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# A STUDY INTO COMPETITIVENESS INDICATORS

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## 1. COMPETITION

With increasing competition in the world, there is a growing interest in the competitiveness strategy. Political leaders, businessmen, and media members all believe to have an idea about what competitiveness is. They also put forward popular strategies related to the competitiveness issue. On the other hand, there are organizations and researchers who try to define the competitiveness and develop proper metrics for measuring the competitive power. However, the term is still ambiguous. Ongoing discussions try to build a proper framework that helps to investigate competitiveness.

The starting point of the debates is closely related to the increasing number of researches that investigate the relationship between competitiveness and the technological capabilities. Researchers such as Fagerberg (1988, 1996), Kaldor (1981), Porter (1990), Lall (2001), OECD (1992) and Wignaraja (2003) argue against the other researchers, who are still trying to define competitiveness with solely price related factors and furthermore, highlight the importance of non price-based factors, especially the technology factor. These discussions have led the revision of traditional views (perspectives) behind the competitiveness issue.

In this study, our aim is to state the traditional perspectives and the recently revised perspectives of competitiveness along with the definitions. In the second, most widely used composite metrics for measuring countries' competitiveness from various aspects and indicators measure the competitiveness of a specific sector are presented and evaluated. The application examples of the indicators are also provided.

Before introducing different perspectives of competitiveness, the dictionary definitions of competition are stated initially. The first definition is from Oxford Dictionary and the second one is from Webster.

1. a. 'The action of endeavoring to gain what another endeavors to gain at the same time' (J.); the striving of two or more for the same object; rivalry. Now largely used in connexion with competitive examinations.

b. *Commerce*. Rivalry in the market, striving for custom between those who have the same commodities to dispose of.

2. a. The effort of two or more parties acting independently to secure the business of a third party by offering the most favorable terms.

b. Active demand by two or more organisms or kinds of organisms for some environmental resource in short supply.

### 1.1. Different Perspectives Behind the Competitiveness Issue

There are two different classical perspectives that try to define competitiveness. In general, macroeconomic perspective is known as the perspective that identifies what international competitiveness is in terms of price-based factors. On the other hand, microeconomic perspective tries to identify firm level competitiveness with non price-based factors investigating rivalry among companies.

Broadly a macroeconomic perspective deals with internal and external balance at the country level and focuses on the effect of price-based factors to the competition. A microeconomic perspective basically deals with a firm's internal dynamics that make a firm strong or weak (Wignaraja (2003), Nelson (1992)).

Generally, global competition is defined under the traditional macroeconomic perspective in the literature (Boltho (1996), Corden (1994)). "The aims of macroeconomic policy are usually described as the achievement of simultaneous internal and external balance in the short run and of as rapid a growth of living standards as possible in the long run. Internal balance is commonly defined as the lowest possible rate of unemployment consistent with an acceptable rate of inflation (for simplicity called full employment), and external balance as some desirable level of the current account (for simplicity equated with current-account equilibrium). The desirable degree of international competitiveness in this context could be defined as the level of the real exchange rate, which, in conjunction with appropriate domestic policies, ensured internal and (broadly defined) external balance." (Boltho, 1996)

In this approach, competition in the short run is handled with real exchange rate and relative price and cost indices are generally used in the studies in computing the exchange rates. (Boltho (1996), Wignaraja (2003), Corden (1994)). As the proxy, 'the domestic ratio of non-tradable to tradable prices' is preferred (Corden, 1994). At this point, Boltho (1996) does not only state the shortcomings of this proxy but also suggests other alternative proxies. According to his

research, 'the domestic ratio of non-tradable to tradable prices' has failed in part due to hardly available data, the next suggested one 'relative price or cost indices' are insufficient due to their highly dependence on the non-traded goods and services and finally 'relative import (or export) prices' are eliminated, since they ignore trade potential and seem only relevant to markets in differentiated products. According to his research, the relative cost indicators (namely relative unit labor cost) can overcome these problems and represent the international competitiveness in the short run (Boltho, 1996). Note that, the detailed information for relative unit labor cost is provided in the indicators section.

