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Comparing National Competitive Performance: An Economic Analysis of World Economic Forum's Competitiveness Index*

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Developing country policy makers worry about national competitiveness and closely watch indices ranking international competitive performance. This paper analyzes from the development economics perspective if competitiveness is a legitimate policy concern, and if the leading indices deserve the attention they get. It assesses the best known index, from the World Economic Forum, and finds grave deficiencies. The WEF definitions are too broad, the approach biased, the methodology flawed and inconsistent, and many measures vague, redundant or wrongly calculated. It concludes that competitiveness indices have weak theoretical and empirical foundations and may be misleading for analytical and policy purposes.

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1. THE COMPETITIVENESS ISSUE

Policy makers the world over express concern about national competitiveness. Such concern is not new;[1] what seems new is its intensity and spread, a response to globalization, rapid technical change, shrinking economic distance and sweeping liberalization. Governments of rich countries seem to worry the most, if concern can be measured by the volume of reports on enhancing competitiveness (not just at the national but also at inter-governmental, state and district levels).[2] Their concerns revolve around retaining their technological lead and entering new activities where high wages are not a competitive handicap. Export-oriented NIEs worry about staying ahead of lower wage entrants and challenging mature industrial countries in sophisticated activities. Import substituting economies opening themselves to competition worry about restructuring their industries while developing new competencies. The least developed countries, many facing survival problems in existing industrial activities, worry about reviving their economies and diversifying into new export activities.

The concern with competitiveness has spawned a significant industry, with a large audience in policy-making and corporate circles. Its output is diverse, ranging from productivity and cost studies for specific activities and institutional analyses to general strategy papers, development plans, cluster studies and so on. Its best-known product, however, is the *competitiveness index*, a composite indicator ranking countries against each other according to selected criteria and measures of national competitive prowess. In addition to two well-known published rankings each year, there are many unpublished ones prepared by governments, consultants and research institutions, all feeding an insatiable appetite for benchmarking competitive performance and providing guidelines for strategy. While their real impact is difficult to assess, the two leading indices (below) attract considerable attention. Their rankings are quoted in policy statements and the media and subjected to intense analysis, particularly in East Asia where competitiveness is regarded almost a matter of national survival. Local academics use the data in their research. Favorable rankings are used to promote inward investment, poor ones to berate policy makers. Competitiveness

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[1] Reinert (1995) argues that competitiveness in a broader sense has occupied policy makers of industrialized countries for centuries, though the terminology was different. The concerns were to increase 'national wealth', promote 'good trade' (exporting manufactures and importing primary products), enhancing 'productive power' by promoting more advanced forms of manufacturing industry, and so on.

[2] For instance, see the third and fourth official reports on UK competitiveness (UK Cabinet Office, 1996, and DTI, 1998, respectively). Ireland, Canada, Australia and Scotland have all published similar reports. In the USA, a great deal of work on competitiveness is conducted at the state or district levels. In addition, there are myriad unpublished official and consultancy reports in all industrial countries. At the international level, studies are undertaken by the European Commission (some references are given in the bibliography), the OECD and regional groupings .

indices have, in other words, become a significant part of the policy discourse in many parts of the developing world.

In view of their importance, surprisingly little is known about the economics of competitiveness indices: how soundly they are grounded in theory, how sensibly the variables are defined or how well they are measured and aggregated. Academic economists (certainly in the industrial world) largely ignore the competitiveness 'industry' and are disdainful of its indices. This is changing, however, as well-known academics are drawn into competitiveness index preparation, and the exercise is given greater theoretical and statistical rigor. This paper examines the indices from an economic (particularly development) perspective. It examines the justification, methodology, model and data for the best-known index: *The Global Competitiveness Report* of the World Economic Forum's (WEF), published by Oxford University Press and led by Harvard professors Jeffrey Sachs and Michael Porter. It also takes note of, but does not analyze in detail, the International Institute for Management Development (IMD) index, published in *The World Competitiveness Report*.[3] Table 1 shows the leading 30 countries as ranked by the two institutions in 2000.

[3] Both are Swiss-based institutions and until 1996 published a joint index in the *World Competitiveness Report.* For a description of their approaches at the time see *The Economist* (1996). Their main current findings are at **http://www.weforum.org** (for WEF) and at **http://www.imd.ch/wcy/wcy.cfm** (for IMD).

Table 1: Competitive rankings by IMD and WEF for 2000

	IMD Competitiveness index	WEF Current competitiveness index	WEF growth competitiveness index
USA	1	2	1
Singapore	2	9	2
Finland	3	1	6
Netherlands	4	4	4
Switzerland	5	5	10
Luxembourg	6	N/A	3
Ireland	7	22	5
Germany	8	3	15
Sweden	9	7	13
Iceland	10	17	24
Canada	11	11	7
Denmark	12	6	14
Australia	13	10	12
Hong Kong	14	16	8
UK	15	8	9
Norway	16	20	16
Japan	17	14	21
Austria	18	13	18
France	19	15	22
Belgium	20	12	17
N Zealand	21	19	20
Taiwan	22	21	11
Israel	23	18	19
Spain	24	23	27
Malaysia	25	30	25
Chile	26	26	28
Hungary	27	32	26
Korea	28	27	29
Portugal	29	2	23
Italy	30	24	30

Sources: WEF (2000) and IMD (2000).

It is not easy for an outsider to analyze either index properly. The reports do not provide full details of the methodology and, since they aim at a non-technical audience, skate over complex theoretical issues. Nevertheless, there is sufficient material in the WEF reports to allow a useful initial assessment of its approach. This paper focuses on the 1999 and 2000 *Global Competitiveness Reports.* These are of particular interest not just because they are the most recent ones available, but also because the index has diversified (the 2000 report has two major indices and an interesting new sub-index) and its methodology improved.

2. COMPETITIVENESS: A 'DANGEROUS OBSESSION'?

The concept of national competitiveness has itself been severely criticized in recent years and it is useful to start here. While it may appear from the wide use of 'national competitiveness' that the term has an accepted economic definition and can be readily measured, this is not the case. The concept of competitiveness and competitive strategy comes from the business school literature. Companies compete for markets and resources, measure competitiveness by looking at relative market shares, innovation or growth and use competitiveness strategy to

improve their market performance. National competitiveness is assumed similar: economies compete with each other in world markets, can easily measure their competitiveness, and are able to mount competitiveness strategy. This may make some sense for competitiveness in specific activities and markets. For instance, it is meaningful to say that the USA has become 'less competitive' in making television sets or textiles for international markets and 'more competitive' in making computers. But is it sensible to say that the USA becoming 'less or more competitive' as an economy?

Krugman (1994) argues that it is not. To him, "competitiveness is a meaningless word when applied to national economies. And the obsession with competitiveness is both wrong and dangerous" (p. 44). He is particularly critical of the US debate on the subject: most people who advocate measures to improve national competitiveness are nationalistic or ideological. They misunderstand simple economic theory, or, even worse, understand but ignore it. Defending national competitive interests often becomes a facade for blaming foreigners, asking for privileges for domestic groups or seeking to prop up uneconomic activities.[4] Krugman's argument raises two separate issues. The *first* is whether 'national competitiveness' has a valid economic definition, and the *second*, if it does, whether competitiveness 'strategy' is justifiable.

To start with definitions, economists use the term 'competitiveness' in different ways. One is purely macroeconomic: the lack of competitiveness is a real exchange rate problem, referring to a country at full employment "running a persistent (and unwelcome) current-account deficit which would in due course require adjustment, usually via a mixture of deflation and depreciation" (Boltho, 1996, p. 2). Competitiveness here is measured by "relative price and/or cost indices expressed in some common currency" (*ibid*. p. 3).[5] This definition assumes that underlying structural factors are constant, and focuses on the kinds of short-term macroeconomic management that affect relative prices of national goods and services relative to other countries. Such analysis serves a useful purpose and is relevant to competitiveness in

[4] Fagerberg (1996) suggests that blaming foreigners is more a US (or large economy) than European phenomenon. "Although the tendency to blame foreigners for one's own failures may be universal, it has never been a real option for smaller economies. The reason is simple; if one depends on export markets for a large share of what one produces, the last thing one would do would be to give other governments an incentive to impose import restrictions... If there is an obsession here, it is not with competitiveness *per se*, but with trade policy/protectionist politics" (p. 40).

[5] Boltho (1996) considers a number of relative cost measures in use and concludes that the most common one is relative unit cost of labor in the manufacturing sector expressed in a common currency.

that it treats nations as 'competing' directly with each other in a meaningful sense: an important consideration, as we see below.[6]

Most analysts of competitiveness, however, use the term more broadly. They focus on *structural factors* affecting long-term economic performance, and tend to be concerned with productivity, skills and innovation (Fagerberg, 1996). Many seek to promote entry into 'high value added' or strategic activities that are thought important for the technological base of the economy. This is the use that Krugman criticizes: the discussion of structural national competitiveness, according to him, repudiates the basic theory of comparative advantage. His argument is that when economies trade with each other they do not (as firms do) compete in a confrontational manner. They engage in a non-zero sum game that benefits all parties. Trade theory shows that countries specializing according to their factor endowments do better than in the absence of trade, regardless of whether one is technically more efficient than another in particular, or indeed all, activities.

