lack of a leniency program for cartel 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 initiate a class action and the fact that the Japanese competition legislation envisages the consideration of goals that are not strictly economic 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 1).

Figure 2 shows the Enforcement CPIs for the same three countries. Whereas the Institutional CPIs tend to be stable over time, because institutional changes are less frequent due to institutional inertia, the evolution of the Enforcement CPIs for the three non-EU countries exhibits more cross-time variation. Moreover, the ranking is different with respect to Figure 1, as Canada is now the country with the highest values (ranging between 0.37 and 0.44). The main reason why Canada has higher values than the United States 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, the positive gap with

[41] 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.

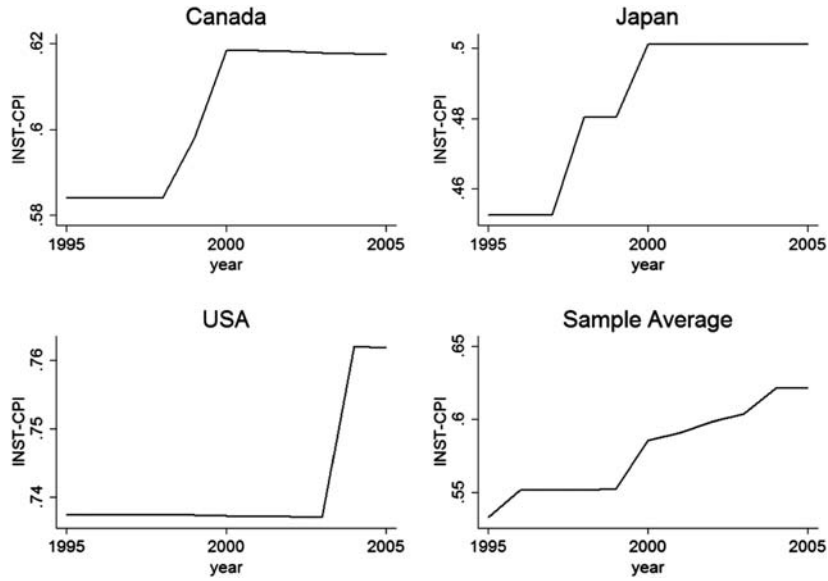

Figure 1. The Institutional CPIs for the non-EU countries in our sample: Canada, Japan, and the United States.

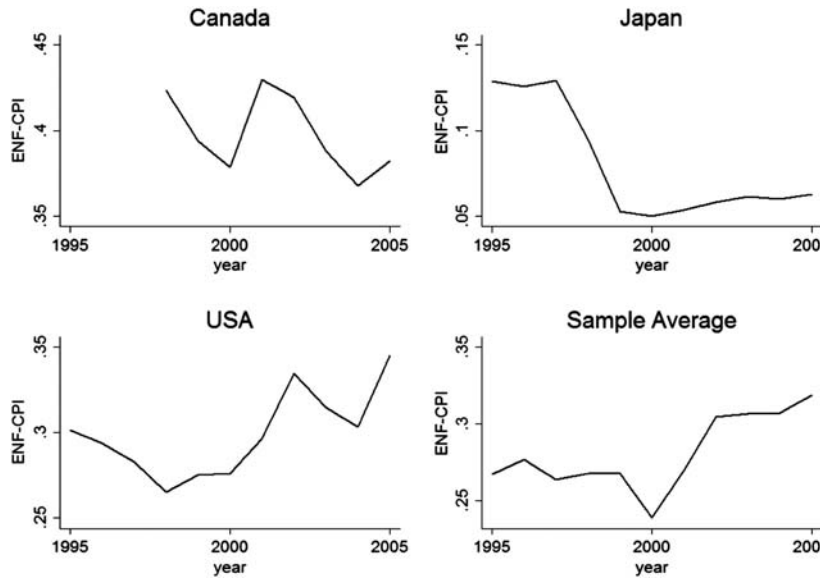

Figure 2. The Enforcement CPIs for the non-EU countries in our sample: Canada, Japan, and the United States.

