Working Paper 6
9 November 2006

ENGLISH ONLY

ECONOMIC COMMISSION FOR EUROPE
CONFERENCE OF EUROPEAN STATISTICIANS

Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development
Second meeting
Oslo, 15-16 November 2006
Item 4c) of the Provisional Agenda

RELEVANCE OF CAPITAL-BASED INDICATORS OF SUSTAINABILITY IN THE FRAMEWORK OF OFFICIAL STATISTICS

Submitted by UNECE[1]

RELEVANCE AND POLICY-RELEVANCE IN THE FRAMEWORK OF OFFICIAL STATISTICS

1. The mandate given by the CES Bureau for the Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development states that the development of statistics in this area should be carried out "within the framework of official statistics". In practical terms, this implies that statistics should be developed for this area in such a way that they can be produced and disseminated not only with full respect of the relevant methodological and terminological statistical standards (of which those to be developed by this group would form one part), but also with full respect of all basic principles of official statistics. Three sets of such principles exist: *The UNECE Fundamental Principles of Official Statistics from 1992, the IMF Special Data Dissemination Standard* (and notably its part on integrity) from 1996, and the *EU European Statistics Code of Practice* from 2005.

2. This is not the place to compare these three sets of principles in detail, but what is normally implied by the term "relevance" is addressed in all three lists. As an example, the first principle of the UN list shall be given here, which reads as:
"*Official statistics provide an indispensable element in the information system of a democratic society, serving the government, the economy and the public with data about the economic, demographic, social and environmental situation. To this end, official statistics that meet the test of practical utility are to be compiled and made available on an impartial basis by official statistics to honour citizens' entitlement to public information.*"

3. In other words, relevance means that the use of tax payers' funds for producing official statistics is only justified when it is legitimized by meeting information needs of the user groups mentioned in this principle (which include the public). Since the resources available for official statistics will never be sufficient to meet all information needs of this kind, official statistics has

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to bundle those expressed by (or anticipated for) different users in such a way that the same statistical operation can cover many information needs for as many users as possible. These possibilities are not only limited by resource constraints, but also by standards of official statistics that follow directly from principles other than relevance, notably the use of agreed professional standards based on robust and tested methodologies.

4. The minutes of the Third Meeting of the Steering Committee for this Working Group use the term "policy-relevance" in the context of the capital approach. In what respect does "policy-relevance" differ from "relevance" as described by the UN's 1st principle? One possible interpretation for the term "policy relevance" could focus on the part of official statistics that is *immediately relevant for evidence-based government decision-making*, i.e. for the information needs of governmental users as opposed to other users. But in what respect is this supposed subset of official statistics really different from what is needed to inform e.g. the public in a democratic society about the situation of a country? Are there examples of results of official statistics that are important for the public debate, but do not play any role in decision-making by government or other public bodies? For all practical purposes, these categories overlap to such a large extent that the distinction is too blurred to serve any practical purposes. Furthermore, in a democratic country, the public debate is part of the political process, since governments are accountable to the citizens through elections.

5. Another interpretation of policy-relevance could be that it focuses on the subset of statistics that describe *elements that can be influenced directly by government decisions*, as opposed to those statistics that measure *the impact* of the activities of various actors, of which those following governmental decisions may be a more or less significant part. Examples for the former type of statistics are government expenditure of various types, as well as statistics on the capacity of infrastructure in sectors such as transport, education, health, etc. Examples of the latter are prominent aggregates of official statistics like GDP or CPI, or income distribution and the unemployment rate, which are only partly influenced by direct actions of the government. Most of the movements in indicators of the second type are either caused by government decision in an indirect rather than direct way (via influencing the behaviour of other actors), or reflect the impact of decisions by other actors that are completely unrelated to recent government decisions. However, such movements may be related to behaviour and incentives influenced by the regulatory framework in a given policy area, which is the result of accumulated decisions in the public sector over a certain period. Changes in such behaviour may be related to recent decisions to change the regulatory framework in a country, but also the effect of changes in the relative strength and weaknesses of the regulatory framework compared to other countries.

6. The second type of statistics is often excluded from "policy-relevance" because of the difficulty to isolate empirically the impact of recent government decisions from other influencing factors. Following this point of view, policy-relevance would limit statistics to *performance indicators that allow assessing the effectiveness of policy actions* net of other influencing factors. Even from a pure policy-making perspective, it is increasingly recognized that the indirect impact of government decisions, through intentional or non-intended incentives for other actors, may be even more important than whatever the government has as direct instruments of intervention.

