Trade and Development Index

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1. INTRODUCTION[1]

All economies are increasingly open in today's economic environment of globalization. Trade plays a vital role in shaping economic and social performance and prospects of countries around the world, especially those of developing countries. No country has grown without trade. However, the contribution of trade to development depends a great deal on the context in which it works and the objectives it serves. In recent decades, a number of developing countries, most notably the East Asian newly industrializing countries, have been able to purposefully use the elemental force of trade to boost growth and development within a relatively short time span. At the same time many other developing countries, especially the least developed countries (LDCs), have embarked on unilateral trade liberalization in recent years, with very limited results at best in terms of increased growth and development.[2]

To act as an engine of development, trade must lead to steady improvements in human conditions by expanding the range of people's choice, a notion that the concept of human development[3] tries to capture. From this standpoint, the trade and development performance of a country cannot be seen as the mere sum of its economic growth and export performance. Instead, it is a composite notion, reflecting how trade relates to the range of choices available to people in a country at a particular point in time. The extent of such choice, in turn, depends much on the interplay among factors that determine both trade outcomes and human development outcomes. The trade and development index (TDI) provides a quantitative indication of the trade and development performance of countries by systematically accounting for the interactions among factors governing these outcomes.

The TDI considers three sets of determinants of trade and human development, namely (a) structural and institutional factors; (b) trade policies and processes; and (c) level of development. This framework, by systematically accounting for the linkages of these determinants and their constituent elements, aims to serve as a monitoring mechanism of trade and development performance of developing countries, a diagnostic device to identify factors affecting such performance, and a policy tool to help stimulate and promote national and international policies and measures with a view to keeping trade focused on development and poverty reduction.

Exploring these linkages is desirable for a number of reasons:

- It is important to consider trade as a means to its ultimate goal, namely the well-being of people. Conventional technical analyses of trade performance of developing countries are for the most part preoccupied with trade trends and liberalization policies, and often overlook the real object of trade and growth.
- Development strategies pursued by countries affect the interaction among the factors defining trade and development performance. It is therefore necessary to shed light on how best such strategies can be designed to enhance trade and development performance.
- Trade negotiations have far-reaching implications for the range of choices which people can have by affecting their access to goods, services and opportunities. Outcomes of these negotiations need to be judged against their contribution to human development.
- In recent years, some developing countries have made significant gains in trade and development, while many others, especially LDCs, are struggling to keep up. It is necessary to keep the spotlight on the constraints faced by countries that have performed poorly, and also to maintain a focus on the need to employ trade in the service of human development in countries that have been more successful.

- The Millennium Development Goals and the 2005 World Summit, by highlighting the role of trade in development, have added to the urgency of examining trade and human development linkages.

In addition to the construction of the trade and development index for developing countries, similar indices were prepared for two other groups of countries: developed countries of the OECD, and the 10 newly acceding countries of the EU (EU 10).[4] The OECD index will serve as the long-term trade and development benchmark for developing countries. The EU 10 countries are at an intermediate stage between developed and developing countries and are in the process of integrating into a highly developed grouping. Their trade and development index will serve as the medium- to longer-term benchmark for developing countries against which progress in trade and development preference will be assessed.

In all, 110 countries are included in the present analysis, of which 72 are developing countries according to UN classification,[5] which includes 17 LDCs. The rest includes OECD developed countries, EU 10 and South-Eastern European and CIS countries. The scarcity of a comparable data set precluded the computation of TDI for a number of countries. In future work, emphasis will be given to increasing country coverage.

2. THE TDI AND BENCHMARKS: CONCEPTS, METHODOLOGY AND CONSTRUCTION

2.1 The conceptual and methodological approach to the TDI

As indicated above, the constituent elements of TDI are grouped under three broad sets of determinants which will be referred to as *dimensions*: structural and institutional (SI); trade policies and processes (TP); and level of development (LD). The relationships among these dimensions, which themselves are composed of a number of *components*, are complex, mutually interacting and multi-directional, so that each of the components is both a cause of change in others and an outcome of the influences of the latter.[6] Finally, these components are composed of a set of *indicators*.

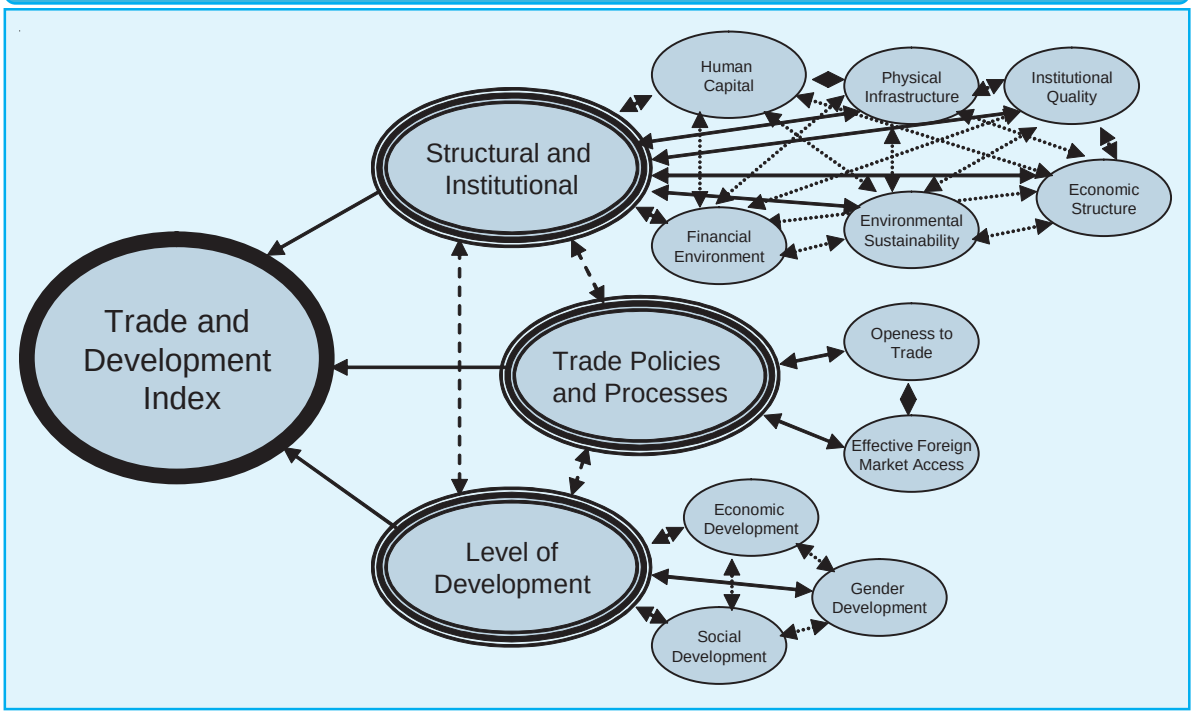
Figure 1.1 presents the conceptual framework of the TDI. The three broad dimensions of the TDI comprise 11 components, which in turn are composed of 29 indicators. In constructing the TDI, the indicators are aggregated to form the respective components. *The weighted sum of the components is the TDI*. The choice of indicators is taken up below. It is not easy to capture the interactions among the constituent parts of TDI in a single numerical figure. The choice of indicators and methodology assumes special significance in this regard.

2.2 Selection of indicators

A description of the indicators under the different components of the three dimensions, as well as the criteria for their retention and their use, is provided below. Attention was paid to data coverage in terms of both number of countries and time period. Cross-country significance and widespread acceptability were also considered. As noted above, lack of availability of data has restricted choice of indicators as well as coverage of countries in our analysis.[7]

What factors go into the complex interplay of trade and human development? This question was posed while selecting the indicators. For example, structural and institutional environment, by affecting supply capacity, has a key role in determin-

Figure 1.1. Conceptual framework of the TDI



ing the range of choices. Access to imports influences the range of choices by increasing the quantity and variety of goods and services that consumers can acquire[8] and making available intermediate goods that firms can use as inputs in the production of final goods.[9] Extensive access to international markets, in its turn, can act as a catalyst for building supply capacity, on the one hand, and improve affordability of imports, on the other.

While such general notions of interrelationships among the components of TDI are useful, they alone do not constitute a sound basis for selecting the indicators. An extensive literature survey was therefore conducted to select possible candidates for inclusion in the TDI framework. Regression analyses were carried out using a generalized linear model to find coefficients of these candidate indicators capturing the strength of their relationship with a combined index made up of Human Development Index (HDI) and Gender Development Index (GDI), which served as a screening device. All retained components are positively and significantly related[10] to the combined index. It was possible that a number of indicators could be highly correlated. To remove possible redundancy caused by it, bivariate analysis was carried out.

To allow for increasing data coverage of indicators chosen in this analysis, and to control for possible yearly volatility that can be observed for some, indicators were constructed on a three-year average between 2000 and 2002. This also serves to capture, although only partly, possible lag effects in the interaction among the various dimensions and their constituents as well as possible cyclical variations.

The selection process yielded the following indicators:

(a) Components of structural and institutional dimension (SI)

Human capital (HC): Human capital plays an essential role in economic growth and development.[11] Two dimensions of human capital are considered here: health and education. Health is a key component of human capital and is expected to be positively related to labour productivity, as better health should lead to higher

Box 1.1. An empirical note on TDI components

The table below presents empirical results showing some degree of interdependence among the components of the trade and development index. Results are discussed extensively in Basu and Fugazza (2005, forthcoming).

The authors investigated the relationship between an index made up of the Human Development Index and the Gender Development Index and the nine indicators included in the SI and the TP dimensions.

Regressions are run in the Generalized Linear Models framework. More specifically, the probability function is binomial and the canonical link function is logit. Results are summarized in table B1.1:

Table B1.1. Regression results

Dependent variable is the combined index made up of HDI and GDI	
	Coefficient
Human capital	0.617**
	(0.287)
Physical infrastructure	0.680**
	(0.327)
Financial environment	0.419*
	(0.148)
Institutional quality	0.513**
	(0.226)
Environmental sustainability	0.940*
	(0.266)
Economic structure	0.668*
	(0.201)
Openness to trade	0.809*
	(0.326)
Market access	0.379**
	(0.194)
Constant	-3.009*
	(0.317)
Observations	110
Statistics	ML=-47.285 BIC=133.391 AIC=1.014

Note: (a) The independent variables are in the form of indices. Standard errors are reported in parentheses.
(b) * significant at 1% and ** significant at 5%.