To focus on competitive leads or lags in specific activities is then partial and misleading. The loss of US competitiveness in TVs or textiles does not mean that the US *economy* is less competitive. On the contrary, the decline of these industries may be part of a shift into more remunerative activities: in a general equilibrium setting, where factors equalize returns to their use across alternative uses, only their optimal allocation matters. In this setting there can be no way to define national competitiveness. Some analysts use national economic growth to measure competitiveness, but this is only a "poetic way of saying productivity that has nothing to do with any actual conflict between countries" (Krugman, 1996, 18). If markets are efficient, competitiveness analysis in this sense is a misnomer for the analysis of growth, which is a well-established, active and controversial branch of economics that has little to do with 'competitiveness' in the normal sense.

This does not, however, dispose of the concept of competitiveness altogether. In theory, free markets lead to optimal resource allocation only under strong simplifying assumptions. These include (among others) perfect competition, efficient markets, homogeneous products, free and universal access to technology (with no learning costs), no externalities or agglomeration benefits, and no scale economies. When these requirements are not met – when market failures exist – free markets cannot allocate resources optimally, and nations can improve

[6] Its usefulness is revealed, for instance, in the regular publication by *The Financial Times* under the heading of 'competitiveness' of data on relative real exchange rate and wage movements in major OECD countries.

their position by intervening to remedy (or exploit) market failures. For instance, they can capitalize on monopoly power held by their firms in other markets. They can promote the shift of resources from low to high return activities where resource mobility or investment is held back by information gaps, unpredictable learning costs, linkages or missing institutions. They can be the first to reap economies of scale, scope or agglomeration (or clustering, as it is more commonly known) where these exist. They can coordinate activities that are closely linked in terms of technology or information flows, but are unable to optimize their decisions individually. They can create new productive or innovative capabilities and strengthen or build supporting institutions. And so on. The diverse and widespread nature of market failures in developing countries is well known, particularly in industrial and technology development.[7] Market failures may interact to create multiple equilibria, with poor countries caught in low-growth traps unless they mount coordinated strategies to shift from low skill, low technology activities to higher value activities.[8]

Given imperfect markets, therefore, competitiveness *does* become a valid policy issue related to the market failures affecting direct competition between countries. Krugman accepts this (as he should, being a pioneer of 'new trade theory' and 'new economic geography', both based on imperfect competition). However, competitiveness has to be analyzed in this context, and "people who talk about competitiveness must understand the basics [of international trade theory] and have in mind some sophisticated departure from standard economic models, involving imperfect competition, external economies, or both" (Krugman, 1996, 18). It is not that such 'sophisticated departures' are rare or unrecognized. Most economists accept that scale economies, increasing returns, externalities and linkages, technological leads and lags, product differentiation, cumulative learning and even serendipity (first mover advantages) are common in real life. Most also realize that national comparative advantage often arises from an interaction of these factors with national endowments of capital, labor, skills or natural resources. It is often 'man-made', or rather created by profit-seeking enterprises investing in proprietary advantages in a setting far removed from the perfect world of textbook theory.

Krugman still opposes competitiveness analysis, even by those who understand trade theory, because he believes that *competitiveness analysis is not useful in practice.* He argues that while theory can easily justify competitiveness strategy, the experience of such strategy is not

[7] See for instance, Pack and Westphal (1986), Stiglitz (1996) and Lall (1995, 1996).

encouraging (Krugman, 1996). He divides analysts into 'realists' and 'strategists'. Realists are skeptical of government capabilities and do not believe that interventions generally work or achieve much good. Strategists are naïve about the practical aspects of strategy, believing that interventions do work and achieve significant results. Krugman considers himself a realist, using the case of unsuccessful US intervention in semiconductors to argue that "it is very difficult to formulate strategic trade policies, and… even if you could, it would not be worth much to the economy" (1996, p. 24). However, this seems debatable and biased. Generalizing from anecdotal evidence to the conclusion that governments invariably fail (or fail more than markets) suggests *a priori* political belief rather than a careful evaluation of evidence. If we take into account the many examples of successful intervention in developing countries as well as of numerous failures, the outcome clearly depends on the context (and the capabilities of governments) rather than on immutable features of governments or markets. The issue is the conditions under which policies can work (and government capabilities improved): there can be no universal case against competitiveness strategy.[9]

The debate on government *versus* markets is not germane to this paper. All we need to establish is that there is a valid case for competitiveness strategy, which we can clearly do. This does not imply that competitiveness analysis can fully redress market failures in terms of returning the economy to perfect competition equilibrium.[10] Competitiveness analysis is necessarily more modest and partial, using limited information and partial equilibrium tools of analysis. It is a way of integrating numerous branches of economic analysis that pertain to such issues as physical and human capital formation, innovation and diffusion, risk financing, competition polity, mobility, clusters and so on. If the integration is done well, with a sound framework, appropriate empirical analysis and a good grasp of governance issues, it can serve as a valuable tool of policy.

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[8] On multiple equilibria and the possibility of low level growth 'traps', see Stokey (1991) and Redding (1999).

[9] 'Strategy' in this sense has to go beyond the provision of security, law and order and essential public goods (i.e. the minimalist Adam Smith state). The minimalist role of the state is *necessary* for competitiveness, but it does not amount to competitiveness strategy since it does not differ by national circumstances or over time.

[10] For obvious informational and computational reasons governments cannot reproduce 'perfect' markets. In fact, in the real world it is not clear that it makes much sense to even try. Correcting for 'market failures', in the sense of remedying deviations from a perfectly competitive equilibrium, is not the correct way to describe development strategy. Developing countries are not trying to achieve some ideal static equilibrium but to create new factors, markets, institutions and capabilities that take them on to a new and higher (disequilibrium) growth path. Given the pervasive and diffuse information failures that characterize market economies, a competitive equilibrium may not only be unachievable but also logically inconsistent (Stiglitz, 1996). Stein (2000) makes a similar point about the Krugman critique and takes the analysis from static comparative advantage into dynamic issues of "sustainable developmental competitiveness".

3. COMPETITIVENESS INDICES: INTRODUCTION

If competitiveness analysis as such is valid, there is a role for *competitiveness indices* to help benchmark countries against each other. Such rankings can help policy-makers design and evaluate national competitive performance in the way technical benchmarking helps enterprises to assess and improve their competence against other firms. Competitiveness indices can also help investors to allocate resources between countries, researchers to analyze economic issues in comparative terms, aid donors and international institutions to judge economic performance and domestic industries and institutions to judge themselves against competitors. The justification for using benchmarks rather than *a priori* norms lies in that many aspects of performance can be better assessed with reference to observed best practice rather than to theory. Theoretical norms are often difficult to construct with the precision needed to allow realistic evaluations in a complex and fast changing world with limited information. This is so for firm-level technical or management performance, where overall profit or growth figures do not provide detailed information on specific functions. It is likely to be truer of economic policy and implementation where there is no clear 'optimum' to which countries can aspire.

The value of competitiveness indices depends on the rigor of the underlying analytical framework and the methodology for making the rankings. In the following sections, we assess the WEF index (with some reference to the IMD index). Let us reiterate that any index, if it is guide countries in building competitiveness, *must revolve around market failures* that imply (explicit or other) economic conflict between nations. Otherwise it simply becomes growth analysis with little relation to 'competitiveness' in a meaningful sense. Market failures do not, however, appear in either the WEF or IMD indices: both assume (below) that markets are essentially efficient. They do, however, assign what the World Bank terms a 'market friendly' role for the government, to remedy generic market failures with functional interventions (World Bank, 1993). They eschew all forms of selective interventions that favor particular activities or actors over others. No analytical justification is provided for this stance. Despite the considerable controversy that surrounds the use of functional and selective interventions, both institutions take for granted that the market friendly view is fully justified. Market failures are not in fact mentioned by either institutions, and the role of government is left largely implicit.

There are *five steps* are involved in constructing a competitiveness index. The first is to measure competitive performance at the national level (define the 'dependent variable'). The

second is to identify national variables that affect the measure of performance (the 'independent variables'). The third is to specify the model, (i.e. meaningful causal relations between the independent and dependent variables). The fourth is to collect data that capture the variables. The fifth is to analyze the data rigorously to produce national indices ranking competitive performance.

4. MEASURING NATIONAL COMPETITIVE PERFORMANCE

WEF and IMD differ in their treatment of the dependent, national competitive performance. Some measure of performance is necessary to specify the model (what determines 'competitiveness') and to test its explanatory power. This is particularly important because there is little consensus on how the competitiveness can be measured, and so also on its determinants. Surprisingly, IMD does not provide a measure of competitiveness. It argues that "a country's competitiveness cannot be reduced only to GDP and productivity, because firms must cope with the political, cultural, and educational dimensions of countries, as well as their economies" (IMD Website, 2000). However, if there is no way of measuring "the competitiveness of firms" (this is the final unit of IMD analysis, but it is not clear how firms are aggregated for an economy as a whole), it is difficult to see how it can measure what affects it. There appears to be serious analytical confusion between *inputs* into competitiveness and its *manifestation.* The inputs are indeed varied and may often be difficult to measure. However, since firms compete with each other in specific ways, measuring their success becomes a matter of defining the relevant activities and markets and summing them up for their home country. The absence of a measure of competitiveness means that IMD asks its audience to take its model and its validity entirely on faith.