7. At the end, the overall outcome in terms of the economic, demographic, social and environmental situation is what counts for the citizens and the economic actors. For this reason, the second interpretation of policy-relevance as a subset of relevance is not a promising avenue

to follow either: *relevance of any official statistics has to be judged by whether it is important for the public debate about where the country stands, **and** whether it is relevant for the evidence-based decision-making of governments at the same time.* [2]

INDICATORS AND THEIR CHARACTERISTICS: HOW WELL DO THEY FIT CAPITAL-BASED MEASURES OF SUSTAINABILITY?

8. Another loose term frequently encountered in conceptual discussions about measurement in official statistics is the term "indicator". As is the case for the term policy-relevance, there are many interpretations of the term indicator. The interpretation that seems to be implied in the discussion about sustainable development is the *normative interpretation*, meaning that, ***ceteris paribus (i.e. all other indicators being equal)**, an upward move of an indicator can be interpreted as either improvement or deterioration of the situation*. Ceteris paribus, a lower crime rate, a higher life expectancy, or a higher disposable average income per capita, indicates an improvement. These normative statements are still within the framework of official statistics, since they are (partial) measurements of goals for which there is a wide consensus in the country, and even across countries as reflected by many UN lists of objectives and concerns.[3]

9. What is the normative interpretation of indicators of sustainability in terms of capital stock? A paper by the World Bank[4] gives the major argument in paragraph 9: sustainability can be equated to *non-declining values of all assets*. What should be added is "*and non-increasing values of liabilities*". An increase in an asset indicator means that the capital reflected by this particular indicator has increased, thus increasing the endowment for future years (and therefore, among other future beneficiaries, also future generations). Whatever the development or progress was in the past period(s), non-declining assets show that this part of progress was not achieved at the expense of this particular component of capital. Therefore, it can be interpreted as an increase in sustainability for *this particular component*. The inverse relationship exists between indicators of liabilities and progress or development.

10. Should *assets and liabilities be balanced against each other*, i.e. should the sustainability indicators be formulated in terms of net wealth, or is it preferable to have separate indicators for assets and liabilities? In an accounting framework, it is obvious that the net position is the main target concept. In a framework of measuring sustainability, however, this is less obvious. The question concerning aggregation of assets and liabilities is linked to the issue of whether different types of assets can and should be aggregated in one overall indicator of wealth, or whether different types of stocks should be treated separately. This issue is discussed more in

[2] The situation is somewhat different for statistics that are important for "the economy" (meaning economic actors). Businesses will need a range of detailed additional statistics, on top of those provided by official statistics, to make their decisions with the various markets they operate. Because of the limited resources, it is legitimate that official statistics does not include the production of statistics at a level of detail where the prime users would be economic actors in specific markets (unless these statistics are a side-product from administrative sources, and do not have to be collected through surveys). The same argument is valid for extra-needs from the research community, over and above the statistics that can be generated by the recombination of existing data in official statistics, including those at micro level.

[3] Quantitative targets, and time targets attached to these quantitative targets, are clearly outside the framework of official statistics; they have to be set by policy-makers.

[4] Working Paper 4, "Measuring social welfare and sustainability" by Kirk Hamilton and Giovanni Ruta, the World Bank.

detail in the chapter on aggregation below. Once this question can be answered, the answer can be extended to aggregating liabilities, as well as to balancing assets and liabilities.

11. In addition to their normative interpretation, the term indicator is distinguished from the term statistics in general (in the sense of results of official statistics) by being *composed of a numerator and a denominator* (with different or the same unit of measurement). The purpose of relating a numerator to a denominator is to correct for the effect of size, so as to render statistics more comparable over time, between regions and population groups, and between countries. Except for some performance indicators for government agencies, all indicators exhibit this rather trivial characteristic, and therefore it makes sense to think of indicators of capital stock that are supposed to reflect sustainability also in terms of a numerator (which reflects the absolute size or value of a stock) and a suitable denominator, such as the population size, the number of households, the number of jobs, the area of a country, or a relevant subset of one of the above totals. In this approach, the time-dimension of the numerator and the denominator should be identical, i.e. they should refer to the same moment.