Results indicate that all indicators included in the SI and TP dimensions are positively and significantly related to the combined index of HDI and GDI. The inclusion of interaction effects is also considered. However, coefficients values for direct effects are only slightly affected and the overall explanatory power increases only modestly.

output performance.[12] Education also has been found to play a major role in enhancing labour productivity and eventually the economic growth of a country.[13] Skilled manpower eases resource constraints, makes productive capacities efficient, and thereby increases productivity. In addition, better health conditions and higher education are generally associated with higher social and human development. Health expenditure per capita and expenditure per student are used as indicators of human capital. As data coverage for expenditure on education tends to be relatively poor, included information may not perfectly correspond to the period under consideration for all countries.

Physical infrastructure (PI): Availability of physical infrastructure is of paramount importance for the productive capacity of an economy. Two aspects are considered: transportation and information and communication technology (ICT).[14] The expansion of efficient transportation facilities also encourages growth prospects.[15] Moreover, it contributes positively to a country's export performance by providing faster, cheaper access to international markets. It is well known that many developing countries cannot achieve their full potential for trade expansion because of insufficient and poor availability of physical infrastructure that impedes their ability to benefit from globalization.[16] There is also an extensive empirical literature[17] indicating the importance of transport infrastructure in determining trade performance.

Selected indicators to reflect transportation conditions are the percentage of paved roads in total roads, and airfreight. Although expenditure on transport infrastructure could be a more appropriate indicator, and so could docks, containers, harbours and other parts of the shipping infrastructure, data availability and country coverage restrict their inclusion in the present analysis.

Information and communications technologies also have considerable potential to promote trade and economic growth.[18] They can foster innovation and as such contribute to the improvement of factor productivity. Efficient ICT activities related infrastructure would make it possible to substantially reduce transaction costs.[19] ICTs are recognized as being able to bring important gains in employment in developing countries especially if made available to small and medium-sized enterprises.

Number of telephone mainlines per 1,000 population is chosen as the indicator to reflect ICT infrastructure. This indicator is likely to capture the access to and the use of ICT facilities, although imperfectly. Other indicators, such as ICT expenditure, could have been more appropriate but have poor data coverage.[20]

Financial environment (FE): The functioning of financial markets significantly affects economic growth,[21] including by determining how businesses raise and manage funds. Not only is credit[22] required in order to finance working capital and investment in fixed capital, but it is also an important means for smoothing consumption. The credit market, if not functioning properly, may fail to direct available funds/savings to where they can be invested most efficiently or used to respond to temporary adverse situations faced by economic agents. As a consequence, credit rationing could negatively affect not only economic development prospects but also social and human development ones. Recent empirical work[23] shows that countries with better-developed financial intermediaries experience faster declines in measures of both poverty and income inequality. Eventually, access to credit enlarges the set of economic choices.

To capture the functioning of the financial system, the ratio of domestic credit to the private sector to GDP was selected as an indicator.[24] This indicator does not capture financial activities in the informal sector, which could be an important source of finance in developing economies and important vehicles for social and human development. However, informal financial activities could also be the consequence of credit rationing that would be associated with low values of the selected indicator.

Institutional quality (IQ): The main focus here is to identify indicators to assess public administration quality and government effectiveness. Since North's seminal research[25] on institutions, policymakers and international institutions, including the United Nations, have started underlining the importance of good practices, and the good governance agenda worldwide. Good institutions are the key to better economic performance. A burgeoning literature has shown that trade in general, and trade liberalization episodes in particular, would be positively related to eco-

nomic growth and eventually to human development only within a good institutional environment.[26] Good institutions also positively contribute to the establishment of a favourable environment for "doing business".[27] The latter is expected to enhance domestic supply capacity through, for instance, technological and know-how transfer.[28]

Bureaucratic quality and corruption are the two indicators (perception-based) that are included to reflect institutional quality. Greater bureaucratic quality and transparency are expected to facilitate economic interactions and then affect positively the productive potential of the economy. Indeed, one of the critical elements of good governance is enhancing of the rule of law including the protection of property rights.[29]

Economic structure (ET): The economic structure of a country can be seen as an indicator of its economic development. This relationship is clearly established in the Rostow-Kuznets theory of stages of growth. On the other hand, this relationship does not clearly appear in neoclassical growth and endogenous growth models. Nevertheless, independently of the underlying mechanism of economic development, developed countries and more advanced developing countries appear to be characterized by low shares of agriculture in GDP relative to that of manufactures and services.

The relationship between trade and development is likely to be conditional upon the structure of the economy concerned. In turn, trade and trade liberalization are also expected to affect the economic structure. It is therefore important to capture a measure of economic structure in the construction of the TDI. Using a somewhat backhanded approach, the indicator chosen to reflect the economic structure is the share of agriculture in total GDP.

Environment sustainability (ES): There is extensive evidence that intense productive activity can pose a risk to the environment, especially at the early stages of economic development.[30] The degradation of environmental conditions may lead to the deterioration of health conditions and as a consequence would affect human development. Poor environmental conditions could then hamper further economic development.[31] Similarly, the human health and development outcome is greatly influenced because of the environment in which people live.

Three indicators have been selected, which should capture the link between environment and human development. The first two indicators are (a) access to an improved water source as indicated by the percentage of the population with reasonable access to an adequate amount of water from an improved source, and (b) access to improved sanitation facilities as indicated by the percentage of the population with at least adequate access to excreta disposal facilities (private or shared but not public) that can effectively prevent human, animal, and insect contact with excreta. The third indicator is the use of energy per unit of GDP in PPP terms.

(b) Components of the trade policies and processes dimension (TP)

This dimension includes a country's own trade openness and market access abroad.

Openness to trade (OT): Trade openness measures will eventually determine the degree of foreign goods' penetration of the domestic economy. It is generally accepted that in the longer term trade liberalization is a pro-development policy (in the absence of externalities or market failures), although rapid liberalization may cause short-medium-term adjustment problems (see Chapter 3). Apart from the so-called optimal tariff, protection may also be motivated by the desire to promote infant industries, and may also be associated with positive externalities, but this needs some qualification, as suggested by practical cases. In particular, there is

theoretical and empirical evidence of the anti-export bias of import restrictions. Therefore, there may be an important difference between the short- and long-term impacts of liberalization. It is also recognized that some country-specific context may generate better results in a given time frame with higher trade barriers, as trade outcomes may reveal.

Two aspects are considered: tariff barriers and non-tariff barriers (NTBs). Three indicators are selected to reflect the former: applied trade-weighted average tariff, the share of tariff lines with national peaks and the share of lines with international peaks. Trade-weighted average tariff based on applied rate accounts for the preferences granted to trade partner countries. The share of lines with national and international peaks can be seen as an indicator of industrial policy, in the sense that it shows, although imperfectly, the extent to which government intervenes in international policy to protect specific sectors. Non-tariff barriers are assumed to be reflected in the share of lines with specific tariffs. This is a rather imperfect indicator of non-tariff barriers, but it remains the best proxy when considering availability and quantitative tractability of data on specific NTBs. NTBs, though increasingly becoming important protective measures in the face of tariff elimination and reductions, are still in the primitive stage in terms of classification and quantification, and their available data are sparse and not comprehensive enough to allow for the calculation of any consistent and comparable indicators.[32] Here the choice of indicator is the share of tariff lines with specific tariff rates drawn from a more comprehensive tariff database. A specific tariff rate, as opposed to an ad valorem rate, has a built-in effect of restricting less costly imports by applying, de facto, higher ad valorem rates to them.

Effective access to foreign markets (MA): Access to foreign markets is an important component of export performance.[33] However, good market access defined as low trade barriers in destination markets may not be sufficient in terms of the export performance of receiving countries. In that context, an attempt is made to define a possible measure of effective access to foreign markets. This measure is a combination of trade barriers faced in destination markets and of the structure of the export sector of the receiving country.

The respective indicators used to capture trade barriers mirror those used for trade openness. For instance, the trade-weighted average tariff that any country faces on international markets corresponds to the trade weighted average imposed by its trade partners. The share of the manufacturing exports in total merchandise exports and a standard index of export concentration capture the export sector structure.

A recent World Bank research paper attempted to compute measures of openness to trade and access to foreign markets that also include non-tariff barriers.[34] Their indices have also been considered for a robustness check. Quantitative results are only slightly modified and qualitative considerations remain the same.

(c) Components of level of development dimension (LD)

To reflect the level of development, the present analysis includes three different components, namely economic development, social development and gender development. These are captured using five indicators.

Economic development (ED) is reflected in GDP per capita in PPP terms. *Social development (SD)* is represented by an index combining adult literacy, gross school enrolment ratio and life expectancy at birth.[35] The education and health improvements are considered to be a fundamental requirement for increasing the quality of life. *Gender development (GD)* is represented by the UNDP Gender Development Index (GDI).[36]

Geographical considerations[37] are not included in our benchmarks essentially because of the absence of a consensual indicator of geography. Moreover, the role and the importance of geography in economic performance and development is intensively debated. Rather, geographical considerations will be used to qualify our results whenever relevant.

2.3 *Computational approach*

The selection of an appropriate methodology is central to any exercise attempting to reflect the interaction of the indicators such as in a system of TDI aggregation. Therefore, a review was undertaken of the available methodologies of construction of indices by a number of UN system organizations.

While these methodologies are well suited to the purposes for which they are employed, they are not designed to account for interactions among the constituents of an index like the TDI. Therefore, alternative methodologies were explored and eventually it was decided to follow the pathways laid by the Nagar-Basu methodology to construct the TDI as a weighted sum of a normalized version of the identified components, where respective weights are the outcome of multivariate statistical analysis of principal components.

Box 1.2. A short survey of three indices

This box presents three important indices developed by organizations of the UN system.

UNCTAD ICT development index: This index aims to evaluate the average achievements in a country in three dimensions: (a) Connectivity is measured by the number of telephone mainlines per capita, the number of mobile subscribers per capita, the number of Internet hosts per capita and the number of PCs per capita. (b) Access is measured by the number of estimated Internet users, the adult literacy rate, the cost of a local call and GDP per capita (PPP). (c) Policy is measured by the presence of Internet exchanges, the levels of competition in local loop telecom and the domestic long distance, and the level of competition in the Internet service provider market.

An index score is computed for each of these indicators of three dimensions with the following methodology:

$$\text{Index score} = \frac{\text{Value} - \text{Minimum}}{\text{Maximum} - \text{Minimum}}$$

It postulates that the minimum value achieved is zero for most of the indicators, and so the index scores amount to a percentage of maximum values:

$$\text{Index score} = \frac{\text{Value} - 0}{\text{Maximum} - 0} = \frac{\text{Value}}{\text{Maximum}}$$

Individual components index scores are averaged over the corresponding dimensions to obtain three indices of connectivity, access and policy. Finally, the Index of ICT Diffusion is computed as an average of the score of these three indices.