WEF, by contrast, does use a measure, *per capita GDP* at purchasing power parity values, but does not really justify its choice. There is a need for a justification, since it is not clear that GDP is the right measure of international competitiveness. National income comprises significant (in many cases the dominant) elements that do not enter international competition, including several services as well as infrastructure, industrial and agricultural activities. While some services are directly traded or feed indirectly into tradable activities, a substantial part (e.g. real estate, catering or domestic service) is fairly remote from inter-country competition. WEF *defines* competitiveness more broadly than direct market competition

between countries[11], so tackling the analysis of incomes and growth as a whole. Its concept of competitiveness becomes, in Krugman's words, "a poetic way of saying productivity". It has little to do with *conflict* in gaining market shares or remedying market failures in improving direct competitiveness.

The analysis of economic growth is, of course, important in its own right and has important lessons for policy. However, the lessons are rather different from those involving direct competition between nations. Take an example. It is not the same thing to say, "Compaq is more competitive than Dell because it is selling more personal computers" as "Compaq is more competitive than Hilton Hotels because its growth rate is higher". Both are meaningful but the context differs. The first refers to direct competition (in the sense in which the business literature uses the term), where company strategy can be analyzed. The second refers to general performance: it says something about firms competing for generic resources like capital but has little relevance to variables like innovation, quality, marketing, overseas investment, exports and so on that are the essence of *strategic* analysis. At the national level, similarly, the comparison of incomes across countries may yield useful general lessons, covering some activities that really compete with each other. However, it would also cover many others that have little relevance to how one country could improve its 'competitive advantage' with respect to the other.

There is another, possibly more serious, drawback to competitiveness analysis using such a broad definition. It takes what is essentially corporate strategy analysis into the realm of *growth economics,* where it competes head-on with a large and well-established literature based on rigorous theoretical models and powerful econometrics. Competitiveness analysis has to match or improve upon this if it is to claim any validity and originality: it is not clear that it does so. The two approaches to growth are very different. Economists strive for rigor in modeling and parsimony in explanatory variables. They specify variables and their causal relations with growth clearly (though the specifications often vary by researcher), though they deliberately simplify reality to get to what they consider the fundamental factors. They sacrifice richness of detail to try and general forces across countries and over time. The competitiveness literature, as we see below, has very different techniques.

[11] Thus, it proposes that competitiveness is "the set of institutions and economic policies supportive of high rates of economic growth in the medium term" (WEF, 2000, p. 14). Other analyses, such as the Commission of the European Community (1993), use a similar income based definition of competitiveness.

This does not mean that the economics growth literature is better just because of its theoretical and econometric sophistication. On the contrary, it is subject to considerable controversy and suffers many methodological weaknesses (Kenny and Williams, 2001). Theories that identify relationships between growth and its explanatory variables are often inadequate and over-simplified. They tend to mis-specify relationships between the explanatory and dependent variables (and between the former). Non-linear and unstable causal relations are often not detected. The search for (or rather, assumption of) universal factors affecting growth ignores context or period specific factors.

The growth accounting literature, the most common econometric approach to explaining growth, cannot capture the separate contributions of labor, capital and technology (the residual) without making *a priori* assumptions. Different assumptions about the role of accumulation and assimilation lead to varying explanations of growth and the contribution of technology, as illustrated in the recent controversy over the Asian miracle (Nelson and Pack, 1999, Felipe, 1999, Temple, 1997). The potential for externalities, path dependence and multiple equilibria make it difficult to generalize from such statistical exercises. As Kenny and Williams (2001) conclude, "the current state of understanding about the causes of economic growth is fairly poor" (p. 15). This applies equally to knowledge about the best *policies* to promote growth. General prescriptions (like that of the 'Washington Consensus' recommending wholesale liberalization and market friendly reforms) actually turn out to have little basis in theory or evidence.

These deficiencies do not, however, necessarily strengthen the case for the competitiveness analysis approach. If anything, they make it weaker: the models and techniques used by the institutions making competitiveness indices face even greater problems. Competitiveness indices, like growth economics, also assume that there are common factors governing growth across countries and over time and also fail to take account of specific contexts. Unlike economics, they strive for diversity and detail, adducing a multitude of variables from the economics, management and other disciplines, without analyzing if they are redundant, relevant of inter-related. They ignore complexities and non-linearities in the relationships and ambiguities in causation, often opting for simple free market interpretations. They aggregate all variables rather than seeking out the most relevant ones. They define some of the variables confusingly, measure them inadequately and use suspect statistical methodology. They claim a degree of precision and reliability greatly in excess of what the underlying theory and

evidence supports. They propose policy guidelines with no attempt to test how these prescriptions have performed in the past.

To examine the analytical framework for competitiveness indices, we focus on last available WEF report (WEF, 2000). This claims methodological advances over previous reports and provides two competitiveness indices, the *Current Competitiveness Index* (CCI) and the *Growth Competitiveness Index* (GCI), instead of the usual single index.[12] It also introduces a new sub-index, the *Economic Creativity Index* (ECI), to feed into GCI, and has a chapter presenting it as an important addition to knowledge. We consider each to illustrate the theory and methodologies involved.

CCI "aims to identify the factors that underpin high current productivity and hence current economic performance, measured by the level of GDP per person". GCI "aims to measure the factors that contribute to the future growth of an economy, measured by the rate of change of GDP per person" (p. 14). The *level* of income depends on the capital stock (including human capital) and the 'current level of technology', while the *growth* of income depends on additions to the stock, the current level of technology and rate of technological improvement.

However, the report spends much more time on the CCI than on GCI. The former shows far more clearly the basic analytical approach of the WEF, and it contains what WEF regards as is its main contribution – quantifying the microeconomic foundations for competitiveness. We therefore focus our analysis on CCI; the points made can be applied equally to GCI. However, we discuss one element of GCI, the Economic Creativity Index, in a separate section. This is interesting not only because it is the latest addition to the WEF stable of indices but also because it draws upon related work on national innovativeness by Porter and others. Moreover, innovative capabilities are central to building competitiveness, and it is important to see how WEF approaches the issue.

5. THE CURRENT COMPETITIVENESS INDEX (CCI)

5.1 THE CCI MODEL

According to WEF, CCI measures *competitiveness at the microeconomic level,* which it suggests is more important for building sustained competitiveness than just good macroeconomic management (something most development economists would agree

[12] It claims that its previous index was mainly related to the Growth Competitiveness rather than the Current Competitiveness Index.

with fully). It is therefore the most critical element of the WEF index and it is important to see how WEF builds up its indicators. The 'Executive Summary' that opens the 2000 WEF report describes its model thus:

> "Gross national product per person is proportional to the amount of capital per person: y = A k, where (A) represents the level of technology, summarized by a single number measuring the average productivity of a unit of capital [and k is the national capital stock per capita]. The level of income, then, is determined by the *capital stock* and the *level of technology*".[13]

How are 'capital stock' and 'level of technology' defined and measured in this (admittedly simplified) model? WEF adopts a broad definition for both. Apart from the physical capital embodied in equipment, buildings and physical infrastructure, *capital sto*ck includes "the level of education, workforce skills and attitudes, and managerial talent. Also part of the stock of 'capital' in an economy are the set of legal interventions and regulatory practices governing business. Social capital (levels of trust, mores and the presence of networks) also contribute to the quality of the overall capital stock" (p. 14). *Technology* includes "not only the technological knowledge embedded in a nation's scientific and technological institutions, but also the technology rooted in firms. Technology is embodied in every activity a firm performs as well as in the strategies firms use to compete". It can also be seen as a stock – of national technological knowledge, capabilities, institutions and corporate strategies (note the inclusion of company behavior in the knowledge stock, on which more below). It appears at once that the concepts are very diffuse, and at odds with economic definitions of income, capital and technology. This need not mean they are not useful – much depends on how they are operationalized.

5.2 IMPLEMENTING THE CCI MODEL

The WEF practice is very different from its model. While the model calls for comparative values of *stocks* of physical, human, technological and strategic capital, the index uses no stock measures of any kind, physical, human, technological or strategic.[14] Nor does the report explain *why* stock measures are not used. There are (well known) problems in quantifying such stocks – and several attempts to overcome them. Estimates exist of national capital

[13] M E Porter, J D Sachs and A M Warner, 'Executive summary: current competitiveness and growth competitiveness' (WEF, 2000, p. 14), italics added.

[14] To compile an index to rank countries, furthermore, these stocks must be measured according to a clear common standard. WEF also fails to do this, as considered later.

stocks and are widely used in statistical analyses of productivity and growth. There also exist estimates of human capital stocks, and for one element of technology – research and development (though the data pertain to only a few developed countries). None of these estimates are used, or even mentioned, in the WEF report.