In fact, no matter which metric is preferred or criticized as a proxy for real exchange rate. The issue is the common characteristic of all these accepted or rejected proxies 'price and/or cost based'. This issue highlights the mostly debated shortcoming of the macroeconomic perspective. As Wignaraja (2003) and Fagerberg (1988, 1996) mention, the main drawback is the equation of international competitiveness only with indicators of relative prices or unit costs. Absence of non-price factors is a too simplified view as the empirical studies have also suggested. Porter (1990) also highlights this drawback. He mentions that this is a narrow scope for the public policy.

The assumptions that the markets are sufficiently competitive, and the firms are efficient, and they do not have any technological constraints that can affect their competitive power constitute another drawback of the macroeconomic perspective (Nelson, 1992).

Microeconomic perspective refers to the firm level view. This perspective mainly deals with the rivalry between firms and the firm level strategies. Further explanation about firm level competitiveness will be provided in Section 1.2.1. In recent years, the microeconomic perspective is enhanced to a new perspective that includes the effect of technology and innovation. Wignaraja (2003) classifies the technology and innovation as a third approach and handles this view in detail. Lall (2001) criticizes the neoclassical economics, which assumes that technology is freely available and the firms are capable of using the technologies at technical "best" levels. However, there is a long learning process, which begins from the import of the technology and goes to the innovation led by these countries.

Furthermore, this enhanced perspective is depicted as the origin of the global competitiveness.

Schumpeter (1943; in Fagerberg, 1988) states the importance of technological capabilities along with the price-based effects. “Economists are at long last emerging from the stage in which price competition was all they saw. (…) But in capitalist reality, as distinguished from its textbook picture, it is not that kind of competition, which counts, but the competition from the new commodity, the new technology, the new source of supply, the new type of organization. (…) –competition which commands a decisive cost or quality advantage and which strikes not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives.” Based on these arguments, Fagerberg (1988) tries to answer the question whether the technological development has an effect on the international competitiveness and growth across the countries. The results obtained support a positive correlation between them.

Another study performed by Fagerberg (1996) supports the positive relationship between change in the technological capacity and the competitiveness.

Kaldor (1981; in Fagerberg, 1996) emphasizes the important effect of differences in technological capabilities on the competitiveness: “Basically in a growing world economy the growth of exports is mainly to be explained by the income elasticity of foreign countries for a country’s products; but it is a matter of the innovative ability and adaptive capacity of its manufacturers whether this income elasticity will tend to be relatively large or small.”

Both traditional macroeconomic perspective and microeconomic perspective omit the effect of technological growth and capabilities on competitiveness. In fact, there is a strong positive relationship between technology factor and competitiveness as supported by various researchers (such as; Fagerberg (1988, 1996), Lall (2001) and Wignaraja (2002, 2003)). Consequently, both of these views have been enhanced in the last decades and the technology factor has been defined as the main driver of the competitive advantage.

Concluding this section, it would be proper to mention that solely the microeconomic perspective would not be sufficient to investigate a firm level competitiveness. Similarly, an investigation of international competition limited only to the macro economic perspective would not be sufficient. The combination of the enhanced views would investigate the competitiveness more thoroughly. For example, the investigation of competition at the micro level (firm level) does not only depends on the price-based factors but also on the non price-based factors including the technology factor.

## 1.2. Competitiveness at Different Levels

Competitiveness can be treated at two different levels:

1. Firm level competitiveness.

2. International competitiveness.

### 1.2.1. Competitiveness at the Firm Level

Many researchers treat the firm level competition as the origin of nations' competition. In other words, *nations are as strong as their companies are*. Therefore, the key point lies behind "the firm level competitiveness". Porter's (1990) popular diamond model is also developed based on this approach.