UNDP human development index (HDI)*:* The human development index (HDI) includes three following indicators: GDP per capita (PPP); adult literacy rate (with two-thirds weight) and the combined primary, secondary and tertiary gross enrolment ratio (with one-third weight); and life expectancy at birth. This method normalizes the indicators against the following minimum and maximum levels: 25 to 85 years for life expectancy; 0%- 100% for adult literacy rate; 0% to 100% for enrolment rate at all education levels; and US$ 100 to US$ 40,000 for GDP per capita.

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(Box 1.2, cont'd.)

Each HDI index is computed according to the general formula:

$$\text{Index}_{ij} = \frac{X_{ij} - \underset{k}{\text{Minimum}}\, X_{ik}}{\underset{k}{\text{Maximum}}\, X_{ik} - \underset{k}{\text{Minimum}}\, X_{ik}},\ i: \textit{indicator},\ j: \textit{country}, k: \textit{specific value}$$

Finally, HDI is computed by averaging the values of all these different indices:

$$HDI_j = \frac{1}{n}\sum_{i=1}^{n} Index_{ij}$$

UNIDO competitive industrial performance (CIP) index: This index benchmarks a set of industrial performance and capability indicators and subsequently ranks countries. UNIDO computes the "Competitive industrial Performance (CIP) index" on the basis of four components, namely, manufacturing value added (MVA) per capita; manufactured exports per capita; industrialization intensity (simple average of the share of MVA in GDP and the share of medium and high-technology (MHT) activities in MVA); export quality (simple average of the share of manufactured exports in total exports and the share of MHT products in manufactured exports).

Following the standard normalisation procedure, the individual indices for each of the components are obtained as follows,

$$I_{ij} = \frac{X_{ij} - \text{Minimum}\, X_{ik}}{\text{Maximum}\, X_{ik} - \text{Minimum}\, X_{ik}}$$

where X_{ij} is the j-th country value of the i-th performance component. The normalization yields on 1 to 0 score, where 1 is the best and 0 is the worst in terms of the specific component.

The indices of four components are combined to arrive at a single index for each of the countries through the following formula:

$$CIP_j(\alpha) = \left\{\frac{W_1 I^{\alpha}_{1,j} + W_2 I^{\alpha}_{2,j} + W_3 I^{\alpha}_{3,j} + W_4 I^{\alpha}_{4,j}}{W_1 + W_2 + W_3 + W_4}\right\}^{\frac{1}{\alpha}}$$

where W_j are the weights given to the individual indices and α is a parameter to control how variations and weights of the individual indices affect the CIP index.

Finally, α is assumed to be unity, and the CIP index expressed by the following formula:

$$CIP_j = CIP_j(1) = \frac{1}{4}\sum_{i=1}^{4} I_{ij}$$

The main reason for employing principal components analysis is that it makes it possible to define a synthetic measure that is able to capture interactions and interdependence between the selected set of indicators making up the TDI. These indicators are called causal variables, while TDI is the explained variable. While standard regression techniques require the explained/dependent variable to be observed, principal component analysis treats the latter as a latent variable. Principal component constitutes a canonical form and helps to understand both the individual contribution of each of the indicators to the TDI and their aggregate contribution. An attractive feature of this methodology is that it permits calculation of statistical weights of the various components of TDI for the sample that thereby identifies what drive the results. A brief technical description of the methodology is presented in box 1.3.

Box 1.3. Constructing the trade and development index: The statistical approach

Principal components analysis (PCA) is a multivariate statistical approach that essentially transforms a set of correlated variables into a set of uncorrelated variables, termed components. The uncorrelated components are linear combinations of the original variables. PCA has in practice been used to reduce the dimensionality problems, and to transform interdependent coordinates into significant and independent ones. This justifies the approach adopted to construct the TDI. For a more comprehensive presentation of the approach we refer the reader to Nagar and Basu (2002). An application of this methodology is provided in Klein and Ozmucur (2002/2003).

The Nagar-Basu (2002) methodology is used to estimate the TDI. Principal components (PC) are used as linear combinations of the indicators selected to compose the TDI. They have special statistical properties in terms of variances. The first PC is the linear combination that accounts for the maximum variance of the original indicators. The second PC accounts for the maximum variation of the remaining variance, and so on. Maximizing variances helps to maximize information involved among the set of indicators, and hence as appropriate a weighting scheme is employed.

The TDI is an abstract conceptual variable and is supposed to be linearly dependent on a set of observable components plus a disturbance term capturing error.

Let $TDI = \alpha + \beta_1 X_1 + ... + \beta_{11} X_{11} + e$ (1)

where $X_1, X_2, ...X_{11}$ is a set of components of the TDI. The total variation in the TDI is composed of two orthogonal parts: (a) variation due to set of proposed components, and (b) variation due to error.

Components are all individually normalized by subtracting the minimum value of the particular component from its actual value and dividing it by the range, which is the difference between the maximum and minimum value of the selected components.

So, for component i for a country j is shown below:

$$C_{ij} = \left(\frac{\text{actual value}_{ij} - \underset{k}{\text{Minimum value}_{ik}}}{\underset{k}{\text{Maximum value}_{ik}} - \underset{k}{\text{Minimum value}_{ik}}} \right), \quad i: component, \; j: country, \; k: specific\ value \qquad (2)$$

When necessary, raw data have been transformed such that normalized values equal to unity correspond to the best situation in the sample.

Correlation matrix R is computed from standardized indicators, followed by solving the determinantal equation $|R - \lambda I| = 0$ for λ where R is a $11x11$ matrix; this provides a 11^{th} degree polynomial equation in λ and hence K roots. These roots are called eigenvalues of correlation matrix R.

Next λ is arranged in descending order of magnitude, as $\lambda_1 \rangle \lambda_2 \rangle ..... \rangle \lambda_{11}$. Corresponding to each value of λ, the matrix equation $(R - \lambda I)\alpha = 0$ is solved for the $11x1$ eigenvectors α, subject to the condition that $\alpha'\alpha = 1$ (normalization condition).

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(Box 1.3, cont'd.)

The TDI is estimated as weighted average of 11 principal components, where the weights are the eigenvalues of the correlation matrix R, and it is known that

$$\lambda_1 = \text{var}\, P_1 (\text{first PC}), \lambda_2 = \text{var}\, P_2 = ...\lambda_{11} = \text{var}\, P_{11} \qquad (3)$$

Thus, the trade and development index is:

$$\hat{TDI}_j = \frac{\lambda_1 P_1 + \lambda_2 P_2 + ... + \lambda_{11} P_{11}}{\lambda_1 + \lambda_2 + ... + \lambda_{11}} \qquad (4)$$

In a nutshell, the estimator of the TDI is computed as the weighted average of the principal components, where weights are equal to variances of successive principal components.

2.4 Interpreting TDI values[38]

The TDI is conceptualized as having a positive relationship with trade and development performance. In other words, a higher value of the TDI reflects a higher trade and development performance, and vice versa. In addition, across periods, an increase in TDI score should indicate overall improvement of a country performance, irrespective of its performance relative to the rest of the countries in the sample. The reverse should also be true. This is essentially due to the fact that results obtained with the methodology used are not affected by the normalization procedure of components. In other words, even if the range of components (sample maximum value *minus* sample minimum value) varies across years, coefficients used to compute components weights should only reflect changes in the actual values of the normalized component. As a consequence, changes in countries' TDI values can be interpreted as absolute changes. TDI values should be comparable across periods even if country sample varies, as long as a sufficiently large number of countries are part of the sample, which is the case here.

A companion of TDI value is TDI ranking, which gives an assessment of any country performance relative to the whole country sample. TDI ranking could be an indicator of changes in relative performance over periods. However, this would be verified only if the selected country sample remains the same. Nevertheless, it would always be possible to refer to changes in TDI values over periods as an indicator of changes in relative performance. Indeed, as mentioned above, results obtained using principal components analysis are not sensitive to changes in country sampling as long as the sample is large enough.[39]

TDI values should then serve as a tool to track the progress of countries in respect of trade and development performance across countries and over time.

3. THE TDI AND BENCHMARKING RESULTS

3.1 TDI scores and rankings

The estimates and corresponding ranking of the TDI for the whole sample of 110 countries are shown in table 1.1. The results indicate that the top 20 are all developed countries, except Singapore (rank 15). Denmark leads the pack, followed by the United States of America and the United Kingdom. TDI scores of Sweden, Norway, Japan, Switzerland, and Germany are particularly close. Countries of southern Europe members of the EU are at the bottom of the top 25. Only three developing countries are in the top 30 performers. Besides Singapore, they are the Republic of Korea (rank 25) and Malaysia (rank 28). This partly indicates that only a handful of developing countries have been able to come close to the trade and development performance of developed countries, signifying the extent to which developing countries need to catch up.

Table 1.1. Trade and development index: Whole sample

TDI Rank	Country	TDI score	TDI Rank	Country	TDI score	TDI Rank	Country	TDI score
1	Denmark	874	38	Thailand	563	75	Rep. of Moldova	421
2	United States	854	39	Kuwait	561	76	Algeria	419
3	United Kingdom	825	40	Chile	558	77	Guyana	414
4	Sweden	811	41	South Africa	557	78	Indonesia	413
5	Norway	806	42	Bulgaria	556	79	Egypt	409
6	Japan	806	43	Argentina	554	80	Armenia	409
7	Switzerland	805	44	Belarus	545	81	Paraguay	405
8	Germany	804	45	Jordan	545	82	Guatemala	404
9	Austria	791	46	Bahrain	541	83	Morocco	370
10	Canada	790	47	Mauritius	525	84	Kenya	359
11	France	774	48	Trinidad and Tobago	513	85	Viet Nam	355
12	Belgium-Luxembourg	773	49	Mexico	505	86	Uganda	340
13	Australia	772	50	Lebanon	505	87	Senegal	332
14	New Zealand	770	51	China	505	88	Syrian Arab Rep.	331
15	Singapore	762	52	Russian Federation	493	89	Ghana	330
16	Finland	761	53	Jamaica	490	90	India	306
17	Ireland	758	54	Brazil	488	91	Madagascar	295
18	Portugal	756	55	Romania	484	92	Yemen	295
19	Spain	744	56	Ukraine	483	93	Bangladesh	294
20	Italy	729	57	Colombia	483	94	Papua New Guinea	290
21	Cyprus	721	58	Philippines	478	95	Pakistan	275
22	Malta	688	59	Sri Lanka	477	96	Malawi	272
23	Slovenia	678	60	Namibia	476	97	Zambia	262
24	Greece	661	61	Saudi Arabia	465	98	Nepal	255
25	Rep. of Korea	646	62	Tunisia	462	99	Côte d'Ivoire	254
26	Hungary	643	63	Iran (Islamic Rep. of)	458	100	Cameroon	248
27	Croatia	632	64	Oman	454	101	Mozambique	238
28	Malaysia	631	65	El Salvador	454	102	Togo	230
29	Estonia	621	66	Botswana	450	103	UR ofTanzania	229
30	Poland	612	67	Bolivia	449	104	Benin	225
31	Lithuania	609	68	Peru	449	105	Sudan	206
32	Slovakia	590	69	Dominican Republic	444	106	Burkina Faso	195
33	Uruguay	580	70	Venezuela, BR	440	107	Ethiopia	186
34	Bahamas	578	71	Nicaragua	435	108	Nigeria	172
35	Costa Rica	572	72	Honduras	433	109	Mali	161
36	Latvia	569	73	Ecuador	431	110	Niger	136
37	Panama	564	74	Albania	425			

Source: Basu, Fugazza and Rahman (2005).