Other components of CCI are inherently more difficult to quantify. There is, for instance, no way to measure stocks of enterprise 'technological capabilities' through an economy, and even more so of stocks of strategies more generally. It is difficult to conceive what it 'stocks' of social capital, legal systems, networks and regulatory practices may mean, and more so how they could be quantified to yield cross-country comparisons. Even if quantification were eschewed in favor of purely qualitative measures, a comparative index could only be constructed if the information yielded an unbiased unit for ranking countries. If not, any comparative ranking would be partial, biased or misleading. As shown below, all these problems are present in the WEF index. However, quantification problems do not account for the WEF neglect of stocks – it has consciously opted to use flow measures because of its analytical approach.

None of the 64 variables going into the CCI index pertains to stocks. While measurement issues are taken up later, we may note now that the measures relate to either current inputs or the quality of services as perceived by business. Take physical capital. The CCI has a set of variables for 'capital availability', based on qualitative measures of 'financial market sophistication', 'stock market access', 'venture capital availability' and the like. These say nothing about capital stocks, nor do they use available data on investment. There *is* a variable measuring the investment rate, but this appears along with 21 other variables in a 'Finance Index' (purporting to measure the efficiency of the financial system). However, the Finance Index appears as a determinant of GCI rather than CCI (an indication of the strange division between the two indices, since both have measures related to capital markets).

Physical infrastructure is not measured by stocks of roads, railroads, air transport etc. in each country but by qualitative ratings of how 'extensive and efficient' infrastructure services are perceived by business. Human capital, in any model a critical determinant of competitiveness, growth and incomes, is treated even more cavalierly. It is captured by qualitative answers to two questions: if local 'public schools are of high quality' and if 'first-class business schools' are available. While we can speculate how human capital theorists will react to these measures, we should note that this typifies the WEF approach to the construction of indices.

5.3 PORTER'S COMPETITIVENESS 'DIAMOND' AND THE CCI INDEX

The theory underlying CCI actually originates in the business strategy literature and has little to do with the economic model quoted above. This section considers the relation between the two. CCI is supposed to have two components: 'the sophistication with which companies or subsidiaries based in the country compete', and 'the quality of the microeconomic business environment'.[15] The quality of the business environment, based on Porter's (1990) well-known 'diamond of competitiveness', comprises variables measuring the quality of inputs (i.e. flows) firms obtain from markets or institutions. The sophistication of company strategies is measured by variables internal to the firms.

Because of the central role that Porter's 'diamond' plays in the WEF analysis, it is worth spending some time on it. In introducing the diamond, Porter (1990) distinguishes 'competitive advantage' from the 'comparative advantage' of trade theory (which he represents by the canonical Heckscher-Ohlin model). In this model, industries use primary factors in different proportions (not reversed across countries), with the relevant technologies freely available to all firms that make undifferentiated products under perfect competition. Countries have identifiable endowments of factors (in the simplest version only capital and labor). Thus, the intersection of factor intensities with national endowments yields predictable patterns of specialization by activity; other simplifying assumptions do not affect this essential result.

Porter's competitive advantages do not arise from such interactions between industrial factor intensities and national factor endowments. They arise instead from firm-level ('man made') efforts to develop new products, improvements, better brands or delivery and so on, to 'innovate' in the broad sense. They give rise to competitive advantages regardless of factor intensity where conditions are conducive to innovative effort. These conditions are given by the elements (below) of his 'diamond'. However, having these conditions is necessary but not sufficient: companies must adopt appropriate strategies to respond to external stimuli and these strategies themselves differ by location. Thus, the combination of the external factors (the diamond) with particular strategies – both having country specific features – yields the competitive potential of each country. Porter provides a wide range of country and industry examples to show how advantages arise from this combination; conventional factor

[15] M. E. Porter, 'The current competitiveness index: measuring the microeconomic foundations of prosperity', WEF (2000), 40-58.

proportions do not, in his view, explain trade patterns well. More significant for the WEF index is his claim that assessing national diamond conditions and company strategies enables one to assess the competitive potential of each nation at the micro level.

While there is much to recommend in Porter's approach, it has weaknesses that reduce its usefulness as a practical guide to competitiveness or its vaunted superiority to received trade theory. Let us review these briefly.

First, Porter does not provide a 'theory' in terms of testable predictions on the competitive advantages of particular activities in particular countries: it only *explains* why particular activities succeeded where they did in a rather diffuse way.[16] The claim that industry characteristics do not relate systematically to innovation (in the broad sense) is also difficult to sustain. While particular advantages may indeed arise in any activity, it is not the case that the certain activities do not enjoy more technological change or create greater spillover benefits – the main sources of sustained competitive advance and diffusion – than others. Similarly it is also not the case that conventional factor endowments do not matter for trade patterns. Where technologies are well diffused, low labor costs do determine where competitive production takes place. It is, in other words, possible to predict a large part of trade patterns from industry and national characteristics.

Second, trade theory is not well represented by the canonical H-O model, nor does it always predict trade patterns precisely. Later trade models relax many simplifying assumptions of the early H-O model. Some include human capital as a primary endowment while retaining its other assumptions. Others go further. Using models based on imperfect competition, they introduce scale economies, technological leads and lags, cumulative learning, product

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16 See a review of Porter's book by Grant (1991). Grant concludes that the book's findings on competitiveness are derived "at the expense of precision and determinacy. Lack of precision is apparent in the woolly definitions of some key concepts in the book and in the specification of relationships between them… Reliance upon broad but ill-defined concepts such as the 'upgrading of competitive advantage' reflects a more general failure to perfectly reconcile micro-level analysis of competitive advantage of firms and industries with macro-level analysis of national development and prosperity… Porter presumes the existence of some invisible hand whereby firms' pursuit of competitive advantage translates into increasing national productivity and prosperity… Lack of precision is also apparent in the 'national diamond' framework. At its most basic, the diamond is a taxonomy for classifying the various national influences on firm and industry competitiveness. Yet the categories overlap to such a degree that it is not clear that the various influences would not be better represented by a triangle or pentagon… Some corners of the diamond become so all embracing that the variables included and their relationship to national competitive advantage are widely diverse… Ambiguity over the signs of the relationships, the complexity of interactions, and dual causation renders the model unproductive in generating clear predictions. Porter's prescriptions in the form of 'national agendas' are symptomatic of this predictive weakness. The chapter establishes imperatives for each country, most of which relate to the removal of impediments to the process of upgrading. But there is little prediction of how each country's industry pattern of comparative advantage is likely to evolve in terms of the industry clusters which will prosper, which will lose out to international competition, and what the implications of structural change and differential rates of upgrading will be for national rates of economic growth" (pp. 541-43).

differentiation and externalities (like agglomeration benefits).[17] Yet others relax the assumption of identical tastes across countries. The pattern of trade remains predictable only where advantages are traceable to industry characteristics and can be related to national endowments (say, of technological innovation). Where endowments between countries are similar or where there is intra-industry trade, comparative advantages may differ because of differences arising from taste differences or from first mover advantages in realizing scale, learning or agglomeration economies. Over time, random patterns become cumulative and self-reinforcing. This is the essence of new trade theory and new economic geography (Krugman, 1991, Venables, 1996). Note that the determinants of *initial* entry are not predicted by trade theory – they could be serendipity or deliberate policy (to exploit first mover advantages, learning potential or externalities, Lall, 2000). They could also arise from the entry of foreign direct investment or other random factors.

Third, many elements of the competitiveness 'diamond' are simply restatements of trade theory. The diamond consists of four interacting elements: *factor conditions, demand conditions, related and supporting industries* and *the context for firm strategy & rivalry*. Of these, factor conditions, demand conditions and related industries exist in standard theory, though Porter introduces some changes – not necessarily for the better. For instance, Porter emphasizes *local* demand, particularly sophisticated customers, in stimulating advantages in activities using advanced factors like technological innovation or modern infrastructure. It is not clear, however, how the 'sophistication' of local demand (national idiosyncrasies based on local resource or climatic conditions apart) can be distinguished at a national level. Income levels would seem to be the only systematic factor explaining the sophistication of demand on a broad basis, but this reverses the causation from the nature of demand to competitiveness and so incomes. It is also unclear if, and how, sophisticated local demand affects different activities differently (say, because each has different costs in collecting market information or interacting with customers), and if it particularly stimulates advanced capabilities. Without such a distinction, little can be said about patterns of competitive advantage: the nature of local demand remains a *post hoc* explanation rather than part of a theory that leads to predictions. [18]

[17] There is a whole class of product cycle and intra-industry trade models dealing where advantages depend on firm-level innovation and location decisions.

[18] The WEF report measures this variable qualitatively, asking respondents if they think their customers are 'knowledgeable and demanding, and buy the latest products' and if they 'actively seek the latest products, technologies and processes'. Even if answers to these questions provide a good measure of 'demand sophistication', it is not clear how the

Similarly, the importance of 'related and supporting industries' lies in agglomeration externalities that economists have acknowledged since Marshall's days. It does not, however, add to the understanding of competitive advantage unless it is established that some locations are better are providing cluster benefits, and some activities need clusters more, than others. If strong clusters exist because of the existence of other productive factors, the variable adds nothing to the analysis. Otherwise they exist only because of good luck or government policy. Showing that particular countries have strong supporting industries does not contribute itself to understanding how these industries came into existence in the first place, driven by variables not already included under factor conditions. The WEF effort does not show anything approaching this.