In recent years, the technological abilities such as abilities of importing, learning and producing technology together with efficient industrial capacity have become the origin of the competitive power of the nations. A definition of competition would not be complete in the absence of the technology factor. The definitions suggested by Department of Trade and Industry (DTI) and Organization for Economic Cooperation and Development (OECD), which are stated below respectively, both highlight the importance of the technology factor.

DTI (1994) defines the firm level competitiveness as; "the ability to produce the right goods and services of the right quality, at the right price, at the right time. It means meeting customers' needs more efficiently than other firms."

Another definition is provided by OECD (1992; in Wignaraja, 2003): "In microeconomics, competitiveness refers to the capacity of the firms to compete, to increase their profits and to grow. It is based on costs and prices, but more vitally on the capacity of the firms to use technology and quality and performance of the products."

However, the firms' competitiveness not only depends on the quality and the performance of the products but also of the processes. The definition stated above should be enhanced and the importance of the processes' quality and performance should be included. The quality and performance of the products mostly depend on the processes' qualification.

### 1.2.2. Competitiveness at the International Level

International competitiveness has also been discussed during the past decades. There appears to be no agreement on what international competitiveness means. As Krugman (1996) mentions, "majority of the people think that it is the view that nations compete for world markets in the same way that corporations do; that a nation which fails to match other nations in productivity or technology will face the same kind of crisis as a company that cannot match the costs or products of its rivals."

Lall (2001) criticizes approaches, which define national competitiveness as the sum of the efficiency of firms, thus omitting the synergy generated.

In the following, two definitions are provided for the international competitiveness.

Fagerberg (1988) defines the international competitiveness of a country as the ability to realize central economic policy goals, especially growth in income and employment, without running into balance-of-payments difficulties.

OECD (1992; in Wignaraja, 2003) states that: "At the macroeconomic level, competitiveness is the ability of a country to make products that meet the test of international competition while expanding domestic real income."

## 2. COMPETITIVENESS INDICATORS

Companies and countries are becoming more interested in determining their competitiveness relative to their competitors. Therefore competitiveness should be translated into tangible metrics that allow companies to rank their countries and compare with others. Based on these metrics generally referred to as indicators, the policy makers and decision makers try to determine the best policies, which might serve as a remedy to overcome their deficiencies. Therefore, the researchers try to determine the indicators and composite measures that can best represent the competitiveness of the companies or the countries.

### 2.1. Competitiveness Index and Competitiveness Scoreboard

There are two well-known indices used for ranking the countries, which are called as the "Swiss Competitiveness Indices". "Global Competitiveness Index" is developed by World

Economic Forum (WEF) and "Competitiveness Scoreboard" is developed by the International Institute for Management Development (IMD). Rankings based on the former index are published as the Global Competitiveness Report and those based on the latter are published as the World Competitiveness Yearbook.

Wignaraja and Taylor (2003) state that there is a high rivalry between these two organizations and claims that the indices are similar. They cite as the underlying reasons for this rivalry, the occasional research staff movement between these two institutions and the fact that they are headquartered in the same country. The similarities are summarized as:

- The analysis is based on a micro-level business strategy (as supported by Porter (1990)).
- They both depend on survey data and published statistics and mostly the data sources are the same.
- They cover the high-income economies amongst developed, transition and developing countries (Wignaraja, 2003).

These metrics are developed in a broad sense including many nationwide sub-factors based on survey data. This issue is known as the methodological problem with the indices in the literature. Lall (2001) mentions weaknesses associated with the indices and suggests a structure that they should really have: "To be analytically acceptable, however, all such efforts should be more limited in coverage, focusing on particular sectors rather than economies as a whole and using a smaller number of critical variables rather than putting in everything the economics, management, strategy and other disciplines suggest. They should also be more modest in claiming to quantify competitiveness: The phenomenon is too multifaceted and complex to permit easy measurement."

The detailed information for the calculation of these two indices are represented in Appendix A and B sequentially.