At the other extreme all the bottom 20, excepting Pakistan and Papua New Guinea, are either LDCs or African countries, or both. All the bottom 10 are African countries, with 9 being LDCs; indeed, only two African countries—South Africa (rank 41), Mauritius (rank 47)—are among the top 50 scorers. This indicates the severity of the trade and development problematique of LDCs and African countries.

A word about the two largest developing countries in population terms, namely, China and India. Despite years of high economic and trade growth, China (rank 51) is not among the top 50 performers. India, on the other hand, ranks 90th among all countries in the sample.

It is also important to look into the inter-country differences among developing countries in the TDI. Table 1.2 presents the TDI scores and rankings of three groups of developing countries: top 10 performers, middle 20 performers and bottom 10 performers. The top 10 ranking countries include mostly newly industrializing economies of East and South-East Asia, and some Latin American and Caribbean countries. After Singapore, the Republic of Korea and Malaysia, Uruguay ranks fourth among all developing countries, and scores highest among Latin American and Caribbean countries.

Table 1.2. Trade and development index: Selected developing countries

	Country	TDI score	TDI Rank
Top 10 TDI ranks			
	Singapore	762	15
	Rep. of Korea	646	25
	Malaysia	631	28
	Uruguay	580	33
	Bahamas	578	34
	Costa Rica	572	35
	Panama	564	37
	Thailand	563	38
	Kuwait	561	39
	Chile	558	40
Middle 20 TDI ranks			
	Iran (Islamic Rep. of)	458	63
	Oman	454	64
	El Salvador	454	65
	Botswana	450	66
	Bolivia	449	67
	Peru	449	68
	Dominican Republic	444	69
	Venezuela, BR	440	70
	Nicaragua	435	71
	Honduras	433	72
	Ecuador	431	73
	Algeria	419	76
	Guyana	414	77
	Indonesia	413	78
	Egypt	409	79
	Paraguay	405	81
	Guatemala	404	82
	Morocco	370	83
	Kenya	359	84
Bottom 10 TDI ranks	Mozambique	238	101
	Togo	230	102
	UR of Tanzania	229	103
	Benin	225	104
	Sudan	206	105
	Burkina Faso	195	106
	Ethiopia	186	107
	Nigeria	172	108
	Mali	161	109
	Niger	136	110

Note: Based on Table 1.

Table 1.3. Distribution of dimensions of TDI (% of developing countries)

DIMENSION			Top 10	Middle 20	Bottom 10
Structural and institutional (SI)		High	90	0	0
		High-medium	10	30	0
		Medium	0	50	0
		Low-medium	0	20	0
		Low	0	0	100
Trade-related policies and processes (TP)	**Openness to trade (OT)**				
		High	40	20	0
		High-medium	20	45	0
		Medium	20	5	20
		Low-medium	10	10	50
		Low	10	20	30
	Effective foreign market access (MA)				
		High	50	5	0
		High-medium	40	20	30
		Medium	10	15	0
		Low-medium	0	35	30
		Low	0	25	40
Level of development (LD)		High	80	5	0
		High-medium	20	25	0
		Medium	0	45	0
		Low-medium	0	25	10
		Low	0	0	90

Explanation:

High	Top 20% ranking
High-medium	20%-40% ranking
Medium	40%-60% ranking
Low- medium	60%-80% ranking
Low	Bottom 20% ranking

The pattern changes as one goes down the list. When one looks at the middle 20 performers, the results show that 10 countries are from the Latin America and Caribbean; eight are from Africa; and one each from East and Central Asian region. Finally, the 10 lowest scorers comprise only African countries.

The results also indicate that the countries scoring high in their TDI score generally high in the constituent dimensions of the index. The reverse, however, is not necessarily observed. To see this more clearly, frequency distributions of developing countries in terms of ranks on three dimensions are categorized as follows: high (top 20%), high-medium (60% to 80%), medium (40% to 60%), low-medium (20% to 40%) and low (bottom 20%). Table 1.3 indicates the resulting distribution.

In the structural and institutional dimension, top-ranking countries in the TDI are also among top ranking countries in SI. Thus 9 out of top 10 TDI performers among developing countries scored high in SI, and 1 scored high-medium. Symmetrically, bottom ranking in TDI are also bottom-ranking countries in SI. Thus, all 10 of them scored low in SI. Middle ranking countries in TDI are fairly evenly distributed around medium ranking in SI.

As for the trade-related policies and processes dimension, there is, however, no such clear relationship with TDI ranking. The country rankings and corresponding OT and MA sub-dimension shares are very dispersed unlike in the case of SI. More specifically, for OT, the distribution of countries in Top-10 level is not remarkably different from the distribution at the Middle-20 and Bottom-10 level. Similar characteristics are obtained for MA as well. Therefore, in terms of trade-related policies and processes, the countries have oriented and implemented their strategies vigorously to match their superiors.

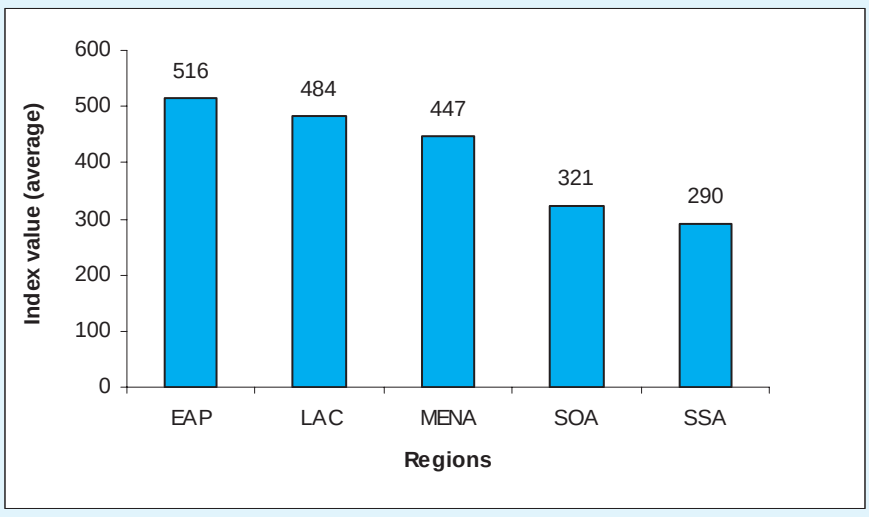
The results obtained for the level of development dimension are similar to those for the structural and institutional dimension. Thus, countries top ranking in TDI are also top ranking in LD components and those bottom ranking in TDI are also bottom ranking in LD components.

3.2 TDI scores and rankings of developing countries: Regional patterns

The inter-country differences among developing countries with respect to the TDI scores also indicate certain regional patterns. To demonstrate this in a more focused way, the 72 developing countries included in the sample are grouped into East Asia & Pacific (EAP), Europe & Central Asia (ECA), Latin America & Caribbean (LAC), Middle East & North Africa (MENA), South Asia (SOA) and sub-Saharan Africa (SSA).[40]

The unevenness in regional achievements confirms discussions and illustrations presented above. As far as the TDI scores are concerned, EAP countries are leading followed by LAC countries and MENA countries. Gaps between these three regions' average scores are not very far apart; thus about 70 points separate EAP and MENA average scores. However, scores of SOA and SSA countries show a significant drop compared with other groups. Indeed, the two regions have comparable scores, and lag quite substantially behind other regions (figure 1.2).