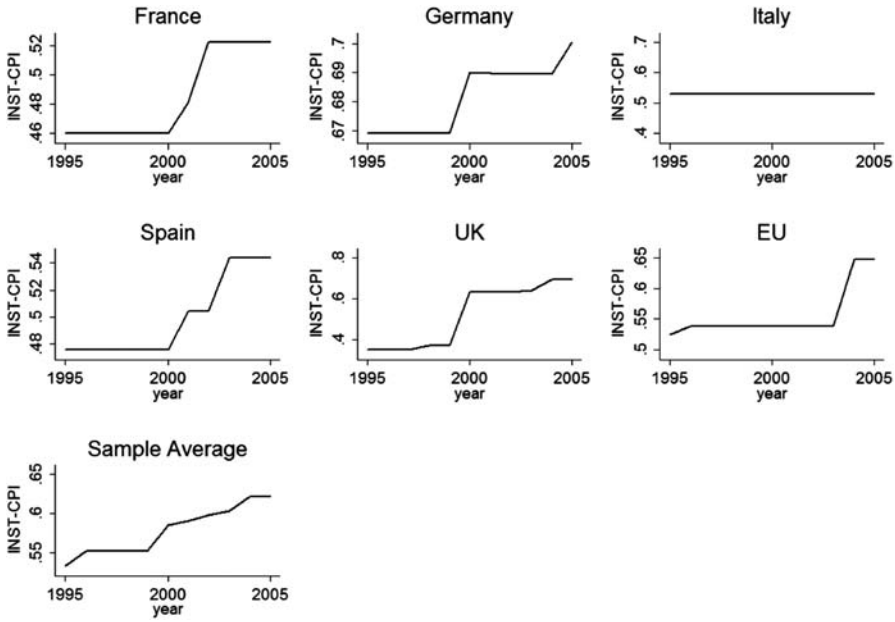

Figure 3. The Institutional CPIs for the large EU countries in our sample: France, the European Union, Italy, Germany, Spain, and the United Kingdom.

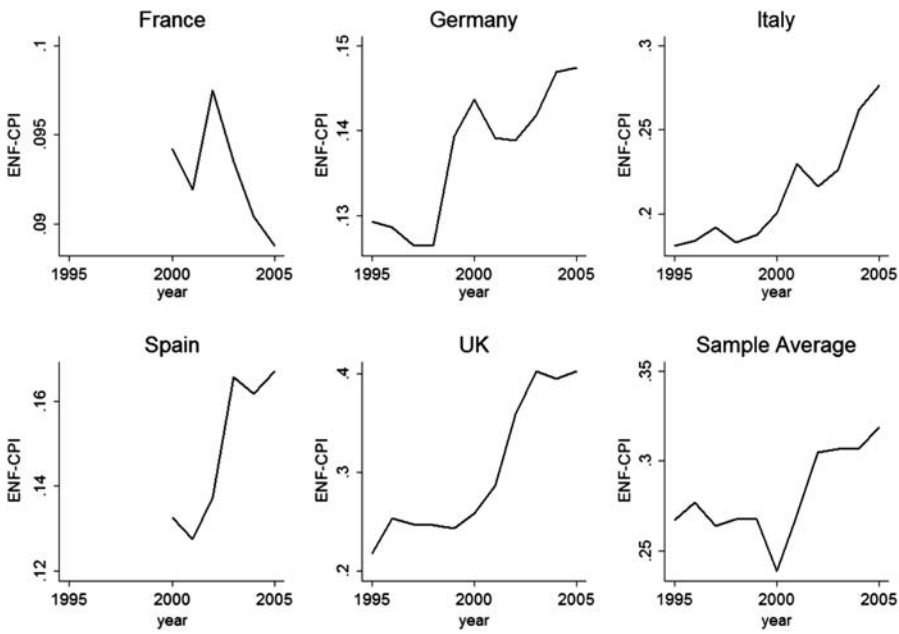

Figure 4. The Enforcement CPIs for the large EU countries in our sample: France, Italy, Germany, Spain, and the United Kingdom.