### 2.2. UK Competitiveness Indicators

DTI releases a competitiveness indicators report, in order to benchmark UK's economic performance against its competitors. This report was first published in 1999 as "Competitiveness

Indicators", its second edition was published in 2001 and finally it is updated and published under a more comprehensive title "Productivity and Competitiveness Indicators". The last report groups the indicators under five productivity drivers; namely, investment, innovation, skills, enterprise and competitive markets. In addition to these five groups, the general indicators that represent the overall life standards are also grouped under the title "results". The information contained in these reports is treated as a valuable resource necessary for upgrading UK's competitiveness. (DTI, 2002) The complete list of the indicators (grouped under productivity drivers) is available in Appendix C.

### 2.3. Manufactured Export Competitiveness Index

Wignaraja and Taylor (2003) develop an alternative metric, manufactured export competitiveness index (MECI). This metric is composed of three components:

- Manufactured export value per capita (last year).
- Average manufactured export growth per annum (last 10 years).
- Technology intensive manufactured exports as a percentage of total merchandise exports in last year.

In other words, this metric incorporates the current position of a developing country in export market, the long term export growth that led to this position and the extent to which the developing country's exports are technology intensive (Wignaraja, 2003). Also, the extreme values are discounted with a logarithm function and approximately equal weights are assigned for three components as 0.3, 0.3 and 0.4, respectively.

$$MECI_i = 0.3\ [\log (F_{1j}) - \log (Min_1)]/\ [\log (Max_1) - \log (Min_1)] + 0.3\ [\log (F_{2j}) - \log (Min_2)]/\ [\log (Max_2) - \log (Min_2)] + 0.4\ [\log (F_{3j}) - \log (Min_3)]/\ [\log (Max_3) - \log (Min_3)]$$

where:

$MECI_i$: The index of country i
$F_{ij}$: The observed value of the factor i for country j
$Min_i$: The minimum sample value for factor i (i = 1, 2, 3)
$Max_i$: The maximum sample value for factor i (i = 1, 2, 3)

The developers tested the MECI index for a sample of eighty countries. In the study, it is mentioned that the correlations with both Swiss indices are low (0.65 and 0.54). The overall sample of MECI index is larger than WEF sample, and MECI index covers a wider regional area. This is shown by Wignaraja (2003) as a key advantage since it allows for policies not only for high-income economies but also for developing world.

### 2.4. Technology Index

There are other similar indices composed of various factors. The technology index used to investigate the 40 garment firms in Mauritius is a composite metric. This index is a variant of the index developed by Wignaraja (1998) for Sri Lankan enterprises and Wignaraja and İkara (1999) for Kenyan enterprises (Wignaraja, 2002). In the metric, there are two categories: (1) production capabilities and (2) linkages capabilities. The first category is composed of 10 activities (i.e., measurement of internal reject rates, ISO 9000 quality status, copying existing products, improving existing products, introducing new products). In the second group, linkages involve two activities: Technological interactions with subcontractors and with buyers abroad. These twelve activities are graded with three levels reflecting the competitiveness level: 0, 1 and 2.

The detailed composition of these two main groups is represented in Table 1. After each company is evaluated according to the following criteria, the total score ($\leq 24$) is normalized and a value between 0 and 1 is obtained as the technology index of the associated firm.

This metric has provided the opportunity of assessing large firms and small medium enterprises (SME) according to their technical capabilities. Results such as the following are obtained: large firms have better maintenance capabilities than SMEs and large firms have better quality management than SMEs (Wignaraja, 2002).