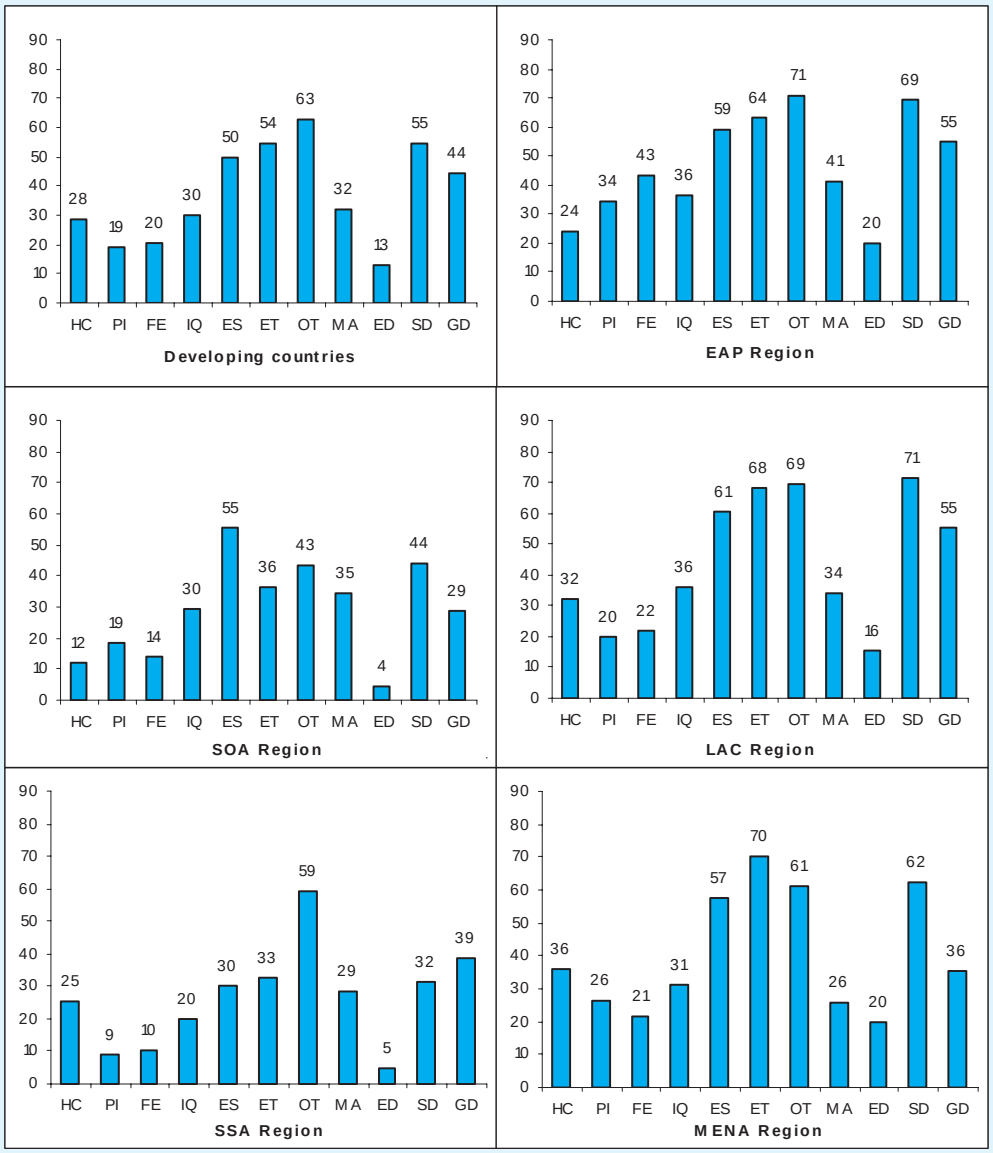
Figure 1.2. Regional pattern of the TDI scores



Note: For explanation of regions, see text.

An overall analysis of the TDI components reveals (figure 1.3) that EAP countries' lead is due to relatively high average scores for physical infrastructures (PI) and financial environment (FE) and to some extent market access (MA). As to SOA and SSA countries, they lag behind for most components. This is particularly true for the following components: social development (SD), the financial environment (FE) and physical infrastructure (PI). SSA countries score particularly low on their physical infrastructure (PI). SOA countries as a group score relatively low in terms of trade openness (OT) score. Significantly, EAP countries' disaggregated scores reveal greater uniformity of performance across different components compared with other regions.

Figure 1.3. Regional pattern in TDI components



Note: (a) The vertical axes represent scores of TDI components.
(b) For explanation of regions and abbreviations, see text.

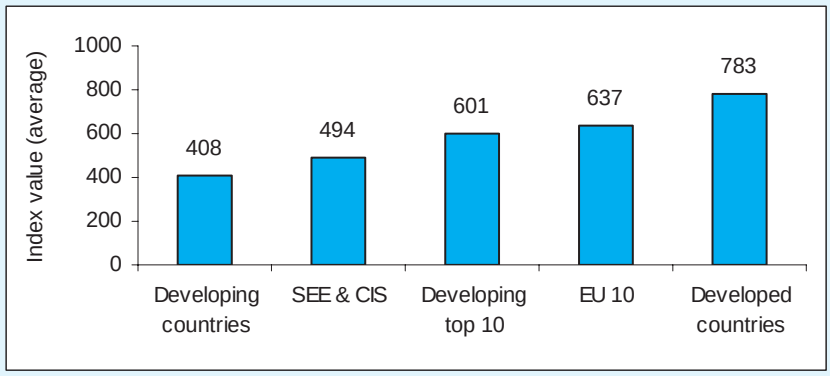
Box 1.4. Trade and development index in transition economies of South-Eastern Europe (SEE) and Commonwealth of Independent States (CIS)

This box locates the TDI performance of SEE and CIS countries (9 countries are in this study; see Annex for the list of countries).

Many countries in Eastern Europe and the Baltics became independent States in the early 1990s. At their early stage of independence, these countries experienced deep economic recession. Svejnar (2002) estimates show that GDP declined by 13-25% in Eastern Europe, 40% in the Baltics and 45-65% in the CIS. Transforming a socialist economic system into a market-based economy was equivalent to "rebuilding a ship at sea" and therefore the initial output collapse reflects the major institutional changes involved during the transition process and the disorganization that followed the sudden end of central planning (Cernat and Vranceanu, 2002).

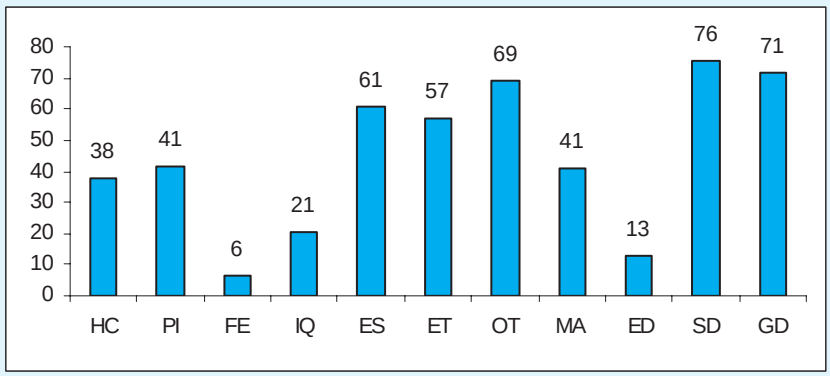
Figure B1.4.1 shows the average TDI performance of SEE and CIS economies. They perform better than the group of developing countries.

Figure B1.4.1 Average aggregate TDI component scores for SEE and CIS countries



A more disaggregated view of their performance (figure B1.4.2) shows that human capital, infrastructure development, environment factors and economic structure feature prominently in their domestic structural and institutional dimension. However, the financial environment and institutional factors are lagging behind. The results indicate that these countries have embraced policies to reduce barriers to trade.

Figure B1.4.2. TDI scores of SEE and CIS countries relative to other country groups

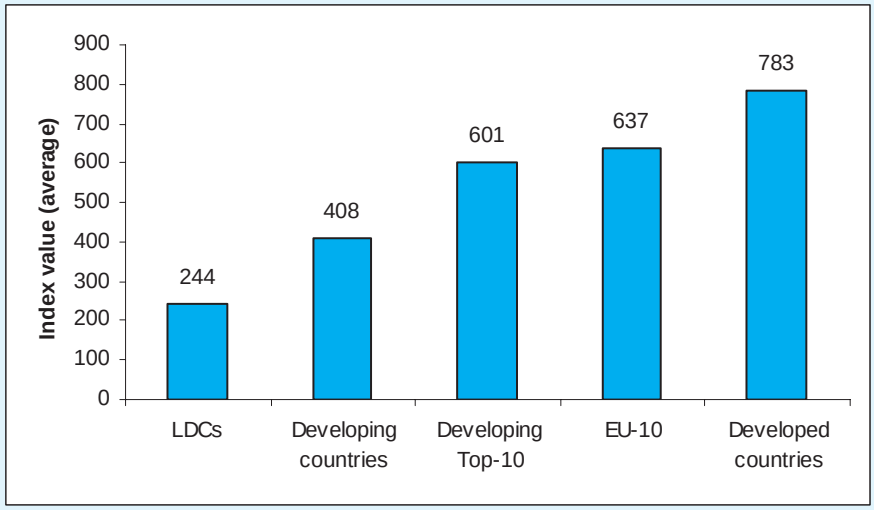


Note: Vertical axis denotes scores of TDI component. For explanation of abbreviations, see text.

3.3 Benchmarking

In order to obtain benchmarking results, countries are aggregated into three groups: developing countries (UN definition), EU10 countries (new EU members since May 2004) and developed countries (EU 15 plus other OECD countries). The two sub-groups are identified, namely the top 10 developing country performers, and LDCs. The average scores for these groups and sub-groups are displayed in figures 1.4 and 1.5.