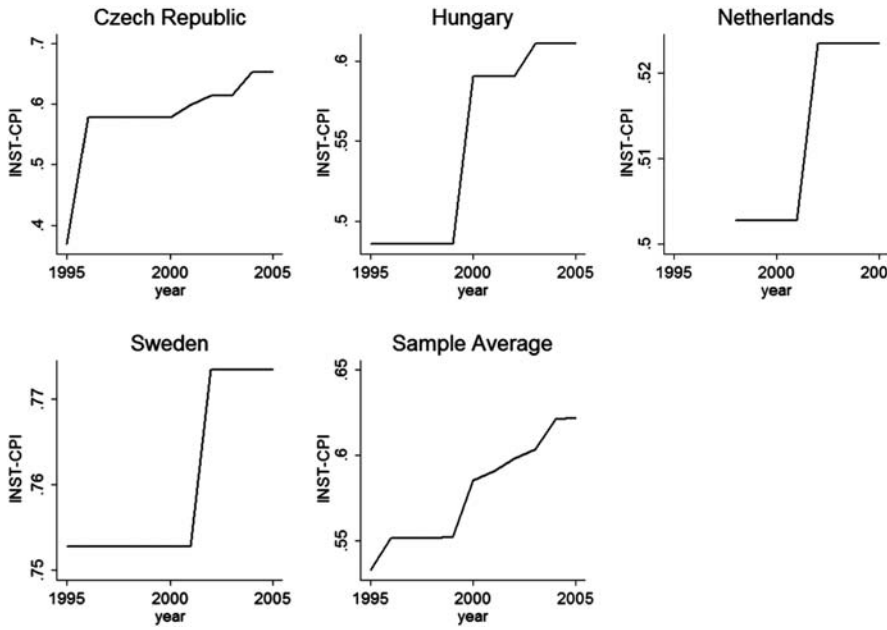

Figure 5. The Institutional CPIs for the small EU countries in our sample: the Czech Republic, Hungary, the Netherlands, and Sweden.

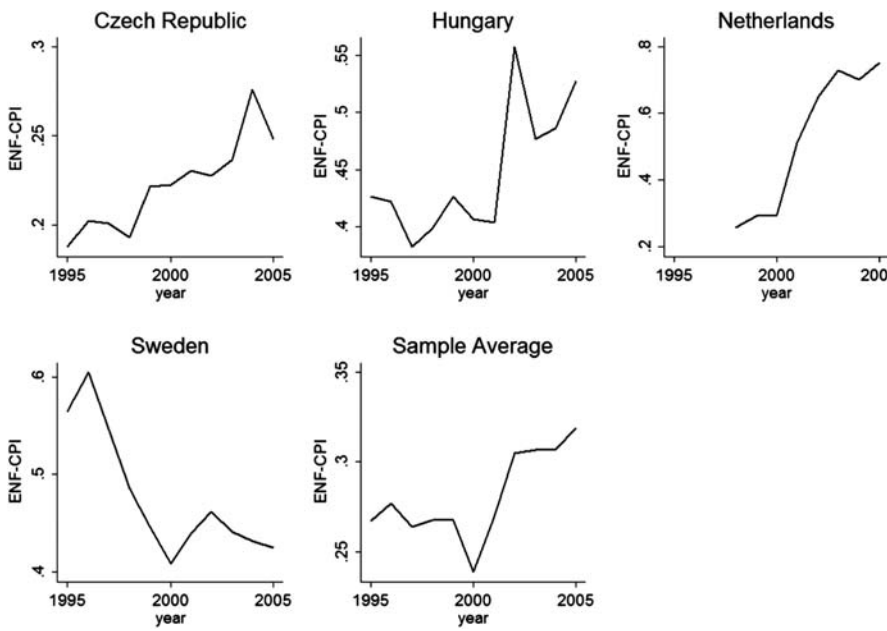

Figure 6. The Enforcement CPIs for the small EU countries in our sample: the Czech Republic, Hungary, the Netherlands, and Sweden.

respect to the United States and the sample average tends to shrink over time and, by the end of our sample period, it is almost closed, with both countries as well as the average taking values close to 0.35.