12. As a very important consequence of the principle of relevance, all indicators have to be capable of *correctly reflecting changes over time*; otherwise, the normative interpretation referred to earlier cannot be deducted. Capital stock measures expressed in physical units have a clear advantage in this respect over capital stock measures expressed in monetary terms. The latter may change mostly because of the changes in the valuation (prices), without any or only few underlying physical changes. Constant price measures, which are common for flows, are very difficult for stocks, both conceptually and empirically. The same holds for international comparisons: PPPs de facto only exist for flows, so that any capital-based measures expressed in monetary terms would have to be converted to a common currency by using exchange rates, with all the problems that this may involve for interpreting such statistics as measures of sustainability. One pragmatic way out of this dilemma is to relate stock measures expressed in monetary terms to denominators that are also expressed in monetary terms (i.e. government debt as percentage of GDP, which is an example of a stock indicator that is politically relevant in a very direct way, reflecting sustainability of public finance).

13. The policy-relevance of stock indicators is sometimes questioned because, contrary to some (but not all) flow indicators, they have a *tendency to move slowly over time*. On the other hand, this characteristic gives them *a higher predictive or forward-looking value* for the future, for the simple reasons that average “service life” of the stock units is in most cases several years, and that, with the exception of natural disasters or wars, stocks are not destroyed rapidly or suddenly, but show gradual patterns of “consumption”, with or without replacement. For stock indicators expressed in terms of population, emigration is an additional form of how elements of a stock can disappear, but it is fair to say that even in this context, the majority of the stock will be present in the same country for some years to come. Flow indicators are better to detect changes in direction, but long time series are necessary to be able to extrapolate flows into the future with some degree of confidence.

LIMITS OF AGGREGATION IN THE FRAMEWORK OF OFFICIAL STATISTICS

14. *Composite indicators*, which try to reduce the complexity of a set of indicators by weighting different indicators to obtain a single measure, have become fashionable, at least outside official statistics. They respond to a certain need, especially of politicians and media, for an unequivocal ranking, notably between countries, and for a quick overview.

15. Within official statistics, aggregation has been limited to areas where there is either a *common measurement unit across the component indicators* (notably money), or where *weights have an empirical and objective basis* like expenditure weights in CPIs. The commonality of the measurement unit is sometimes achieved through imputation of prices for items for which no transaction prices can be observed. The framework of national accounts does include some imputations of monetary values to flows (e.g. for owner-occupied housing), but this is more an extension of observed prices to a wider range of flows than an imputation from scratch without empirical basis. Certain satellite accounts such as the SEEA use physical units of measurement alongside monetary units in order to limit the range of imputations. The reasons for being cautious about imputations are manifold:

- official statistics should reflect reality, and not a virtual situation in which everything is exchanged against payment;
- official statistics has to be based on robust methodologies that can be repeated over time and be applied across countries without creating statistical artifacts;
- the notion of impartiality in the principles of official statistics cannot be reconciled with official statisticians arbitrarily selecting imputed values in areas where no mechanism exists that allows the differences in "willingness to pay" between various economic actors to be expressed as part of transactions.

16. From the point of view of policy-relevance (interpreted as evidence-based decision making, and not as a promotion type of activity), *aggregation in form of a composite indicator*, i.e. without common unit of measurement, beyond what is permitted within the framework of official statistics, *does not offer additional advantages* either. The reasons are as follows.

a) A composite indicator implies the reduction of an array of different indicators to one summary measure by using subjective weights that have no empirical foundation. Which weights should be used? Certainly not the statisticians'. Policy-makers (and other users, including journalists or "experts") may use their own weights, but these weights should never appear as if they were as objective as the components, for which the official statisticians take responsibility. A composite indicator blurs the division of responsibilities between producers and users of official statistics.

b) In an international context, policy-makers from different countries may want to assign different subjective weights to the components, based on the relevance in their national context at a given moment. Whereas the components one by one would be comparable, a composite index with weights that differ between countries would not, and a composite indicator with identical weights across countries would lose relevance for individual countries.

c) A composite index implies *the possibility of substitution*, i.e. a "bad" ranking in one indicator can be offset by a "good" ranking in another. For evidence-based decisions, it is more important to locate where the strengths and weaknesses are, without artificially averaging them. A composite indicator therefore decreases visibility of key information by amalgamating indicators of very different types or, in other words, decrease policy-relevance.