Figure 1.4. Benchmarking in TDI

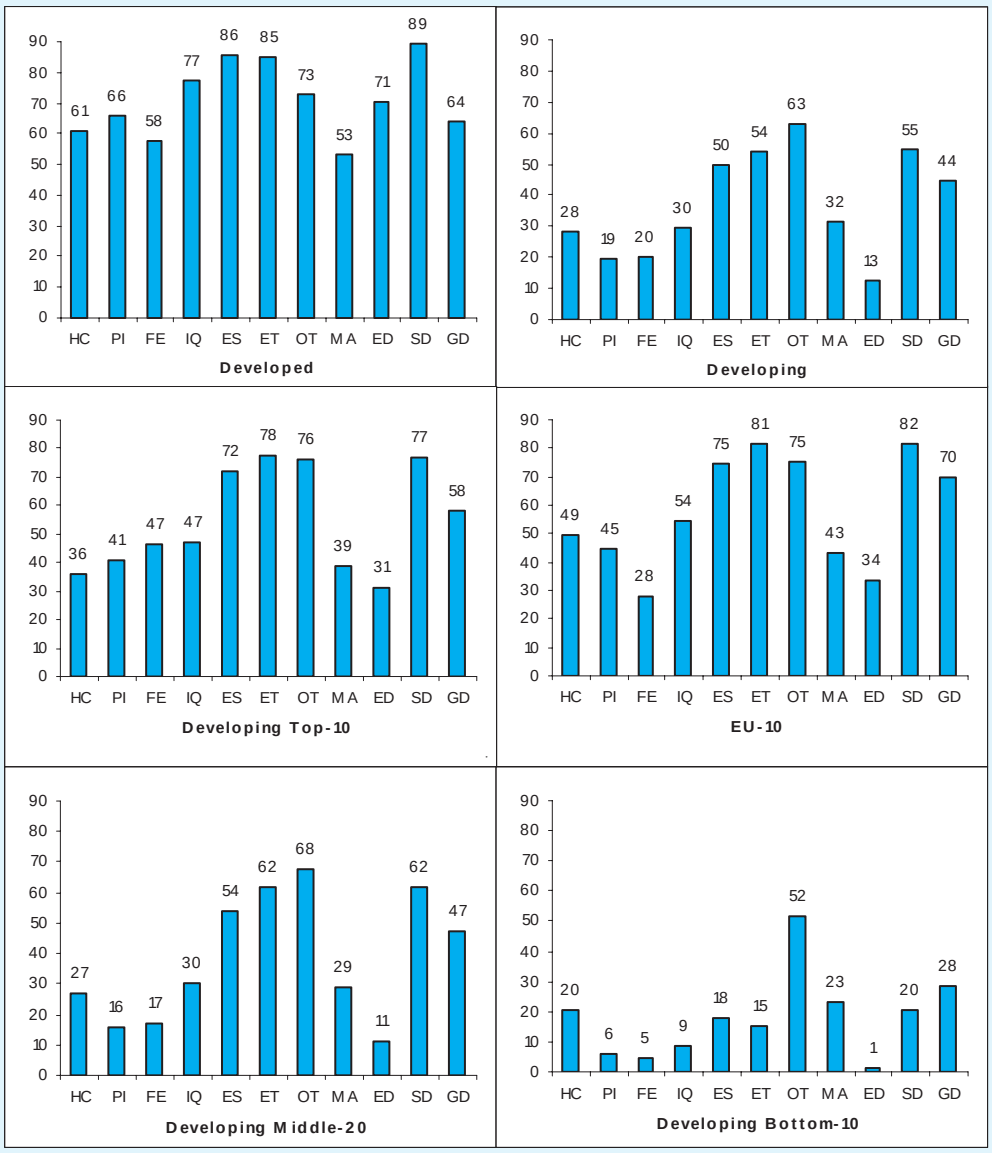


The developed countries group scores the highest, followed by the EU 10 countries, whose performance stands between that of developing and developed countries. Disaggregated scores are also obtained for all structural and institutional components (figure 1.5). The top 10 developing country performers have come significantly closer to developed countries in a number of areas, such as environment, economic structure, openness to trade, and social development. However, there is a substantial gap between the two groups in regard to most other areas, especially human capital, physical infrastructure, institutional quality, market access and economic development. It is therefore not surprising that there are huge differences in performance between developed countries and other developing countries. The catching up challenge is especially formidable for LDCs.

Figure 1.5 also indicates that the top 10 developing countries, as a group, have nearly caught up with EU 10 in respect of physical infrastructure, environment, economic structure, openness to trade, market access, economic development and social development. In other areas, their differences are not very pronounced, indicating a strong possibility of their catching up with EU10 in the medium term.

In terms of the three dimensions of TDI, a disaggregated analysis shows that the various groups of countries are closer to one another in respect of openness to trade relative to other components. In other words, most economies have become open economies. Yet, substantial differences in many other components indicate the limits to what openness alone can achieve. This question becomes especially pertinent when one looks at the differential performance in regard to the components of SI as well as ED.

Figure 1.5. Benchmarking the TDI components across country groups



Note: Vertical axes represents scores of TDI components. For explanation of abbreviations, see text.

Market access (MA) scores of developed countries and EU 10 are again above those of the developing country group. This result could be due in part to the existence of peaks and specific tariffs in developed countries' tariff schedules applied to developing countries. However, the lower score of developing countries is also driven by the persistence of relatively high trade barriers applied among developing countries.[41] The ongoing Global System of Trade Preferences Among Developing Countries (GSTP) negotiations could be useful in reducing these barriers.[42]

When the level of development (LD) scores are examined closely, the results indicate that developed countries' average score in ED is more than twice that of EU 10 and more than five times that of developing countries. The gap is much smaller when looking at the social development component, where the averages for EU10 countries and developed countries are very close, 89 against 82, respectively. The top 10 developing countries also score high at 77. The gender development (GD) component displays a pattern similar to that of the trade openness indicator. EU 10 countries are leading and the developing countries' average scores are relatively close to both developed and EU-10 countries.

3.4 TDI scores: Driving factors

What drives the results presented above? To respond to this question, coefficients of each of the 11 components of the TDI were obtained. These coefficients make it possible to work out the relative dominance and/or importance of the respective components in determining the TDI scores. A straightforward rearrangement of the weighted components of the TDI helps to express it as a weighted sum of the actual value of its 11 constituent components. Hence,

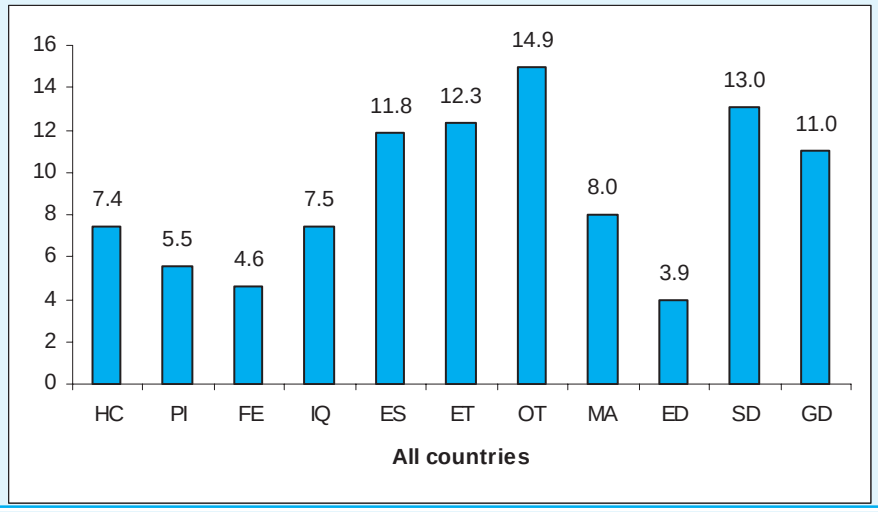
$$\hat{TDI} = 0.170*HC + 0.198*PI + 0.214*FE + 0.206*IQ + 0.191*ET + 0.190*ES + 0.218*OT + 0.130*MA + 0.201*ED + 0.205*SD + 0.178*GD$$

However, these coefficients should not be interpreted as partial regression coefficients since the left-hand side variable is not observable. For instance, it should not be interpreted as if as FE increases, TDI will increase by a figure that is proportional to the FE coefficient. The above identity can be used to compute the share of each component in the TDI for each country and for the average TDI value for the sample as a whole.

Figure 1.6 presents share of each component in the average TDI score for the entire sample.[43] The contribution to the TDI of the openness to trade component (OT) is the largest and explains almost 15 per cent of the TDI score. Contributions of other components vary between 3.9 per cent and 13 per cent. The contribution of the social development component (SD) is the second highest followed by that of the economic structure component (ET), the environmental sustainability component (ES) and the gender development component (GD). The lowest contribution comes from economic development component (ED).

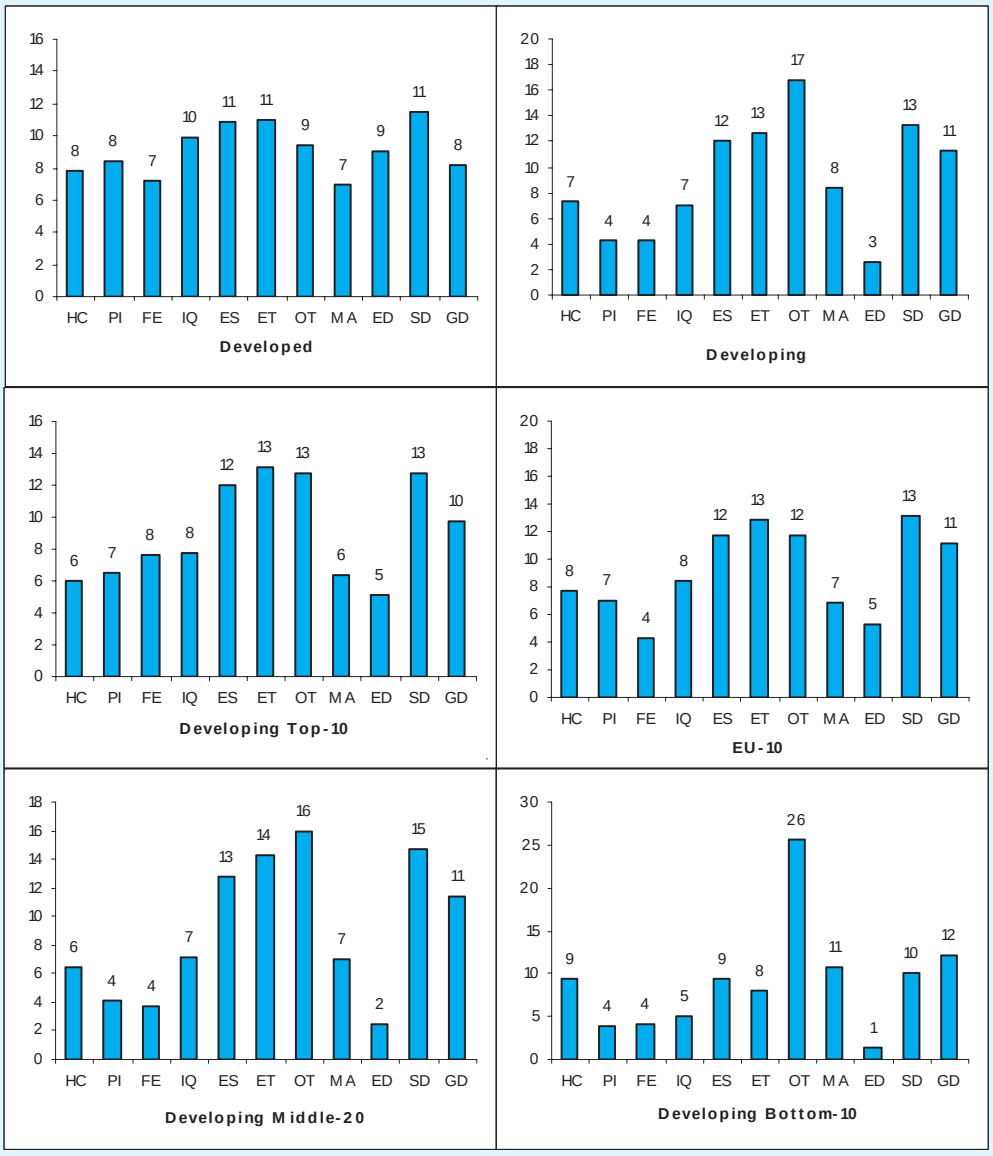
A disaggregated picture of relative contributions of the components is presented in figure 1.7. It shows that the importance of the openness to trade (OT) component tends to be higher for countries with lower TDI scores, and vice versa. While its contribution to the TDI is around 17 per cent for developing countries as a group, it falls to less than 12 per cent for the EU 10 countries and less than 10 per cent for developed countries. In other words, trade liberalization played a much

Figure 1.6. Average shares of TDI components



Note: Vertical axis represents shares of TDI components in TDI scores (in per cent). For explanation of abbreviations, see text.