Also in this case, Japan shows very low values for the Enforcement CPIs. This is due to the low level of human and financial resources available to the Japanese CA. The significant drop from a value of 0.13 to a value of 0.05 that can be observed between 1997 and 1999 is due to a strong reduction in the number of mergers examined by the Japanese CA, as a result of a change in legislation that modified the criteria for the notification of mergers (Figure 2).

Figure 3 depicts the Institutional CPIs for the large EU member states in our sample and for the EU itself. The CPIs for Spain (ranging between 0.48 and 0.54), France (from 0.46 to 0.52), and Italy (which stays stable on the value of 0.51) are consistently below the sample average (0.55 to 0.63). Germany, in contrast, shows a much better performance (ranging between 0.67 and 0.7), and its Institutional CPI is well above the sample average. The Institutional CPIs for the EU (from 0.52 to 0.65) and the United Kingdom (from 0.4 to 0.71) start below the average (from 0.54 to 0.62), but grow significantly over time until they pass it.

The most interesting features of this picture are the changes that characterize three of the jurisdictions. The CPI for the United Kingdom 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 experienced a substantial improvement between 2000 and 2003. Spain benefited from the introduction of class actions in 2001 and of the powers to investigate business premises in 2003. In France, the quality of the Institutional CPI improved because of the introduction of a leniency program for cartel whistleblowers of the obligation to notify mergers. Finally, the Institutional CPI 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 program for cartel whistleblowers, and the second, in 2004, is the result of the introduction of the power to inspect private premises in the investigation of hardcore cartels and abuses (Figure 3).

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. Moreover, the data for France and Spain in the first five years of the sample are also missing. This lack of information does not allow us to portray a clear picture of the trend for those jurisdictions.

Surprisingly, with respect to the enforcement characteristics of the competition policy, Germany (ranging between 0.13 and 0.15) now ranks well below both Italy (ranging between 0.18 and 0.28) and the United Kingdom (ranging between 0.21 and 0.4), and is close to Spain (ranging between 0.13 and 0.17). This is partially due to the fact that less financial resources are available to the German CA, but is also a consequence of its limited number of employees (relative to the United Kingdom) and the lower level of skills of

those employees (relative to Italy). Another relevant aspect is the consistent improvement in the overall deterrence properties of the enforcement features of the competition policy in the United Kingdom, 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. The decline of the constantly very low French index (from 0.095 to 0.090) is due to a decrease in the overall number of employees, a reduction in the number of qualified economists, and a reduction in the budget in real terms (Figure 4).

Figure 5 depicts the Institutional CPIs for the small EU countries in our sample. Sweden is consistently the country with the highest Institutional CPI values (ranging between 0.75 and 0.77), not only 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 (ranging between 0.38 and 0.66) and Hungary (ranging between 0.48 and 0.61) improve over time, and their Institutional CPIs 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 (ranging between 0.505 and 0.525). It experienced only a small jump in 2002, due to the introduction of a leniency program for cartel whistleblowers (Figure 5).

Figure 6 depicts the Enforcement CPIs for the same subset of jurisdictions. Again, Sweden shows the highest values in its Enforcement CPI in the first half of the sample period, yet this consistently declines over time (ranging between 0.6 and 0.4). 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 (ranging between 0.19 and 0.27), and its Enforcement CPI is always below the sample average, whereas Hungary (ranging between 0.43 and 0.55) 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 (ranging between 0.22 and 0.78) is related to a constant increase in the amount and the quality of its CA's resources (Figure 6).