Table 1 Factors used in Technology Index calculation (Wignaraja, 2002)

| **Production Capabilities** | | | **Linkages Capabilities** |
|---|---|---|---|
| *Process Engineering* | *Product Engineering* | *Industrial Engineering* | |
| Internal defect rates<br>-No measurement 0<br>-High (>2%) 1<br>-Low (<2%) 2 | Copying<br>- None 0<br>- Ad hoc 1<br>- Systematic 2 | Productivity improvement<br>- None 0<br>- Some 1<br>- Systematic 2 | Subcontracting linkages<br>- None 0<br>- Ad hoc technology transfer 1<br>- Systematic technology transfer 2 |
| ISO 9000 status<br>- No accreditation 0<br>- In progress 1<br>-Obtained 2 | Improving existing products<br>- None 0<br>- Some 1<br>- Considerable 2 | | |
| Maintenance awareness<br>- None 0<br>- Only repair when breakdown 1<br>-Preventive system 2 | Introducing new products in-house<br>- None 0<br>- Some 1<br>- Considerable 2 | | |
| Calibration of equipment<br>- None 0<br>- Little 1<br>- Frequently 2 | | | |
| Substitution of local raw material<br>- None 0<br>- Little 1<br>- A lot 2 | | | |
| Buy new material<br>- None 0<br>- Little 1<br>- A lot 2 | | | |

## 2.5. Relative Unit Labor Cost

A frequently discussed metric is the Relative Unit Labor Cost (RULC) (Fagerberg (1988), Wignaraja (2003), Kibritçioğlu (1996), Boltho (1996), McFetridge, (1995)).

$$RULC^{i,n} = ULC^{i} / ULC^{n}$$

$$ULC^{i} = w^{i} * a_{L}{}^{i}$$

where:

$RULC^{i,n}$: Relative unit labor cost of domestic sector i relative to foreign sector n
$ULC^{i}$: Unit labor cost in domestic sector i
$ULC^{n}$: Unit labor cost in foreign sector n
$w^{i}$: Cost of labor in sector i
$a_L{}^{i}$: The labor needed for producing one unit of a good in sector i

RULC may grow; (1) because wages and social costs for workers in national currency are rising faster than in other countries, (2) because the exchange rate is improving relative to other countries, or (3) because productivity growth is lower than in other countries (Fagerberg, 1988).

The insufficiency of this metric is highlighted in many research results and is mainly based on too much simplification (Fagerberg (1988), Wignaraja (2003), Kibritçioğlu (1996)). Fagerberg (1988) states that; higher growth in RULC leads to decrease in exports, increase in imports and this consequently slows down economic growth. However, he also refers to some studies (namely Kaldor (1978), Kellman (1983), Fetherston *et al.* (1977)), which conclude that "effect of costs or prices on markets or market shares seem to be rather weak and sometimes 'perverse'".

McFetridge (1995) concludes by emphasizing the needs for a broader metric as: "Although ULC comparisons are increasingly viewed as poor indicators of international differences in total cost, the RULC measure can illustrate the type of competitive problems confronting an industry. (…) Labor cost may be a small component of the cost of tradable goods and services. Changes in labor cost may be offset by changes in other factor prices or in other sectors. Therefore, changes in RULC might not result in great changes in exchange rates. A broader unit-cost measure might be a better predictor. A broader unit-cost measure might incorporate the cost of capital as well as the cost of labor" (McFetridge, 1995).

On the other hand, Boltho (1996) strongly supports RULC. According to his research RULC can overcome all the problems that other price-cost related indices face (as referred to in the previous section). "The main advantage of such an index is that sudden changes in competitiveness (whether these take the form of falls in wages, rises in productivity, or nominal depreciations), can now be associated with either declines in tradable prices or with increases in profitability, or with a mixture of the two, depending on what strategies firms follow and on the nature of the markets in which they compete. It is true that the index ignores costs other than

labor but it can be argued that changes in both raw material and capital costs will be more similar across countries than changes in wages, given capital mobility and the existence of world-wide commodity markets" (Boltho, 1996).

### 2.6. Technological Level and Growth in Technological Competitiveness

Fagerberg (1988) first discusses RULC and then states the importance of technological level of a country and ability of delivery on the international competitiveness. In his study, he defines the growth in technological competitiveness as the major factor behind the delivery ability. Therefore, two indicators, namely, technology level and growth in technological competitiveness are introduced. These indicators are defined based on two sources: Technology input and technology output. Expenditures on R&D are used for technology input, whereas patenting data is used for technology output. A weighted average is used in each indicator based on the standard deviations in order to reduce the possible multicollinearity.