Figure 1.7. Components' shares (%) in TDI: Country groups' average



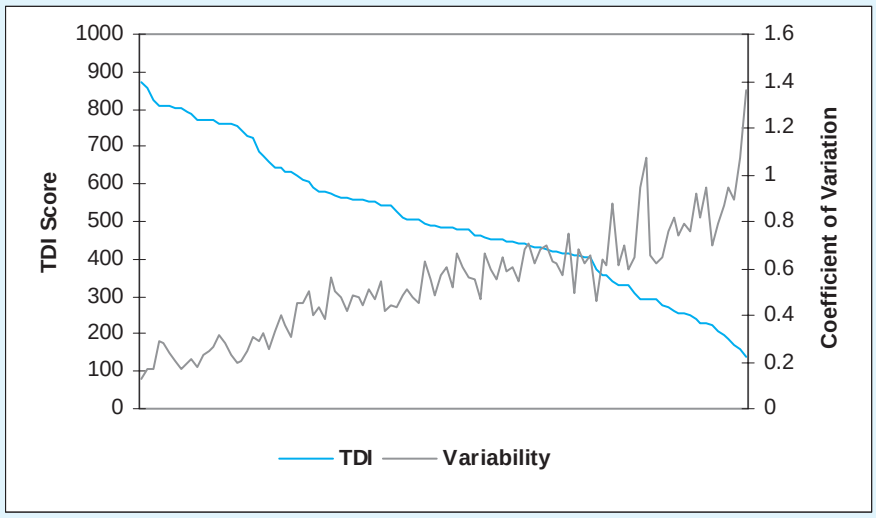
Note: Vertical axes represent shares of TDI components in TDI scores (in per cent). For explanation of abbreviations, see text.

larger role in explaining the TDI scores in the case of developing countries as a whole, and especially for LDCs, than in the case of developed countries. The contribution of the access to markets indicator (MA) is similar for all country groups, although it plays a much less pronounced role relative to OT in the case of developing countries than in developed countries. The contribution of environmental sustainability (ES), economic structure (ET) and social development (SD) indicators are closer to one another across countries. However, there are significant differences among country groups in regard to the respective contribution of economic development (ED), human capital (HC), physical infrastructure (PI), financial environment (FE) and institutional quality (IQ). In general, their contribution tends to decline as one moves down the list of countries in declining order of TDI scores.[44]

4. POLICY IMPLICATIONS

Results presented in section 3 point to an interesting pattern as regards the relative contribution of different components to the TDI scores among the country groups. The highest TDI scoring countries tend to score uniformly high in different components. In other words, these countries display a relatively low variability among contributions of individual components. Variability is defined by the coefficient of variation.[45] The variability increases as one moves down to list in decreasing order of TDI scores. The highest variability is found among the bottom 10 scores. This scissors pattern is evident in figure 1.8.

Figure 1.8. The scissor diagram of TDI and variability



It is observed quite clearly that the higher TDI scoring countries exhibit lower variability in the contribution of individual components, while lower scoring countries have higher variability. Taking the sample of countries as a whole, the correlation coefficient between the TDI and coefficients of variation series is equal to -0.93, while the respective coefficient for developing countries only is -0.90,[46] indicating a very high degree of reverse association between TDI scores and the variability of contribution of components. Therefore, the following general rule appears to hold:

The higher the TDI score, the lower the variability in the contribution of its components and vice versa.

An implication of this finding is that while changes in the value of TDI scores over time could be regarded as a quantitative indication of trends in the trade and development performance of countries, those in respect of the variability could be seen as qualitative changes. Therefore, in addition to TDI scores the coefficient of variation will serve as a tool to track the progress of countries in respect of trade and development performance over time.

Reducing the variability in the contribution of different components should be an important objective of trade and development policies and strategies. In other words, to be successful, a country must put a simultaneous thrust on multiple goals within a coherent trade and development strategy, while emphasizing reduction of the existing gaps in areas where performance is lagging. As the case of LDCs[47] and other low scoring countries indicates, a disproportionate emphasis on a limited number of objectives such as trade liberalization without concomitant focus on factors that make liberalization work can yield only marginal results. By demonstrating significant inter-country variations in the coefficient of variation, the analysis points to the importance of country-specific approaches to trade, development and poverty reduction strategies.

The above analysis also has implications for development partnership. For example, a comparison between the disaggregated results of the EU 10, on the one hand, and developing countries, especially middle- and low-ranking ones, on the other, indicates what works: a simultaneous thrust on a broad-based development agenda to be pursued with a well-defined time frame under strict institutional discipline, and facilitated by adequate financial and technical support and market access. In the case of EU-10, the policy stringency of the pre-accession strategy has been further balanced by clear perspectives of possible welfare gains associated with eventual EU membership. Indeed, the European integration process, as well as the experiences of more successful developing countries, could provide important insights into the formulation of development partnership paradigms aimed at fast improving TDI performance. The above rule also points to the need for greater coherence between trade policy and rule making, on the one hand, and development strategies and partnership and solidarity, on the other. Future work on TDI will include in-depth focus on these issues.

APPENDIX 1

A 1.1 List of countries in the sample

Developing countries (72)

Algeria
Argentina
Bahamas
Bahrain
Bangladesh
Benin
Bolivia
Botswana
Brazil
Burkina Faso
Cameroon
Chile
China
Colombia
Costa Rica
Côte d'Ivoire
Dominican Republic
Ecuador
Egypt
El Salvador
Ethiopia
Ghana
Guatemala
Guyana
Honduras
India
Indonesia
Iran (Islamic Rep. Of)
Jamaica
Jordan
Kenya
Kuwait
Lebanon
Madagascar
Malawi
Malaysia
Mali
Mauritius
Mexico
Morocco
Mozambique
Namibia
Nepal
Nicaragua
Niger
Nigeria
Oman
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Rep. of Korea
Saudi Arabia
Senegal
Singapore
South Africa
Sri Lanka
Sudan
Syrian Arab Republic
Tanzania
Thailand
Togo
Trinidad and Tobago
Tunisia
Uganda
Uruguay
Venezuela, BR
Viet Nam
Yemen
Zambia

Developed countries (20)

Austria
Belgium-Luxembourg
Germany
Denmark
Spain
Finland
France
United Kingdom
Greece
Ireland
Italy
Portugal
Sweden
Australia
Canada
Switzerland
Japan
Norway
New Zealand
United States

EU-10 countries (9)

Cyprus
Estonia
Hungary
Lithuania
Latvia
Malta
Poland
Slovakia
Slovenia

SEE and CIS countries (9)

Albania
Armenia
Bulgaria
Belarus
Croatia
Rep. of Moldova
Romania
Russian Federation
Ukraine

A 1.2 Definitions of the indicators included in trade and development index

Health expenditure per capita (% of GDP): Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities and emergency aid designated for health, but does not include provision of water and sanitation.

Education expenditure, public (% of GDP): It includes both capital expenditures (spending on construction, renovation, major repairs and purchase of heavy equipment or vehicles) and current expenditures (spending on goods and services that are consumed within the current year and would need to be renewed the following year). It covers such expenditures as staff salaries and benefits, contracted or purchased services, books and teaching materials, welfare services, furniture and equipment, minor repairs, fuel, insurance, rents, telecommunications and travel.

Roads, paved (% of total roads): Paved roads are those surfaced with crushed stone (macadam) and hydrocarbon binder or bituminized agents, with concrete, or with cobblestones, as a percentage of all the country's roads, measured in length.

Air transport, freight (million tons per km): Air freight is the sum of the metric tons of freight, express and diplomatic bags carried on each flight stage (the operation of an aircraft from takeoff to its next landing) multiplied by the stage distance, by air carriers registered in the country.

Telephone mainlines (per 1,000 people): Telephone mainlines are telephone lines connecting a customer's equipment to the public switched telephone network. Data are presented per 1,000 people for the entire country.

Domestic credit to private sector (% of GDP): Domestic credit to the private sector refers to financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable that establish a claim for repayment. For some countries these claims include credit to public enterprises.

Bureaucracy quality: This is a perception-based indicator. The institutional strength and quality of the bureaucracy is another shock absorber that tends to minimize revisions of policy when Governments change. Therefore, high points are given to countries where the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services. In these low-risk countries, the bureaucracy tends to be somewhat independent of political pressure and to have an established mechanism for recruitment and training. Countries that lack the cushioning effect of a strong bureaucracy receive low points because a change in government tends to be traumatic in terms of policy formulation and day-to-day administrative functions.

Corruption: This also is a perception-based indicator. Corruption impedes investment for several reasons: it distorts the economic and financial environment; it reduces the efficiency of government and business by enabling people to assume positions of power through patronage rather than ability; and, last but not least, introduces an inherent instability into the political process.

Agriculture, value added (% of GDP): Agriculture corresponds to International Standard Industrial Classification (ISIC) divisions 1-5 and includes forestry, hunting and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated

assets or depletion and degradation of natural resources. The origin of value added is determined by the ISIC, revision 3.

Improved sanitation facilities (% of population with access): Access to improved sanitation facilities refers to the percentage of the population with at least adequate excreta disposal facilities (private or shared, but not public) that can effectively prevent human, animal and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection.

Improved water source (% of population with access): Access to an improved water source refers to the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 litres a person a day from a source within one kilometre of the dwelling.

Energy use: GDP per unit of energy use is the PPP GDP per kilogram of the oil equivalent of energy use.

Weighted mean tariff: Average of effectively applied rates weighted by the product import shares corresponding to each partner country.

Share of lines with international peaks: Share of lines in the tariff schedule with tariff rates that exceed 15 per cent.

Share of lines with national peaks: Share of lines in the tariff schedule with tariff rates that exceed three times the average tariff.

Share of lines with specific rates: Share of lines in the tariff schedule that are set on a per unit basis or that combine advalorem and per unit rates.

GDP per capita, PPP (constant 1995 international dollar): PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the USD has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 1995 international dollars.

Literacy rate, adult: The percentage of people ages 15 and above who can, with understanding, both read and write a short, simple statement related to their everyday life.

Enrolment ratio, gross: The number of students enrolled in a level of education, regardless of age, as a percentage of the population of official school age for that level. The gross enrolment ratio can be greater than 100% as a result of grade repetition and entry at ages younger or older than the typical age at that grade level.

Life expectancy at birth: The number of years a newborn infant would live if prevailing patterns of age-specific mortality rates at the time of birth were to stay the same throughout the child's life.