Figures 1 to 6 give a general idea of the quality of the competition policy in the jurisdictions included in our sample and of the relevant changes that 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, 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 data on the enforcement features of this jurisdiction were not available (Figures 7, 8, and 9).

Table 5 shows the ranking of the 12 countries in our sample based on the average value of their Aggregate CPIs over the years from 1995 to 2005 and on the value in 2005. Sweden and the United States 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 United Kingdom and Canada are the countries that experienced the most marked changes.

Table 6 shows the ranking obtained when the Aggregate CPIs are calculated using the weights obtained through the factor analysis. The rankings resulting from the use of the two weighting schemes are broadly consistent (Tables 5 and 6). Sweden and the United States 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.

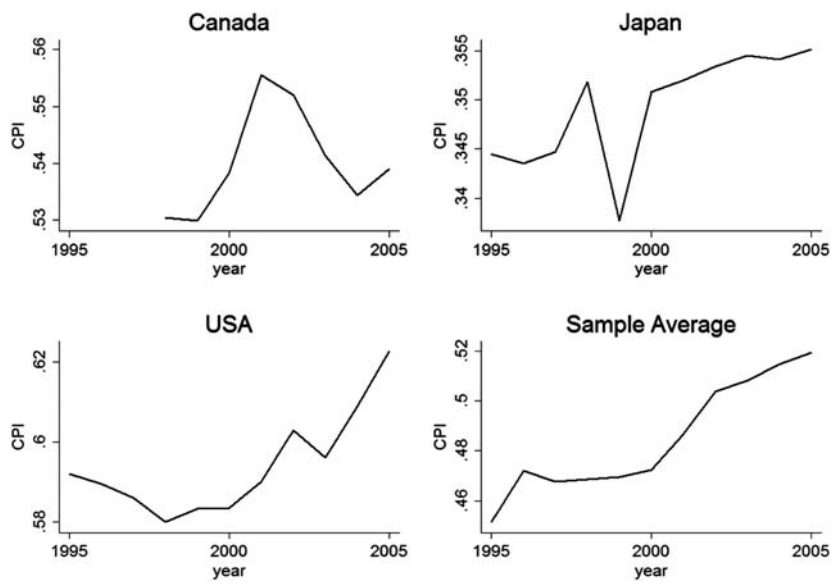

Figure 7. The Aggregate CPIs for the non-EU countries in our sample: Canada, Japan, and the United States.

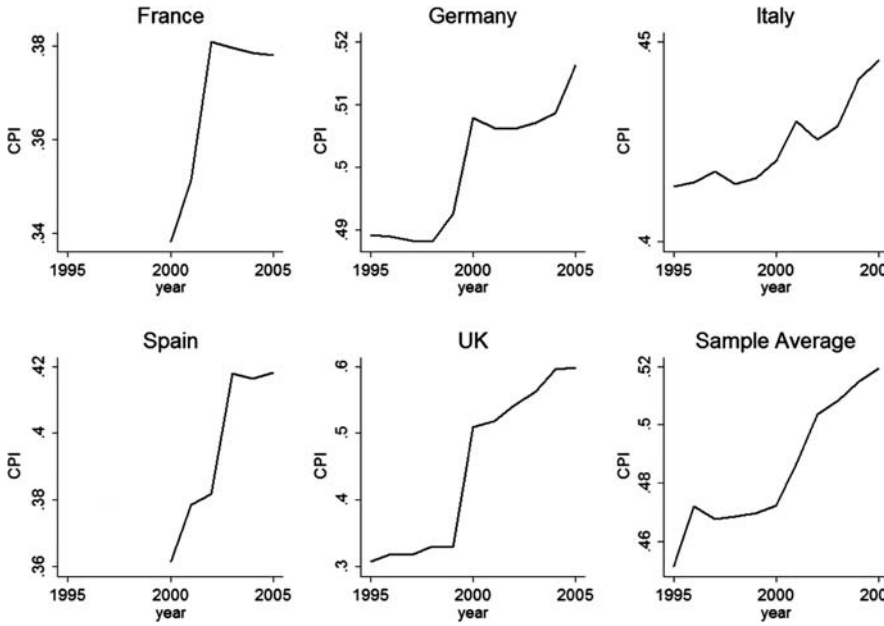

Figure 8. The Aggregate CPIs of the large EU member states in our sample: France, Italy, Germany, Spain, and the United Kingdom.