Fourth, Porter differs sharply from economic analysis in his approach to *firm strategy.* Porter treats strategy as a distinct country-specific determinant of competitiveness, assigning it a prominent place in his analysis. Economics treats firm responses as rational (profit maximizing) reactions to signals emanating from the market, and so fully captured by market variables (like those discussed above). Individual firm reactions may still differ because of differences in individual incentives, evaluations of risk, access to information or 'animal spirits', but these are random and cannot have systematic effects on national performance. Porter suggests, by contrast, that there are unique strategic patterns in each country (influenced by the local context for 'rivalry') that have systematic effects on national competitiveness.[19] This does not appear justified by either theory or evidence. It is not clear that there are distinct corporate strategy patterns in each country that differ sufficiently among countries *irrespective of the usual market variables* to yield predictable patterns of competitive behavior. If firms upgrade their strategies to cope with higher incomes, greater competition, faster technical progress, increasing complexity of information flows and so on, the patterns are bound to be similar given similar conditions. Where there exist local market differences, they are captured by variables related to income, openness, technology, skills and the like. If there are still differences, they are likely to be random. No separate *theory* of

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variable promotes competitiveness in specific activities. Are discriminating customers good for all activities? Are they equally discriminating in whatever they buy? How discriminating must they be before it yields a distinct advantage?

[19] We may quote Porter on this. "To become more competitive, companies must widen their capabilities in other activities such as marketing, logistics and service. To achieve more advanced development, firms must become more strategic. Greater focus, continuity and discipline are needed if firms are to gain a real competitive advantage… Only through sustained strategies can companies assemble the truly unique skills, build the unique customer franchises, and operate at a level of productivity and innovation necessary to support high wages and profits… Successful economic development is a process of successive upgrading, in which the *business environment in a nation evolves to support and encourage increasingly sophisticated and productive ways of competing*" (WEF, 2000, p. 41-2). Italics in original.

location or competitiveness emerges from the inclusion of corporate strategies and nothing is added to the analysis by including strategic variables. On the contrary, the use of redundant variables is likely to confuse the final assessment. In addition, as discussed later, many strategic variables are based on ambiguous qualitative responses and causal relations, compounding the problem raised by their unnecessary inclusion.

5.4 CONCLUSIONS ON CCI

The foundations of WEF's microeconomic analysis of competitiveness seem very weak. The economic model underlying CCI, simplified as it is, is ignored in implementation. While levels of income are posited to depend on stocks of productive factors and 'technology', neither is measured even roughly. Physical capital is prominent by its absence; human capital is captured by a rather bizarre pair of qualitative variables. Technology only appears in the quantification of company strategy rather than as a measure to capture the sum of scientific, technological and institutional capabilities in a country. A number of other stocks are mentioned but mostly measured by somewhat odd or unsatisfactory measures (on which more below).

The model CCI is really based on comes not from economics but from business strategy: Porter's 'diamond of competitiveness'. This is not as much a theory of competitive production as a collection of anecdotal evidence on the determinants of competitive success strung together by vague ideas on how they are inter-related and measured. While many concepts are similar to those in trade theory (unfairly berated by Porter), they are not analyzed in a rigorous manner to yield testable propositions on the determinants of competitive activity. The stress on company strategy as an independent determinant of competitiveness, rather than a manifestation of factors already covered under other headings, is unnecessary and confusing. The separation of 'current' from 'growth' competitiveness does not appear analytically sound. While there are many elements in the analysis of microeconomic competitiveness that seem sensible, it is not clear that they add up to the comprehensive explanation of the structural foundations of competitiveness. In addition, the index faces further difficulties in terms of how the causal relations are specified and the variables defined and measured.

6. THE ECONOMIC CREATIVITY INDEX (ECI)

The Economic Creativity Index is a new entrant to the WEF's 2000 report, and has a whole chapter devoted to it.[20] The idea of linking innovation with prosperity and measuring national innovative capability was introduced in 1999. The 1999 report had a 'Capacity for Innovation Index' (CAP index) but did not include it in its general competitiveness index. In the 2000 report the Innovative Capacity Index was replaced by the (very different) Economic Creativity Index, which now plays a prominent role in deriving the growth index GCI. The change in the structure and components of the index between 1999 and 2000 is not mentioned in the later report.

The 1999 index drew upon work by Porter and others on an 'Innovation Index' for advanced industrial countries for the US Council on Competitiveness.[21] This Index sought to explain the "ability of a country to produce a stream of commercially relevant innovations", and was a relatively complex exercise, with panel data over 1973-96 for 17 OECD countries. The basic premise of this index was that *domestic innovative capacity* – and not the use of technology created elsewhere – was the most important technological variable in competitiveness. Innovative capacity was measured by patents taken out internationally by each country.

The methodology of the Innovation Index has many similarities with the WEF work but also notable differences. The explanatory variables used were per capita GDP, R&D personnel, R&D spending, openness, strength of intellectual property regimes, GDP share on secondary and tertiary education, R&D share funded by private industry and R&D share performed by universities. Data on variables like 'openness' and intellectual property protection were taken from WEF. As with the WEF approach, the rationale for some variables and causal links is obscure. Per capita GDP is difficult to accept as an explanatory variable, as it is likely to be highly correlated with all technological and skill variables. Many other variables, like R&D personnel and R&D spending, are likely to be highly inter-correlated. Private R&D spending is supposed to capture the strength of local 'clusters' in innovation, but this interpretation is difficult to accept. The same applies to university R&D as a measure of the strength of

[20] 'Economic creativity' by Andrew M. Warner, pp. 28-39, WEF (2000).

[21] See Stern, Porter and Furman (2000) and for a more popular version, Porter and Stern (2000). The latter is available on the Internet at **http://www.compete.org**

technological linkages between research institutions.[22] The variable for skills is unlikely to capture the high level technical skills most relevant to advanced R&D. The relationship between openness and innovation is controversial, depending on the stage of industrial development of the country in question.

The CAP index in the 1999 report is a scaled-down version of the Innovation Index, and also emphasizes the importance of local innovative effort for competitiveness. The WEF derives its main measure of innovativeness from qualitative responses, with top marks given to countries where "companies obtain technology by pioneering their own new products and processes" and the lowest to countries where "companies obtain technology exclusively from foreign countries". The obvious question, of why frontier innovation was important for technological competence in the large number of developing countries in sample, is simply not addressed. Data are also compiled on international patenting in 56 (out of 59) countries in the sample for 1996-98. These are found to have a similar distribution to the qualitative measure of innovativeness. Despite the problems in the underlying reasoning and the causal sequence, the report concludes that "a doubling of patent output would result in a nearly $2000 increase in GDP per capita… In Chile, for example, increasing patent output from 0.6 to 1.2 per million persons could imply a 15% increase in GDP per capita" (WEF, 1999, p. 59). If only all development problems were as easy to solve! Again, note the cavalier use of data and the slackness in the theoretical underpinnings.

In WEF 2000, 'creativity' replaces 'capacity for innovation' and acquires a different meaning. Creativity is now includes not just the ability to generate new technology (similar to the previous year's innovation index) but also the ability to import it from other countries. In a reversal of the earlier argument, WEF suggests that "Nations can link themselves to the global technology engine by being centers of innovation themselves, or by facilitating technology transfer and the rapid diffusion of innovation. Both innovative countries and technology-transfer countries have been successful in the 1990s" (p. 28). While this is certainly more relevant to developing countries, the way in which the ECI is constructed leaves many questions unanswered.

ECI has two components: the Innovation Index and the Technology Transfer Index. The Innovation Index is based on 10 qualitative questions on technology, innovation, resource

[22] The regression analysis used panel data with a three-year time lag. Interestingly, and unlike the WEF procedure, the results of the regression (from a 'preferred model' including per capita income) were used *to assign weights to variables* according to their impact on the dependent.

quality, research collaboration, IPR protection, aggressiveness in absorbing technology and so on. Many of questions are very similar to each other, and many are also confusing and ambiguous (see below on data). The Technology Transfer Index is made up of answers to two questions: 'FDI is a source of technology transfer' and 'Licensing of foreign technology is a common way to get technology'. The final index gives equal importance to both innovation and technology transfer. Thus, a country scores equally highly whether it innovates or imports technology, with the highest score on either counting as its score in creativity.

In other words, a country with little R&D capacity but with heavy reliance on imported technology, like Mexico, which ranks 45th in innovation, comes 12th overall because it ranks fourth in technology transfer. Not only does this reverse the reasoning of the 1999 WEF (and Porter's Innovation Index for the OECD) it also raises analytical issues concerning the relationship between local technological activity and the sustainability and quality of technology imports. It is plausible to argue, for instance, that without strong domestic technological activity, a high level of dependence on foreign technologies will result in limited, shallow or low-level technology transfer and so constrain long-term competitiveness. High dependence on technology transfer, say by FDI, may also limit the growth of domestic R&D capacity, given the propensity of MNCs to keep innovative activity centralized in a few developed economies (Porter, 1990, himself made this argument). Again, we end with rather unsatisfactory rigor, consistency and soundness in the construction of a potentially important index.