The technological level of a country *i* ($TL_i$) is defined as a weighted average of a patent index ($P_i$) and a R&D-based index ($R_i$). $P_i$ is defined as the number of external patent applications ($PAT_i$), divided by the number of inhabitants in the country ($POP_i$) and the openness of the economy measured through exports as a percentage of GDP ($XSH_i$). The R&D-based index $R_i$ is defined as the civil research and development expenditures as a percentage of GDP. Each index is normalized with the highest value observed in the related period (Fagerberg, 1988).

$$TL_i = \{ std(R) / [std(P) + std(R)] \}*P_i + \{ std(P) / [std(P) + std(R)] \}*R_i$$

$$P_i = PAT_i / (POP_i * XSH_i)$$

Where, std stands for the standard deviations of the associated variable.

The growth in country *i*'s technological competitiveness relative to other countries ($TG_i$) is defined as the weighted average of a patent based index ($PG_i$) and a R&D-based index ($RG_i$). The patent based index ($PG_i$) is defined as growth in external patent applications for country *i*, less the average growth rate for all countries. The R&D-based index ($RG_i$) is defined as the ratio between civil R&D expenditures as a percentage of GDP ($RD_i$) and GDP per capita ($T_i$) for country *i*, less the average ratio for all countries in each period.

$$TG_i = \{ std(RG) / [std(PG) + std(RG)] \}*PG_i + \{ std(PG) / [std(PG) + std(RG)] \}*RG_i$$

$$RG_i = RD_i / T_i - \overline{(RD_i / T_i)}$$

As previously mentioned, Fagerberg (1988) has used these indicators in his study as a part of his model, which suggested that "the main factors influencing differences in international competitiveness and growth across countries are technological competitiveness and the ability to compete on delivery."

### 2.7. Revealed Comparative Advantage

Revealed comparative advantage is a widely used competitiveness indicator. Although there are several different suggestions for indicators to represent "Revealed Comparative Advantage", we will concentrate here on the following two representations; named as RCA and RCA-2.

RCA is developed by Balassa (also known as *Balassa Index*) in 1965. Broadly RCA is based on export performance and observed trade patterns. It measures a country's exports of a commodity relative to its total exports and to the corresponding export performance of a set of countries. If RCA>1, then a comparative advantage is revealed (Demir (2001), Kibritçioğlu (1996), Lall (2001), McFetridge (1995)).

$$RCA = (X_i/X) / (X_{iw}/X_w)$$

where:

$RCA_i$ : Revealed comparative advantage in production of commodity i
$X_i$ : The value of exports of commodity i
$X_{iw}$ : The total value of exports of commodity i to a given sector or world
$M_i$ : The value of imports of commodity i
$M_{iw}$ : The total value of imports of commodity i to a given sector or world

Among studies which employ RCA indices some are by Lall (2001), Demir (2001) and DPT (2001a). Lall (2001) has computed RCAs by technological categories in developing regions in his research and he states, "the regions' relative export strengths show up more clearly in their RCA indices."

Demir (2001) has also computed RCA indices for Turkish white goods industry and in order to benchmark, he has also calculated that of some other countries' white goods industry. Finally,

State Planning Organization (Devlet Planlama Teşkilatı – DPT) has computed RCA indices for measuring the competitiveness of tea sector in Turkey (DPT, 2001a).