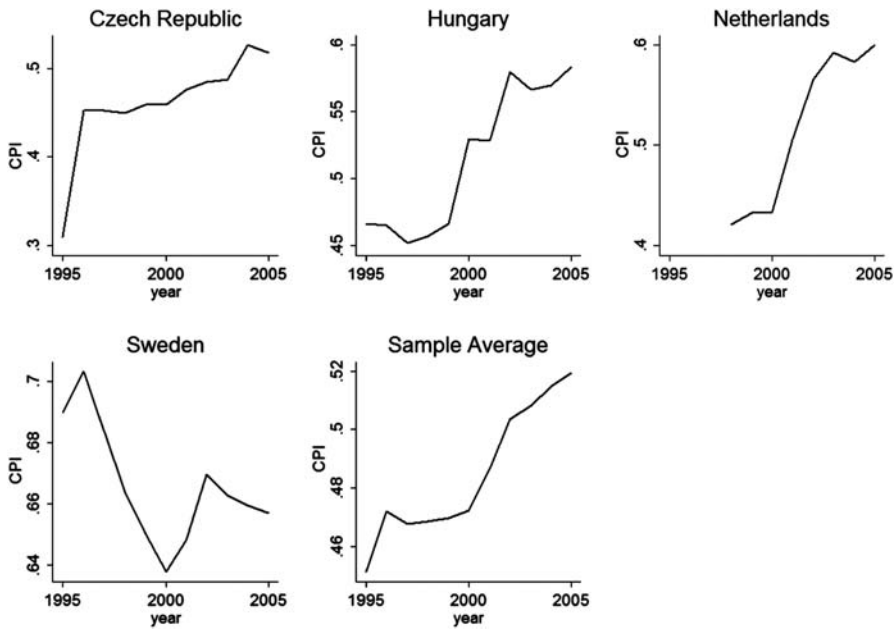

Figure 9. The Aggregate CPIs of the small EU member states in our sample: the Czech Republic, Hungary, the Netherlands, and Sweden.

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
United States	2	2
Canada	3	6
Netherlands	4	3
Hungary	5	5
Germany	6	8
Czech Republic	7	7
United Kingdom	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
United States	2	2
Germany	3	4
Canada	4	5
Hungary	5	6
United Kingdom	6	3
Czech Republic	7	7
Netherlands	8	8
Italy	9	9
France	10	10
Spain	11	11
Japan	12	12

As a further check, we 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. That coefficient is very high (equal to 0.96) and it is significantly different from zero at the 1 percent level.

X. COMPARISONS WITH OTHER SIMILAR INDICATORS

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

As mentioned in the introduction, the OECD has developed a set of CPL indicators (only for the year 2003) 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 of a country. The ranking of the CPL indicators, with respect only to the competition policy, slightly differ from the one of the Aggregate CPIs.[42] Several factors may determine these differences. First, the CPL indicators do not include information on some institutional characteristics that are included in the Aggregate CPI, namely the extent of powers available for the CAs during their 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 features. 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 some similarities with the CPIs are the four indicators developed by Voigt.[43] 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 summarize the key features of a regime in a single index, but are more akin to the low-level indexes discussed in Part IV, in that each one includes information on a limited aspect of a competition regime.[44]

Hylton and Deng also provide a quantitative summary measure of competition law.[45] Their objective was 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 from January 2001 to December 2004. Their scope index differs from the CPIs, 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

[42] *See* Høj, *supra* note 4, at 8. Høj's ranking is based on the "Antitrust Framework" index, which is possibly the closest measure to our CPI *Id.* at 8-9.