7. AMBIGUITIES IN CAUSATION AND ECONOMETRICS

There are many ambiguities in the causal relations put forward by the WEF. The 2000 report does acknowledge (p. 47) that many explanatory variables are likely to be correlated with the dependent (per capita income) without being *its cause*, but then proceeds as if this problem did not exist. Many of the relations it proposes are likely to run the other way around. There is no theoretical reason to expect, for instance, that such variables as 'demanding regulatory standards' and 'stringency of environmental regulations' are the *cause* of higher incomes.

Some proposed causal relations, particularly those dealing with the role of government, are also controversial. WEF generally favors free-market outcomes.[23] Thus, it is assumed that

[23] IMD is more straightforward in its free market ideology and far more simplistic in its reasoning. We can illustrate with some quotations from its 'Principles of World Competitiveness'. "Openness for international economic activities increases a country's economic performance… International investment allocates economic resources more efficiently worldwide… The state intervention on business activities should be minimized apart from creating competitive conditions for enterprises… A

free trade, strong intellectual property protection and liberal capital accounts are all beneficial for growth regardless of income levels. The assumption on the universal benefits of free trade ignores valid infant industry considerations and the role of industrial policy in developing countries (and the substantial literature showing their beneficial effects in the larger 'Tiger economies' of east Asia, see Lall, 1996, Stiglitz, 1996). That on intellectual property protection ignores the well-established argument that newly industrializing countries are likely to lose: they will face higher costs of technology import and also lose a valuable source of technological learning from reverse engineering. The case of liberal capital accounts is particularly weak after the experience of the recent Asian financial crisis (and unexpected in a report that has Sachs as one of the main authors).

The free market bias is found elsewhere in the report. Government spending as a share of GDP, private as well as indirect taxes, union power, and pension benefits are assigned uniformly negative relations to income. The ability of firms to hire and fire workers freely is regarded as uniformly positive for competitiveness: this leads Sweden, Germany and Italy, respectively, to have the worst scores, and Russia one of the highest. Appealing as all this may be to the report's corporate audience, the economic validity of many such propositions is debatable. Nowhere does the WEF mention the possible exceptions, weaknesses, non-linearities and ambiguities.

WEF uses statistical analysis to strengthen its findings, showing the results of bivariate regressions for each of the 64 independent variables in the CCI index on 1999 GDP per capita. It argues that each of the variables is significantly related to the dependent for the whole sample. However, given the ambiguities in the causal relations (and the peculiarities of the data, on which more below), it is difficult to gauge what this actually proves. The results confirm rather than overcome the weaknesses of the underlying model. It is impossible, for a start, to ascertain the direction of causation. For instance, demanding regulatory standards and stringency of environmental regulations are among the variables explaining the most variation in incomes (83% and 82% respectively). 'Buyer sophistication' scores the highest (84%), but is likely to be a product of higher incomes rather than the other way around.

The results of bivariate regressions cannot, in any case, show which variables are the most significant for competitiveness and growth, an important consideration in using indices. Since

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well-developed internationally integrated financial sector in a country supports its international competitiveness." Many of its statements are of dubious analytical rigor, others are amazing banal (the quaint language does not help!).

many variables are highly inter-correlated (in fact they are slight variations on the same measure), they cannot be used together in multiple regression. To overcome this problem, the report uses common factor analysis to compute the 'dominant factor' for the Microeconomic Competitiveness Index. This also does not show which individual factors matter most. The dominant factor captures 70% of the covariance between the variables (p. 48) and is then used as the CCI measure.

Regressing this CCI measure against per capita GDP explains *83.3%* of the variation in the latter. Since this is higher than a similar result in 1999 (82.4%), WEF claims that it is "due to improvements in the model". However, since many of the variables and the causal relations are suspect (the high value of the regression coefficient for a cross-country regression itself makes one doubt the result), it is difficult to place much faith in the robustness of the index. The WEF goes on to use the index to rank countries according to whether they have higher incomes than predicted by their CCI score or lower. Those with higher incomes face the risk that their incomes are 'unsustainable' (like Singapore, USA, Ireland, Italy and Norway). Those with lower than predicted incomes are 'under-performing' relative to their potential (like Finland, Israel, South Africa, India, Turkey and Brazil). Interesting as these extensions of the analysis are, their analytical foundations remain weak. This type of exercise begins to appear more like selling snake oil than serious analytical work.

One more WEF sub-index is worth noting for methodological purposes: the International Index that measures "openness to the global economy". WEF assumes that greater openness in all forms is beneficial for growth for all countries. As noted above, no possible conflicts between growth and trade, investment and capital account liberalization are admitted. This leads to odd results. Thus, a chapter on globalization and international competitiveness observes, "the era of globalization has seen widening global disparities."[24] It attributes this growing dispersion (almost tautologically) to the inability of backward countries to use new technologies, but implies that this inability has nothing to do with the speed of liberalization or with deficiencies in the way technologies are imported and absorbed. Yet there is a significant literature on technological capability building that suggests that the *process* of liberalization can itself retard the absorption and deployment of technology (Lall, 1996). Having ruled out this option, and assuming that free markets are fully efficient, the authors have to conclude that further integration with world markets is all that is needed. To quote,

> "Globalization alone is unlikely to solve the problem of much of the world's poor, yet a reaction against globalization is even less of an answer. Countries can counteract the isolating effects of geography with infrastructure, break local telecommunications monopolies that make access to the Internet prohibitively slow and expensive, ensure proper incentives for innovation to overcome their own specific problems, and leave aside false solutions based on a fear of global integration" (p.27).

While we may agree that developing countries should not to withdraw from the global economy, the conclusions on how they can cope with its demands are so trivial and shallow that one wonders at the analysis supporting them. Even strong proponents of liberalization like the World Bank would not argue that these measures meet the needs of the least developed countries, increasingly facing the risk of marginalization to a technology driven world economy.

8. DATA AND AGGREGATION

Even if the methodology and theory of the WEF are faulty, it would serve a useful function if its contacts in the business world yielded sound new data on important aspects of competitiveness. This section assesses the WEF database and how the variables are aggregated into indices.

WEF covered 59 countries in 2000, compared to IMD's 47. It used a mixture of qualitative data (questionnaire responses) and 'hard' data (from published sources). The qualitative data came from some 4000 respondents in the sample countries, 91% of whom were from the private sector. Of these some 25% were from local affiliates of MNCs and the remainder from the local private sector. This breakdown is important, since the background of the respondents largely determines the soundness and generality of the variables used to construct the competitiveness indices.

Let us start with the number and nature of the variables. WEF 1999 has a chapter describing its methodology but WEF 2000 does not. Since the methodology is essentially unchanged in this period (though the number and framing of questions has changed somewhat), we can rely on the 1999 report for the analysis. In 1999, a total of 173 variables went into the index. They were grouped under nine headings, of which eight were '*factors of competitiveness*' and went

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[24] J. D. Sachs and A. M. Warner, 'Globalization and industrial competitiveness: some broad lessons of the past decade',

into the main competitiveness index, while the remainder was 'supplementary' information on business strategy (Table 1). Most variables (135) were qualitative responses, based on a seven-point scale where the respondent "strongly agrees" or "strongly disagrees" with a statement.

Table 2: Variables in WEF, Global Competitiveness Report 1999 (numbers, sources and weights)

Category of variable	Numbers of variables			Weight in factor		Weight in overall index
'Factors in competitiveness'	Quantitative	Qualitative	Total	Quantitative	Qualitative	
1. Openness	3	10	13	¾	¼	16.7%
2. Government	9	13	22	¾	¼	16.7%
3. Finance	9	15	24	¾	¼	16.7%
4. Infrastructure	5	11	16	¼	¾	11.1%
5. Technology	5	17	22	¼	¾	11.1%
6. Management	-	23	23	0	1	5.5%
7. Labor	7	10	17	¾	¼	16.7%
8. Civil Institutions	-	23	23	0	1	5.5%
Supplementary (business operations and strategy)	-	13	13	-	-	-
Total	38	135	173	-	-	100%

Quantitative variables were assigned different weights from qualitative ones. The former was given higher weight in categories 1, 2, 3 and 7 and lower in 4 and 5 (6 and 8 had no quantitative variables at all). The reasoning was: "Wherever we have both quantitative and survey data available, we tend to give higher weight to the quantitative data… For the rest of the data however, there is often a scarcity of quantitative data, so we rely more heavily on the survey results. Furthermore, there are some aspects of competitiveness that are difficult to quantify, such as management, institutional quality and corruption, where it is preferable to rely on survey data. Therefore, for two factors, management and institutions, we rely entirely on survey data and for two other factors, infrastructure and technology, we give the survey data a weight of ¾" (WEF, 1999, p. 97).

The variables under each heading (factors in competitiveness) were standardized and aggregated to yield a score (or 'factor indices') for each of the eight. The factor indices were assigned different weights to yield the final score for each country. This time the weighting was *a priori* (apparently "based on the economic growth literature", p.98). No econometric methods were used to include, exclude or weight the factors.

WEF (2000), 18-27.

Since qualitative responses (overwhelmingly from local business) are the main foundation of the rankings, it is important to establish their soundness and reliability. Four issues arise here.