Voltrah (1991) suggested RCA-2. This index includes both import and export factors. The relative import advantage is illustrated by RMA, and the relative export advantage is illustrated by RXA, the Balassa index. If RCA-2>0, then a trade advantage is revealed (Kibritçioğlu (1996), Demir (2001)). In his study, Demir (2001) has also computed RCA-2 indices for the white goods industry along with RCA indices.

$$RCA\text{-}2 = RXA_i - RMA_i$$

$$RXA_i = (X_i/X) / (X_{iw}/X_w)$$

$$RMA_i = (M_i/M) / (M_{iw}/M_w)$$

where:

$RXA_i$: Relative export advantage for commodity i
$RMA_i$: Relative import advantage for commodity i
X : Country's total exports
$X_w$: The sector's (or the world's) total exports
M : Country's total imports
$M_w$: The sector's (or the world's) total imports

### 2.8. Revealed Technological Advantage

For evaluating the relative technological strengths, an indicator namely, revealed technological advantage (RTA) is developed. The competitive advantage is reached for values greater than 1 (Demir, 2001).

$$RTA_{ij} = ( P_{ij} / \sum_i P_{ij}) / (\sum_j P_{ij} / \sum_{ij} P_{ij})$$

where:

$RTA_{ij}$ : Revealed technological advantage of technological field i of country j

$P_{ij}$: The number of patents of technological field i of country j

Demir (2001) has represented RTA indices for other countries. RTA indices for Turkey have not been calculated since it would be meaningless: The total number of patents granted within a year is very low and this coefficient is close to zero.

### 2.9. Research and Development Related Indicators

In general, research and development (R&D) related indicators are divided into two groups; input based and output based. R&D expenditures (a share of gross domestic product (GDP)), scientific personnel (i.e., scientific personnel/total personnel) are shown as input based, whereas publications or the number of patents are shown as output-based indicators. (Demir (2001), Soete 1981; in Fagerberg 1988, 1996)

Many studies evaluate the R&D expenses and R&D related other indices and display them as the indicator of competitiveness, such as, Demir (2001), Fagerberg (1988, 1996).

What's more, in some studies performed in Turkey, the amount of funding supported by The Scientific and Technical Research Council of Turkey (TUBITAK) is represented as a competitiveness indicator. (DPT, 2001e).

### 2.10. Total Factor Productivity

Total factor productivity (TFP) (also known as Solow Residual or Multi Factor Productivity – MFP) is a widely used productivity measure that is used in representing the competitiveness of a sector or a country. Among the studies calculating TFP are Department for Environment, Food & Rural Affairs (DEFRA) (2002), Filiztekin (2003) and Wong and Sim (1999).

TFP captures anything that changes the relation between measured inputs and measured output (Mankiw, 1997). The input set is generally consists of labor and capital as can be seen in Filiztekin (2003), Mankiw (1997), Wong and Sim (1999).

Another widely known and used metric is labor productivity. However, this single productivity measure is generally treated as missing the productivity growth caused by the capital related reasons and technical changes (Filiztekin (2003), DEFRA (2002)). OECD (2001)

represents a more detailed and technical information along with the technical discussion for the main types of productivity measures.

The general form of the TFP formulation is as follows (Filiztekin (2003), Mankiw (1997)):

$$\Delta A/A=\Delta Y/Y-\alpha\Delta K/K-(1-\alpha)*\Delta L/L$$

where:

A: Total factor productivity

ΔA: Change in TFP

Y: Output

ΔY: Change in output

K: Amount of Capital

ΔK: Change in the amount of capital

L: Amount of labor

ΔL: Change in the amount of labor

α: Capital's share of output

1-α: Labor's share of output (The sum of capital's share and labor's share is equal to 1 under the assumptions of perfect competition and constant returns to scale.)

Mankiw (1997) and Filiztekin (2003) present more detailed information for the formula and an extended explanation for the underlying assumptions.

Broadly, the growth in TFP (ΔA/A) is the difference between the growth in output (ΔY/Y) and the contributions of capital and labor. This formulation represents the TFP in terms of tangible and available data (growth in output, labor and capital). TFP explains the changes that are not caused by the changes in capital and labor. This term is generally treated as the capturing the change in the technology level. Mankiw (1997) explains the underlying reasons that lead changes in TFP: "Changes most often arise because of increased knowledge about production methods. The Solow residual is often used as a measure of technological progress. Yet other factors, such as education and government regulation, can affect TFP as well. For example, if higher public spending raises the quality of education, then workers may become ore productive and output may rise, which implies higher TFP. As another, example, if government regulations

require firms to purchase capital to reduce pollution or increase worker safety, then the capital stock may rise without any increase in measured output, which implies lower TFP."