[43] *See* Voigt, *supra* note 19.

[44] 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 indicator measures the factual independence of the legislation.

[45] *See* Keith Hylton & Fei Deng, *Antitrust Around the World: An Empirical Analysis of the Scope of Competition Laws and Their Effects*, 74 ANTITRUST L.J. 271 (2007).

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.[46]

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 characteristics of a country's competition policy, there also exist other indicators that are based on the subjective assessment of the effectiveness of these policies. The best example of these subjective indexes is the index published annually 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 these types of indicators is that they are not easily comparable among each other, as they are built on subjective survey answers. Indeed, local business people 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.

XI. CONCLUSION

This article presents a newly designed set of indicators for measuring the deterrence effect of a competition policy regime, the CPIs. 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. We have assessed the sensitivity of the CPIs to these weights by recalculating them using a set of weights generated by a purely statistical technique, the factor analysis.

There is room for further research and refinement of the CPIs. First, the exercise could be repeated so as to cover a longer time period, as well as more countries. Second, the database could be expanded 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.

[46] 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 abuses of dominance and restrictive trade practices that are prohibited.

APPENDIX

Tables A.1 and A.2 summarize the scores given to each feature of a competition policy regime in building the low-level indexes (explained in Part IV) and provide reference to the sources on which we have based our evaluation. For those variables that could be measured on a meaningful quantitative scale, for example, those dealing with the amount of resources, or with the powers of the CAs, our scoring approach is based on the simple assumption "the more, the better."[47] Hence, a jurisdiction obtains a higher score if the relevant CA is endowed with more investigative powers or resources.

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

ANTITRUST INFRINGEMENTS	SCORES	REFERENCES
Independence		
Body that performs the investigation:		Voigt (2009), p. 1233 Oliveira. et al.
Independent agency	1	(2009) OECD (2005a, 2005b)
Investigation splits between an independent and a ministerial agency/department	0.5	
Ministerial agency/department	0	
Body that takes the decision		Voigt (2009), p. 1233
Independent agency/Court and Gov. cannot over-rule decisions	1	
Independent agency/Court and Gov. can over-rule decisions	0.5	
Ministerial agency/department	0	
Quality of the law		
Standard of proof for hardcore cartels and goals that inform the decision		Voigt (2009), p. 1232 Motta (2004), p. 191 OECD (2002b)
Per-se prohibition	1	
Rule-of-reason and only economic goals	0.5	
Rule-of-reason and economic and other goals	0	
Standard of proof for abuses and other agreements and goals pursued		Voigt (2009), p. 1232
Per-se prohibition	0	
Rule-of-reason and only economic goals	1	
Rule-of-reason and economic and other goals	0.5	
Leniency program		OECD (2002a, 2002b) ICN, (2006)
There is	1	Motta (2004), p. 193 Spagnolo
There is not	0	(2000)
Sanctions and damages		

Continued

[47] 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 many 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 interested only in measuring the effectiveness of competition policy and not its efficiency.

Table A.1. *Continued*

ANTITRUST INFRINGEMENTS	SCORES	REFERENCES
Sanction to firms and criterion for maximum fine		OECD (2002a, 2002b)
Illicit gain/ turnover	1	
Discretionary decision by adjudicator	0.66	
Maximum value	0.33	
No fine can be imposed	0	
Separation of power		
Nature of appeal court		OECD (2007)
Specialized	1	
Non-specialized	0	
Separation between prosecutor and adjudicator		Posner (1988) Wils (2004) Neven (2006)
There is	1	
There is not	0	

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

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

Continued

Table A.2. *Continued*

MERGER CONTROL	SCORES	REFERENCES
Separation between bodies that decide in phase 1 and in phase 2		
There is	1	
There is not	0	