- Whether quantitative data are available for issues on which qualitative data are sought; if they are, there must be a strong reason to use the qualitative responses instead.
- Whether statements and questions to which qualitative responses are sought are clear and unambiguous, allowing respondents in different countries to interpret them identically.
- Whether the respondent has sufficient information on the question to provide an answer that allows his/her country's position to be ranked in global terms. If the last two conditions are not met, the resulting ranking may be unreliable.
- Whether the data sought in qualitative responses are repetitive (and so redundant) for the purposes of building an index. If the same information is sought in different forms, it is likely to cloud rather than improve the rankings, since respondents are likely to try and interpret them in different ways.

There are deficiencies on each front. There are many questions on which quantitative data are available but not used; instead, the WEF chooses to rely on qualitative responses. Second, the questions – at least as reported – often appear unclear and confusing. Third, it appears that the respondents do not use the same benchmarks in giving their responses, leading to misleading rankings when assessed against quantitative indicators. In addition, some rankings jump around from one year to the next; when these are for structural factors, where there is no possible reason for such jumps, it reinforces the suspicion that the subjective responses are not soundly based. Finally, many questions are very similar, with the minor variations apt to cloud rather than improve the rankings.

We can illustrate all these points with reference to *technology*, a critical determinants of national competitiveness on which I have been collecting cross-country data. As noted, the Economic Creativity Index has indices for innovation and technology transfer. Let us see how these meet the criteria set out above.

First, the *availability of quantitative data.* The WEF uses eight qualitative questions to arrive at its assessment of local technological effort. These include (apart from one on IPRs):

1. 'Your country is a world leader in technology'

2. ‘Scientific research institutions in your country are world class’
3. ‘The business sector in your country spends heavily on R&D’
4. ‘Companies in your country are aggressive in absorbing technology’
5. ‘Competitive advantages of companies are due to unique products’
6. ‘Companies develop their own products’
7. ‘Product designs are developed locally’

Many of these qualitative questions revolve around the intensity and quality of local business R&D. It is surprising that the report chooses not to use published data that capture these efforts better on a comparable basis. Data on national R&D broken down by the source of finance are available from UNESCO, OECD and national sources. *Enterprise-financed R&D as a proportion of GDP* would be an ideal measure of the intensity of business research effort, easily compared across countries. A possible supplementary measure on the ‘quality’ of R&D would be *scientists and engineers employed in R&D.* None of these are used by WEF.

Second, judging the clarity of the questions from the published version of the report (it is not clear if the questions sent to respondents were different), many seem to be vague and subject to misinterpretation (or to different interpretation by different respondents). For instance, take the question about a country being a ‘*world leader in technology’*. Which technology – that of the respondent’s own industry? In other industries? Across all activities, including services? What does ‘world leader’ mean: leader in market share by sales? In taking out patents? In bringing new products to market? Even given the industry, the technology for which products? Leader over how long? And so on. Or take the question on whether local ‘*scientific institutions are world class’*. Which institutions are included and which excluded? Does the question refer to the average of all institutions, if there is a lot of variability in quality? How is ‘world class’ judged? Or take the fourth question: what does it mean to be *‘aggressive in absorbing technology’* – buying the newest vintage or making efforts to build up local R&D? How is ‘aggressiveness’ to be assessed for a country as a whole? We could go on, but the point is clear: the answers can vary enormously by respondent and context.

Third, and related to the previous point, respondents seem to use different criteria, not just because questions are ambiguous but also because they do not have the same (implicit) benchmark. This is hardly unexpected when most respondents are local executives in

different parts of the world, with different access to information, experience of technology and perspectives on standards. This leads to strange results. For instance, the 1999 report ranks Mauritius ahead of Korea (at 29 and 30 respectively) in the quality of research institutions. To someone who has examined research institutions for industrial technology in both countries (Najmabadi and Lall, 1995, and Lall and Wignaraja, 1997), this is a patently absurd result. There is no doubt that Korean R&D institutions are far in advance of Mauritius (which has hardly any industry related formal R&D outside of university, which is of low research productivity and industrial relevance). More interestingly, the 2000 report switches the ranking around dramatically, ranking Korea 14 places ahead of Mauritius. How can structural rankings change so much in one year, unless the responses were subjective and unreliable?

Fourth, repetitive and redundant questions: it appears that the questions on technology ask for the same information in many slightly different forms. This raises the risk that respondents seek to differentiate their answers without really adding meaningful information. The result may be counterproductive.

In the end, the rankings yielded by this approach may be highly unreliable. We can illustrate by comparing the WEF technology rankings with those yielded by quantitative data, taking the top 40 ranks. Table 3 shows *enterprise innovative effort*, using the Table 7.07 from WEF ('private sector spending on R&D' as measured by responses to question 3 above) and UNESCO, OECD and national data for the quantitative ranks. There are significant differences between the two. Japan leads the quantitative rank for enterprise financed R&D and Switzerland comes fourth; in WEF the positions are exactly reversed. The differences for the Asian Tigers are even more interesting. Korea is 2 on the quantitative rank and 13 for WEF; Taiwan comes 11 and 15, Singapore 19 and 12 and Hong Kong 57 (not shown in the table) and 27. There are in fact very few identical rankings – the only ones are Belgium and South Africa Clearly, when countries pay a great deal of attention to their precise position on the rankings, these differences matter.

Table 3: Innovative effort: comparison of R&D data with WEF R&D rankings

	R&D 1995-97	WEF		R&D 1995-97	WEF
1	Japan	Switzerland	21	Czech Republic	Australia
2	Korea	Finland	22	South Africa	South Africa
3	Sweden	United States	23	Netherlands	Spain
4	Switzerland	Japan	24	New Zealand	Hungary
5	United States	Germany	25	Spain	Vietnam
6	Germany	Sweden	26	Brazil	Egypt
7	Finland	Israel	27	Hungary	Hong Kong
8	France	Netherlands	28	Poland	Italy
9	United Kingdom	France	29	Costa Rica	Brazil
10	Belgium	Belgium	30	Turkey	Costa Rica
11	Taiwan	Denmark	31	Malaysia	New Zealand
12	Denmark	Singapore	32	China	Poland
13	Ireland	Korea	33	India	Malaysia
14	Norway	United Kingdom	34	Greece	China
15	Israel	Taiwan	35	Chile	Turkey
16	Canada	Austria	36	Portugal	Chile
17	Australia	Canada	37	Argentina	Mauritius
18	Austria	Norway	38	Indonesia	Philippines
19	Singapore	Ireland	39	Venezuela	India
20	Italy	Russian Federation	40	Mexico	Greece

R&D data are the latest available from UNESCO and national sources. WEF rankings are from Table 7.07 of the 2000 report, on 'Private sector spending on R&D'. Note that Russia does not appear in the quantitative rankings because no data are available for enterprise financed R&D.

A comparison for *technology transfer* data, another element of the Creativity Index (Table 4) shows even larger differences. Indian businesses, for instance, seem to regard themselves as highly dependent on licensed technology, coming first in the WEF index. However royalty payment data show India to rank 61 (and so absent from the table). Ireland, by contrast, has the highest technology payments per capita but does not perceive itself as relying heavily on technology transfer (ranking 34 according to WEF). No country in the two samples appears in the same position in this table.

The same point could be made for other variables on which quantitative data are available, but there is no need to belabor the point. It is evident that some or much of the information used by WEF to construct indices is unreliable. While business perceptions may be a valuable source of data, they are difficult to use in cross-country comparisons where respondents' perceptions, norms and information differ widely. At the end of a long and convoluted process of eliciting impressionistic information, ranking countries by various (and unclear) criteria, and building indices based on these rankings, it is not clear exactly what the final result shows. Certainly, the impression given in the WEF reports of great precision and rigor, reinforced by statistical tests, is unwarranted. There is little basis for the magisterial pronouncements on the rising or declining competitiveness of individual countries. The

constant 'improvements' to the index by the addition of new variables and indices are of dubious value unless the base of data is improved.

Table 4: Technology transfer: comparison of royalty data with WEF rankings of licensing

	Royalties etc. per capita	WEF		Royalties etc. per capita	WEF
1	Ireland	India	21	France	Germany
2	Singapore	Turkey	22	United States	Indonesia
3	Netherlands	Singapore	23	Israel	Egypt
4	Hong Kong	Australia	24	Portugal	Hungary
5	Switzerland	Japan	25	Hungary	New Zealand
6	Malaysia	Spain	26	Italy	Czech Republic
7	Belgium	Portugal	27	Thailand	Finland
8	Sweden	Netherlands	28	Argentina	Chile
9	United Kingdom	Taiwan	29	Czech Republic	France
10	Austria	Canada	30	Denmark	Belgium
11	Finland	South Africa	31	Brazil	United Kingdom
12	Norway	Brazil	32	Egypt	Italy
13	Japan	Hong Kong	33	Costa Rica	Austria
14	New Zealand	Mexico	34	Ecuador	Ireland
15	Canada	Malaysia	35	Greece	Greece
16	Taiwan	Thailand	36	Mexico	United States
17	Germany	Korea	37	Poland	Norway
18	Australia	Philippines	38	Indonesia	Zimbabwe
19	Korea	Israel	39	South Africa	Denmark
20	Spain	Switzerland	40	Chile	Argentina

Royalties and technical fees are for latest available year from the International Monetary Fund and national sources. WEF ranks are from Table 7.08 of the 2000 report, based on responses to the question 'Licensing of foreign technology is a common means to acquire new technology'.