Gender-related development index (GDI): A composite index measuring average achievement in the three basic dimensions captured in the human development index—a long and healthy life, knowledge and a decent standard of living—adjusted to account for inequalities between men and women.

Note: The definitions above are taken from their respective sources.

A 1.3. Primary sources of data

ICAO: Air transport indicator is obtained from International Civil Aviation Organization, Civil Aviation Statistics of the World.

IMF: Domestic credit to private sector data is from International Financial Statistics 2004.

IRF: The paved road indicator is obtained from International Road Federation, World Road Statistics 2004.

ITU: Telephone mainline indicator is taken from the World Telecommunication Development Report and database 2004.

PRS Group - International Country Risk Guide (ICRG): Bureaucratic quality and corruption are obtained from ICRG 2004 database. http://www.prsgroup.com/icrg.

UNCTAD: Data on tariff barriers are based on TRAINS database in WITS.

UNDP: The education expenditure per capita (% GDP) data is obtained from UNDP. Data on the adult literacy rate, gross enrolment ratio, life expectancy at birth, and data related to gender development measure are taken from Human Development Report 2004.

World Bank: GDP per capita, agriculture value added, and energy use database are obtained from World Development Indicators 2005.

WHO: The health expenditure per capita (% of GDP) data is obtained from the World Health Organization, World Health Report and updates from the OECD for its member countries, supplemented by World Bank poverty assessments and country and sector studies, 2004. The data on improved access to water and sanitation are obtained also from the WHO database.

A 1.4. Descriptive statistics of indicators

Dimension	Component	Indicator	Mean	CV (%)	Max.	Min.
Structural and Institutional (SI)	**Human capital (HC)**	Health expenditure per capita (%GDP)	3.59	51.05	8.10	0.60
		Education expenditure per capita (%GDP)	4.38	35.66	10.00	1.00
	Physical infrastructure (PI)	Paved roads ratio (of total roads)	52.39	62.15	100.00	3.50
		Air transport freight (million tonnes per km)	889.83	350.89	2 9051.97	0.00
		Telephone mainlines per 1000 population	220.74	97.80	749.07	1.90
	Financial environment FE)	Domestic credit to private sector (%GDP)	50.78	86.75	184.58	3.57
	Institutional quality (IQ)	Bureaucratic quality index (0-4 scale)	2.27	47.74	4.00	0.00
		Corruption index (0-6 scale)	2.71	40.60	6.00	1.00
	Economic structure (ET)	Agriculture value added (%GDP)	13.93	87.61	44.74	0.12
	Environmental sustainability (ES)	Access to improved sanitation (%)	63.41	47.54	100.00	4.00
		Access to improved water (%)	78.20	26.09	100.00	11.00
		Energy use	0.30	60.01	0.90	0.10
Trade policies and processes (TP)	**Openness to trade (OT)**	Applied trade-weighted average tariff (%)	9.55	61.39	30.10	0.00
		Share of lines with national peaks (%)	1.68	267.31	37.00	0.00
		Share of lines with international peaks (%)	2.77	187.75	33.22	0.00
		Share of lines with specific tariffs (%)	26.39	80.79	92.26	0.00
	Effective foreign market access (MA)	Applied trade-weighted average imposed by trade partners (%)	4.00	69.59	15.00	1.00
		Share of lines with domestic peaks in trade partners (%)	9.00	81.66	43.00	0.00
		Share of lines with international peaks in trade partners (%)	3.00	63.14	12.00	0.00
		Share of lines with specific tariffs by trade partners (%)	10.00	70.43	39.00	2.00
		Merchandise exports concentration index	0.30	69.93	1.00	0.06
Level of development (LD)	**Economic development (ED)**	GDP per capita, PPP constant 1995 dollar	8810.01	96.25	32398.45	495.22
	Social development (SD)	Adult literacy rate (%)	82.84	24.63	99.80	12.80
		Gross combined enrolment rate (%)	72.15	27.35	114.00	19.00
		Life expectancy (years)	67.21	17.38	81.50	32.70
	Gender development (GD)	Share of GDP per capita, female to Male	0.51	28.42	0.90	0.21
		Share of adult literacy rate, female to male	0.89	18.89	1.09	0.37
		Share of gross enrolment ratio, female to male	0.98	12.35	1.19	0.56
		Share of life expectancy rate, female to male	1.07	3.45	1.20	0.99

Source: See Appendix.
Note: CV (%)=coefficient of variation max = maximum min = minimum.

NOTES

1 This chapter draws on Basu, Fugazza and Rahman (2005, forthcoming).

2 See UNCTAD's *Least Developed Countries Report* (2004a) for a qualified discussion.

3 See Sen (1990) and Anand and Sen (1993) for conceptual framework of human development.

4 The following nine countries are in the EU-10 sample: Cyprus, Estonia, Hungary, Lithuania, Latvia, Malta, Poland, Slovak Republic, and Slovenia. The Czech Republic could not be included due to gaps in availability of certain data.

5 See appendix Table A 1.1 for the complete list of countries in the sample.

6 See appendix Table A 1.2 for definition and appendix Table A 1.3 for data sources. Descriptive statistics are provided in appendix Table A 1.4.

7 See De Vries (2001) for a review of the international debate on statistical indicators.

8 See Krugman (1979) for a seminal contribution on the theoretical rationalization on how countries could gain from trade through the import of new varieties. Broda and Weinstein (2004) present some estimates of the welfare gains due to the import of new varieties in to the United States over the period 1972-2001.

9 See Ethier (1982) for an early theoretical presentation of the argument and Fugazza and Robert-Nicoud (2005) for an application of the argument to South-South Trade. Madani (2001) provides some empirical evidence for Singapore, the Philippines and Malaysia.

10 For a detailed result, see Basu and Fugazza (2005, forthcoming).

11 See the seminal work of Uzawa, (1965) and Lucas (1988) for a theoretical presentation of the argument.

12 See Bloom, Canning and Sevilla(2001).

13 See for instance Krueger and Lindahl (2001) for a qualification of the relationship.

14 Future work will include also energy infrastructure. In particular, access to energy is also of primary importance in defining the productive potential of an economy and thus its trade potential. Energy services are also found to help meet basic human needs and eventually contribute to human development. See IEA (2004) for a discussion.

15 See Nagar and Basu (2004a) for an empirical investigation of the linkages between infrastructure and economic growth in India.

16 *World Development Report* (1994) and Krugman (1998).

17 See among others Limão and Venables (2001).

18 UNCTAD (2004b).

19 See Baldwin and Martin (1999) for an extensive discussion.

20 An indicator on the percentage of Internet users is excluded owing to its high correlation with telephone mainlines.

21 See Levine (1997).

22 See for a review of the theoretical literature Ghosh, Mookerjee and Ray (2000).

23 See Beck, Demirgu, and Levine (2004) for empirical evidence.

24 There are some difficulties in the use of the ratio of domestic credit to the private sector to GDP as an indicator of the quality of the financial environment. Growth of lending above a certain ceiling – which may be higher than that of GDP at current prices but not that much higher – is generally considered to be a harbinger of serious problems such as asset bubbles in the financial sectors of emerging-market economies. However, a good alternative is not easily at hand. Ideally, one needs an indicator of the availability not only of credit to firms and individuals but also of other basic financial services such as the storage of their assets and good facilities for payments and transfers. One possibility would be ratio of the value added of the financial sector to GDP but this solution faces the difficulty that the data for such value added are sometimes poor or even non-existent. Another possible indicator would be the net interest spreads of banks (and of other lending institutions, if available). i.e. total interest income minus total interest expense as a percentage of total assets. This

could be combined with an indicator of the availability of credit to individuals and firms such as credit to the private sector as a proportion of total bank assets. Again, data constraints preclude the use of such an indicator.

25 See North (1994).

26 See Rodrik (2002), Kaufmann et al (2003), and Basu (2004).

27 As defined and discussed in World Bank (2005)

28 See UNCTAD (2003) for an extensive discussion of the role played by FDI in fostering domestic supply capacity.

29 See Acemoglu et al (2002, 2004) for an extensive discussion and empirical investigation.

30 See UNEP, Annual Report, various years.

31 See UNDP (2003),*Human Development Report*. Water (e.g. emissions of organic water pollutants) and air (e.g. emissions of the sulfur dioxide or nitrogen dioxide) pollution indicators might be more appropriate to reflect the degradation of environment and its possible impact on health conditions. However, there are gaps in data availability.

32 The UNCTAD-TRAINS database (http://r0.unctad.org/trains/) remains the most comprehensive source of information on NTBs. In September 2005, UNCTAD hosted an Expert Meeting on Non-Tariff Barriers, where issues concerning collection, classification and quantification of NTBs were discussed. As a result, it was agreed that UNCTAD would reinforce its effort to improve the quality as well as data coverage of its NTB database and establish methodology for its quantification.

33 See Redding and Venables (2003) for a theoretical discussion and Fugazza (2004) for empirical evidence.

34 See Kee, Nicita and Olarreaga (2005).

35 ED and SD elements are included in the HDI. See UNDP *Human Development Report* (various issues) for a detailed description.

36 See Anand and Sen (1993 and 1995) for a conceptual discussion of the HDI and GDI.

37 See for instance Gallup, Sachs and Mellinger (1998) for an empirical assessment of the role of geography/location and climatic factors in explaining cross-country differences in economic growth and development

38 A more comprehensive discussion is provided in Basu, Fugazza and Rahman (2005, forthcoming).

39 See Nagar and Basu (2004b) for discussion of statistical properties of a composite index as estimate of a single latent variable. See also Rao (1964).

40 The World Bank (2005) country classification is followed.

41 See Cernat, Laird and Turrini (2003) and Fernandez de Cordoba, Laird and Vanzetti (2004) for quantitative evidence.

42 See São Paulo Consensus, 2004.

43 For example, to calculate the average share of HC, the current value of HC for each country is multiplied by the value of the coefficient (i.e. 0.17) and divided by the country's TDI current value. The average of countries' share of HC in TDI is then computed.

44 As mentioned before, statistical properties of principal component analysis should make results robust to the increase in the number of countries in the sample. In addition, results were found to be robust to changes in the set of indicators making each component.

45 The coefficient of variation is equal to the ratio of the standard deviation over the mean of the series under consideration. The measure is unit free and controls for possible scoring-scale effects.

46 Both these coefficients are statistically significant at 1% level.

47 See Puri (2005) on a comprehensive approach to the trade and development problematique of LDCs.

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