17. In the context of sustainability, the issue of whether different forms of capital or assets can be substituted is the other key element in deciding about the optimal level of aggregation and the necessary number of indicators. *Different forms of assets other than financial assets are generally less open to substitution than non-capitalized goods or services*, due mainly to their different length of life as opposed to goods or services that are consumed in the same period. As soon as capital acquires a "fixed" form (whether tangible or intangible), substitution possibilities against another types of fixed capital are limited. Some forms of fixed capital can be exchanged back into financial assets, but this is of limited relevance in the context of sustainability. Each of the "capital stocks" is an aspect of sustainability in its own right, and any

decrease of a particular stock is an indicator of declining sustainability that cannot be offset by other non-financial types of asset. This is normally referred to as *strong sustainability*, and for measuring sustainability this sets clear limits to aggregation over different types of assets, even where aggregation would be possible because of a common unit of measurement.

18. For *financial assets and liabilities*, there is no physical counterpart, and *monetary valuation is the only conceptually and empirically possible way*. It is also obvious that the net position of assets and liabilities is the most relevant form of the numerator for an indicator of financial assets. For this form of capital, measuring wealth as part of national accounts and for sustainability are not different, except that the overall net worth of a country (over all institutional sectors) is in too aggregated a form to be policy-relevant. The balance of assets and liabilities by institutional sector, and the external position of a country may be the more appropriate level of aggregation in the context of sustainability. But what about the various forms of *fixed and technological capital*, which are also valued as assets in the national accounts framework? Should they be measured in monetary or physical terms to reflect sustainability? What is the optimal level of (dis)aggregation?

19. Let us start with a kind of capital that has been completely neglected in the discussion about sustainability: *infrastructure*. A key question of sustainability in a country is: *has our stock of infrastructure increased or declined*? Valuations, whether based on historical values of building up this infrastructure, or hypothetical values to replace (rebuild) it, are not very straightforward in answering this question, especially if you look at changes over time. Therefore, for this type of fixed capital, physical measures would be preferable as main indicators of stocks (but supplementary flow measures should be added, see below).

20. Concerning the *stock of buildings outside infrastructure*, both monetary and physical measures have conceptual advantages and disadvantages. For measuring sustainability from the economic side, assets like building and land have to be included in the net worth indicators mentioned above, valued at market prices. The question of sustainability goes further, however: it includes the question whether the stock of buildings, serving as dwellings or places of work, is increasing or decreasing relative to the size of the population/economy, and is properly maintained. If monetary values are used in this context, they risk being affected by e.g. changes in the price of land, which do not indicate anything about changes in sustainability. On the other side, a suitable physical unit of measurement is not obvious, especially not for buildings that serve as work places.

21. *In the context of sustainability, stock indicators are therefore not an array of statistics, all expressed in the same measurement unit, that can be easily added up to a total*. The example of building stocks shows that there can be an overlap, because different measures indicate a different aspect of sustainability, both being policy-relevant.

MEASURES OF FLOWS DIRECTLY RELATED TO STOCKS

22. Relevance of stock indicators can be enhanced considerably by complementing the stock indicators with ***indicators that reflect flows into, out of or otherwise directly related to the stocks, such as investment, depletion, or maintenance***. It should be clear, however, that these complementing flow indicators are different from the indicators that measure development or progress; the flow measures referred to here are intended to improve the measurement of sustainability over time. Again, the question arises as to whether they should be expressed as gross or net flows, and whether they should be expressed in monetary or physical units. In terms

of the normative interpretation mentioned above, sustainability is only guaranteed if investment is at least at the level of depletion/consumption of fixed capital, and if the maintenance (in proportion to the stock of capital) is kept at the same level. Therefore, these complementary flow indicators have to be expressed primarily in monetary terms: indicators of gross flows in physical terms may be added, but seem to add less value to the stock indicators.

23. The flow measures proposed here are *not identical* to what is normally called *services flowing from a given type of assets*. "Services" in this context means something like "fruits from" a given form of assets, in analogy to capital income. Such measures belong clearly to the measurement of development or progress, because they do not reveal anything about the sustainability of the underlying capital. It is clear that such services would not be possible without the capital being present, while at the same time there is no proportional relationship between capital and services.