9. CONCLUSIONS

'National competitiveness' has a powerful hold on the imagination of policy makers and businessmen. While professional economists are often skeptical of the concept, this seems misplaced. Once the possibility of market and institutional failures is admitted, there is a legitimate role for analysis and policy recommendations to overcome them in areas in which economies do compete with each other. Economists constantly work on issues related to competitiveness – investment, skills, innovation, clusters, information, competition policy and so on – but do not integrate it under the label of 'competitiveness'. If such integration could be accomplished in a coherent and practically useful manner, there would be a flourishing branch of the discipline under this name. However, in this paper we have not sought to establish whether this is possible, only that it is analytically valid.

Economists are also skeptical of attempts to quantify competitiveness in the form of national indices covering all aspects of performance. While the benchmarking of national performance can be very useful if done carefully (and there is certainly a large market for such benchmarks), this skepticism seems more justified, at least as far as the leading indices are

concerned. Our examination of the WEF index shows that several analytical, methodological and quantitative weaknesses reduce its reliability as a tool of analysis. Moreover, the way it is presented does not make the audience aware of its assumptions and limitations; on the contrary, it gives an impression of precision and robustness that is quite unjustified. The WEF report does contain some useful material – the chapters dealing with current issues are particularly good and business perceptions of some items may be relevant for policy. However, on the whole its shaky base of theory and data means that the indices do not merit the attention and concern with which they are greeted.

At the most general level, the index suffers from two faults. The first is its underlying assumption that most markets are efficient and policies must be 'market friendly'. This removes from the analysis a large and important set of issues, particularly in developing countries, where market failures call for selective and strategic responses. Second, it defines 'competitiveness' in a general way (per capita incomes) that take it away from the analysis of direct competition between countries and into the sphere of growth and productivity analysis. It does not seem that its approach gives it any advantage over the economic analysis of these phenomena; on the contrary, it makes it look fuzzy and confused.

Even given its chosen approach, there are problems with the specification of the model, the choice of variables, the identification of causal relations and the collection and use of data. Current competitiveness should be accounted for mainly by stock variables, but WEF makes no attempt to examine the relevant stocks. Almost all its variables are flows (or rather, perceptions of the flows) based on the analytical framework of the Porter 'diamond of competitiveness'. This framework suffers from vagueness and imprecision, in particular in the way it mixes corporate strategy with economic variables. The causal relations between the independent and dependent variables are very unclear, and many non-linear or controversial relationships are excluded or left unexplored. The plethora of explanatory variables, many apparently repetitive or irrelevant, does not add to the real explanatory power of the index. Many relations that may go against the market efficiency premise are ignored. The use of bivariate regressions to demonstrate the statistical power of the analysis is misleading. Possible exceptions and non-linear relations are excluded from the investigation.

The strong point of the WEF analysis is its emphasis on structural micro-level conditions as a vital determinant of competitive performance. It is becoming clear that getting the macroeconomic situation right (the standard IMF prescription) is unlikely by itself to promote sustained growth. It is vital to improve the economic structure and also the way in which

economies insert themselves in the global market and technology flows. This can often require extensive policy intervention (Stein, 2000) and has done so through history (Reinert, 1995). Certainly it needs far more than the surprisingly insipid conclusion from WEF quoted earlier on least developed countries coping with globalization.

The data used to generate the indices, held up as one of the major strengths of WEF, are of dubious provenance. While it is true that many relevant pieces of information cannot be quantified, it is surprising that those that can are not. The extensive use of responses from businesses across the world conceals many ambiguities and weaknesses. These questions are posed in an ambiguous manner and relate to questionable hypotheses. They are combined into indices at various levels using weights that are difficult to justify. The resulting indices are presented as magisterial pronouncements on various aspects of performance. They are subjected to statistical analysis to prove their validity and to provide insights into sustainability, under-performance and so on and so to provide policy makers with further guidance on areas of competitive weakness. This impressive pyramid of analysis and results rests on a rather small, inadequate and often suspect base.

There *is* a real need for sound benchmarking of countries' competitive capabilities, and it is important that other institutions undertake this effort. The effort should be more modest – it can certainly be more rigorous and balanced.

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Table 1: Competitive rankings by IMD and WEF for 2000

	IMD Competitiveness index	WEF Current competitiveness index	WEF growth competitiveness index
USA	1	2	1
Singapore	2	9	2
Finland	3	1	6
Netherlands	4	4	4
Switzerland	5	5	10
Luxembourg	6	N/A	3
Ireland	7	22	5
Germany	8	3	15
Sweden	9	7	13
Iceland	10	17	24
Canada	11	11	7
Denmark	12	6	14
Australia	13	10	12
Hong Kong	14	16	8
UK	15	8	9
Norway	16	20	16
Japan	17	14	21
Austria	18	13	18
France	19	15	22
Belgium	20	12	17
N Zealand	21	19	20
Taiwan	22	21	11
Israel	23	18	19
Spain	24	23	27
Malaysia	25	30	25
Chile	26	26	28
Hungary	27	32	26
Korea	28	27	29
Portugal	29	28	23
Italy	30	24	30

Sources: WEF (2000) and IMD (2000).

Table 2: Variables in WEF, Global Competitiveness Report 1999 (numbers, sources and weights)

Category of variable	Numbers of variables			Weight in factor		Weight in overall index
'Factors in competitiveness'	Quantitative	Qualitative	Total	Quantitative	Qualitative	
1. Openness	3	10	13	¾	¼	16.7%
2. Government	9	13	22	¾	¼	16.7%
3. Finance	9	15	24	¾	¼	16.7%
4. Infrastructure	5	11	16	¼	¾	11.1%
5. Technology	5	17	22	¼	¾	11.1%
6. Management	-	23	23	0	1	5.5%
7. Labor	7	10	17	¾	¼	16.7%
8. Civil Institutions	-	23	23	0	1	5.5%
Supplementary (business operations and strategy)	-	13	13	-	-	-
Total	38	135	173	-	-	100%

Table 3: Innovative effort: comparison of R&D financed by productive enterprises with WEF rankings

	R&D 1995-97	WEF		R&D 1995-97	WEF
1	Japan	Switzerland	21	Czech Republic	Australia
2	Korea	Finland	22	South Africa	South Africa
3	Sweden	United States	23	Netherlands	Spain
4	Switzerland	Japan	24	New Zealand	Hungary
5	United States	Germany	25	Spain	Vietnam
6	Germany	Sweden	26	Brazil	Egypt
7	Finland	Israel	27	Hungary	Hong Kong
8	France	Netherlands	28	Poland	Italy
9	United Kingdom	France	29	Costa Rica	Brazil
10	Belgium	Belgium	30	Turkey	Costa Rica
11	Taiwan	Denmark	31	Malaysia	New Zealand
12	Denmark	Singapore	32	China	Poland
13	Ireland	Korea	33	India	Malaysia
14	Norway	United Kingdom	34	Greece	China
15	Israel	Taiwan	35	Chile	Turkey
16	Canada	Austria	36	Portugal	Chile
17	Australia	Canada	37	Argentina	Mauritius
18	Austria	Norway	38	Indonesia	Philippines
19	Singapore	Ireland	39	Venezuela	India
20	Italy	Russian Federation	40	Mexico	Greece

R&D data are the latest available from UNESCO and national sources. WEF rankings are from Table 7.07 of the 2000 report, on 'Private sector spending on R&D'. Note that Russia does not appear in the quantitative rankings because no data are available for enterprise financed R&D.

Table 4: Technology transfer: comparison of royalties and fees paid abroad per capita and WEF rankings

	Royalties etc. per capita	WEF		Royalties etc. per capita	WEF
1	Ireland	India	21	France	Germany
2	Singapore	Turkey	22	United States	Indonesia
3	Netherlands	Singapore	23	Israel	Egypt
4	Hong Kong	Australia	24	Portugal	Hungary
5	Switzerland	Japan	25	Hungary	New Zealand
6	Malaysia	Spain	26	Italy	Czech Republic
7	Belgium	Portugal	27	Thailand	Finland
8	Sweden	Netherlands	28	Argentina	Chile
9	United Kingdom	Taiwan	29	Czech Republic	France
10	Austria	Canada	30	Denmark	Belgium
11	Finland	South Africa	31	Brazil	United Kingdom
12	Norway	Brazil	32	Egypt	Italy
13	Japan	Hong Kong	33	Costa Rica	Austria
14	New Zealand	Mexico	34	Ecuador	Ireland
15	Canada	Malaysia	35	Greece	Greece
16	Taiwan	Thailand	36	Mexico	United States
17	Germany	Korea	37	Poland	Norway
18	Australia	Philippines	38	Indonesia	Zimbabwe
19	Korea	Israel	39	South Africa	Denmark
20	Spain	Switzerland	40	Chile	Argentina

Royalties and technical fees are for latest available year from IMF and national sources. WEF ranks are from Table 7.08 of the 2000 report, and are based on responses to ‘Licensing of foreign technology is a common means to acquire new technology’.