TYPES OF CAPITAL WITHOUT DIRECT MEASUREMENT OF STOCKS

24. *Human, social and institutional capital* is usually mentioned as those parts of capital for which it is difficult to conceive of any direct measurement of stocks reflecting sustainability. Human capital (and part of social capital) are *embedded in people*, and population is a concept that is traditionally measured both by stock indicators, as well as flow indicators that are directly related to these stocks.

25. The first question is whether the basic population statistics, *the level of the population and its change over time*, can be used as an indicator of sustainability. Does a decreasing population indicate lack of sustainability? At a small geographical level, this is certainly not the case. At a national level, however, population decline over many years may be seen as a problem of sustainability. On the other hand, population increase at a very high level is not necessarily a sign of improved sustainability, but rather the opposite. Because of this ambiguous normative interpretation, it is not advisable to include population size (or its growth rate) as such among the indicators measuring sustainability of one component of capital.

26. Human capital is normally equated with the *accumulated knowledge and skills* of the population. Conceptually, the average skill/competence of the population is very close to a stock measure. In practice, functional literacy measures come closest to this concept. However, we are confronted with the usual issue of how to aggregate different skills without subjective weights. More aggregate indicators are the accumulated years of education beyond compulsory schooling, but non-formal education, as well as training on the job at equivalent levels, should be included in such a measure. The major conceptual problem is, however, about how to treat obsolescence of knowledge (in analogy to consumption of fixed capital).

27. One closely related, and very policy relevant flow indicator that is directly related to a stock measure of human capital is the *immigration and emigration of highly skilled people* (brain drain/brain gain). Whether expenditure on education can be considered as a flow in the same way is doubtful, however; the national accountants have not (yet?) agreed to treat this kind of expenditure as investment.

28. A related issue to accumulated knowledge embedded in people is the *R&D expenditure*, which the expert group in charge of the revision of the SNA proposes to capitalize, or in other words, to treat as investments rather than as intermediate or final consumption. This proposal does not meet with unanimous approval for inclusion in a revised SNA. The same problem on

how to depreciate this form of capital (based on assumptions that can be tested empirically, so as to stay within the framework of official statistics) as that for the above indicators of human capital is present. If national accountants agree on the way the consumption of this capital should be spread over time, a R&D stock, and a related flow measure, should be added to the list of sustainability indicators.

29. Another form of human capital is the *health status of the population*. Measures like life expectancy or infant or maternal mortality are typically included in measures of development, and using exactly the same type of indicators for measuring the sustainability of this development would be confusing. One indicator that is relatively close to a negative stock indicator is the percentage of long-term disabled. To express sustainability, this indicator should not be adjusted, in international comparisons, for differences in age structures. Unlike the skills indicator, this is not a positive asset type of indicator. Health may be the area where development and sustainability indicators overlap to the greatest extent, although some stock measures that are distinct from the above expectancy or probability indicators are conceivable.

30. The concept of stock of people in a situation that is supposed to continue can also be applied in a specific form to the difficult measurement of *social capital*. As in the case of health, it looks easier to think of negative rather than positive stock indicators, in the form of the *percentage of the population (or of specific sub-population) who are in precarious or problematic state* ***over a considerable time***. The specification "over a considerable time" is necessary to assimilate such indicators to a stock indicator, as opposed to the normal type of development or progress indicators, which look at the percentage of persons (or households) being in a precarious situation *at a given moment, independently of the duration of this precarious situation*. The normative interpretation is that an increase of the number of persons who continue to stay in precarious situations is a decrease of sustainability, whereas an increase in the snapshot measure of the same situation does not necessarily reflect a decrease of sustainability in itself, if most of the persons can escape this situation in a relatively short time. The corresponding measure of flows related to this negative stock measure would be the probability for a person in this long-term precarious situation to get out of this situation.

31. The basic concept of persons being in a precarious situation for a considerable time can be extended to social issues beyond health and poverty. Possible examples: persons without insurance against risks such as sickness, unemployment, or long-term disability (assuming a certain duration of this situation), or, with reference to children, the percentage of children growing up away from both parents. Social capital being sometimes defined as networks of social interaction, another indicator may the percentage of persons living alone and having no network affiliation.

32. The problem with this indicator is to define what "over a considerable time" means for different aspects of precariousness, and to equate what is conceptually desirable with the practical possibilities of *longitudinal sample surveys*, a very costly instrument within official statistics. *Linking of administrative sources* over time may be an alternative in some countries that offers more possibilities for compiling indicators of this type.

33. Finally, some positive stock indicators, based on the percentage of the population in a given situation, may be considered for issues like *cultural and institutional capital*, although it is recognized that they are approximate indicators for something that, in its greatest part, is likely to escape measurement within the framework of official statistics. The basic indicator formulation is: number of professionals in a certain area, working independently or as

employees of service providers in this area, in relation to the total population. Some examples for this type of proxy stock indicators are included in the Annex.

CONCLUSIONS

34. The paper has tried to demonstrate that capital stock indicators can indeed be measures of sustainability that are relevant in the sense of the principles of official statistics, if interpreted not only in terms of the SNA concept of net worth, and if accompanied by indicators that measure flows into and out of these stocks. A common conceptual framework for these measures is possible, without going beyond the limit of official statistics, if this framework is interpreted with some flexibility.

35. The Annex gives an overview of the various stock and related flow indicators for measuring sustainability of certain types of capital that were mentioned in this paper. They do not cover all types of capital, especially natural resources and environmental assets, for which proposals of capital stock measures are more readily available. These indicators are meant to illustrate the possible implementation of the approach, but more systematic work would be required to explore and assess various indicator options for specific forms of capital within this framework.

ANNEX

Type of capital	Stock indicators	Related flow indicators
Economic capital		
Economy as whole	External position (net) in % of GDP	Change in asset position in % of value of assets at the beginning of the period
		Change in liabilities position in % of the total value of liabilities
Business sector (industry and commercial services, excluding businesses that operate infrastructure, and excluding the financial sector)	Assets minus liabilities in % of value added	Investment in fixed capital minus consumption of fixed capital in % of value of fixed capital at the beginning of the period
		Change in total assets in % of value of assets at the beginning of the period
		Idem for liabilities
	Square meters of floor space in industrial and service buildings per job	
Households sector	Net wealth per capita	Savings in % of disposable income
	Square meters of habitable surface in dwellings per capita	Maintenance expenditure for housing in % of total value of dwellings stock
Government sector	Government debt in % of GDP	Government deficit in % of GDP
Social security	Degree of coverage of pension liabilities for capitalized pension funds	
	Implicit degree of coverage of pension liabilities for non-capitalized pension funds	
Infrastructure		
Physical networks like roads, rails, pipelines, high-voltage electricity, water, sewage	Length of network per square kilometre	Investment minus consumption of fixed capital in % of value of stock at the beginning of the period
		Network maintenance in % of the value of the stock
	Percentage of the population not connected to the network	

Type of capital	Stock indicators	Related flow indicators
Health infrastructure	Hospital beds per capita	Investment minus consumption of fixed capital in hospital in % of value of stock
		Maintenance expenditure in % of value of stock
Education infrastructure	Square meters of floor space in school buildings for primary and secondary education per person between age 6 and 15	Investment minus consumption of fixed capital for school buildings in % of value of stock
		Maintenance expenditure in % value of stock
Human capital		
Education/skills	Percentage of adults with functional illiteracy	
	Accumulated number of years of education/training at tertiary level (average over all persons presently in employment)	Net migration balance of persons with professional or scientific qualifications
Health	Percentage of population in long-term disability	
Social Capital		
Social exclusion	Percentage of households in continuous poverty for 2 years or more, disaggregated by households with at least one person in employment, and households without any person in employment	Probability for such a household to get out of poverty
	Percentage of adults living alone and being without (family or other) network	
	Percentage of children growing up away from father and mother	Probability for a child to lose both parents
Social protection	Percentage of population not covered by health insurance	
	Percentage of labour force not covered by unemployment insurance (including those for whom entitlements to unemployment benefits are exhausted)	
	Percentage of employed persons not covered by	

Type of capital	Stock indicators	Related flow indicators
	disability insurance	
Cultural capital	Number of artists working independently or employed by a cultural institution in % of total population	
Institutional capital		
Diversity of media	Number of journalists working independently or employed by media institutions in % of total population	
Judicial system	Number of lawyers working independently or employed by institutions of justice (i.e. courts) in % of total population	
Technological capital	Capitalised value of R&D in % of GDP	R&D expenditure minus depreciation in % of GDP

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