## 2.11. Domestic Resource Cost

Domestic resource cost (DRC) is a metric that displays whether the domestic resources are used efficiently or not. Values higher than 1 state that the resources are not used efficiently in the production of the associated commodity. This conclusion leads to the investigation of possible production areas in which the domestic resources can be better utilized. For the analysis of competitiveness of the Turkish white goods industry, Demir (2001) has calculated the associated DRC indices.

$$DRC_j = (PV_j - DIV_j - FIV_j) / P_j (1 - FIV_j / PV_j)$$

where:

$DRC_j$: Domestic resource cost of commodity j
$PV_j$: Production value of 1 unit of commodity j
$DIV_j$: Domestic input value in 1 unit of commodity j
$FIV_j$: Foreign input value in 1 unit of commodity j
$P_j$: Import price of 1 unit of commodity j (in terms of local currency)

## 2.12. Trade Entropy Index

Trade entropy index (TEI) is used in trade analysis for measuring the concentration or dispersion of trade. These trade flows can be either in terms of imports or exports.

$$I_{xi} = \sum a_{ij} \ln(1/a_{ij}) \quad \text{with } 0 < a_{ij} < 1 \text{ and } \Sigma\, a_{ij} = 1$$

$$I_{mi} = \sum b_{ij} \ln(1/b_{ij}) \quad \text{with } 0 < b_{ij} < 1 \text{ and } \Sigma\, b_{ij} = 1$$

where:

$I_{xi}$: Entropy index of export.
$I_{mi}$:Entropy index of import.
$a_{ij}$: Export share of country i to country j.
$b_{ij}$: Import share of country i from country j.

In the formula each entity (share of a commodity) is weighted by its relevance and very high export (or import) share is weighted with correspondingly low weights and the very low ones are weighted with higher weights, consequently the higher values (in sum) are obtained for approximately equally distributed shares. In brief, the higher the index the more dispersed is the export (or import) pattern of that country (Yılmaz (2003), Yılmaz and Ergun (2003), Laaser and Schrade, (2002)).

TEI is preferred in studies for comparing trade concentration of countries, for benchmarking purposes such as in Yılmaz and Ergun (2003) and Laaser and Schrader (2002).

## 2.13. Trade Overlap

Trade overlap deals with the import export balance. The overlapped portion of the imports and exports are represented in the dollar terms. This indicator can take values between 0 and 1, and values close to 1 represents high overlap in the trade (exports and import values are close to each other). In the formula, x stands for the exports while m stands for the imports (in dollar value) (Yılmaz (2003), Yılmaz and Ergun (2003)).

$$TO=2\sum_{i=1}^{n}\min(X_i,M_i)/\sum_{i=1}^{n}(X_i+M_i)$$

In his studies Yılmaz (2003), Yılmaz and Ergun (2003), they compare five candidate countries to the European Union (EU) with trade overlap. Since a large deficit between imports and exports is not observed for the EU countries, the value for these countries is close to unity. This (closeness to unity) is also an indicator of "intra-industry trade specialization".

Inter-industry trade specialization refers to the countries exporting goods belonging to one sector and importing goods from another sector. Intra-industry trade (IIT) specialization refers to the countries exporting and importing similar goods. Also note that, Jansen and Landesmann (1999) distinguish IIT as vertical IIT and horizontal IIT, where horizontal IIT refers to the exchange of different varieties of the same basic product (differences in design) and vertical IIT refers to the exchange of goods of different qualities.

## 2.14. Export Similarity

Export similarity (ES) index measures the similarity of export patterns of countries (or country groups) *a* and *b* to market, *b*. In the formula represented below, Xi(ac) is the share of commodity i in *a*'s exports to *c*. If the commodity distribution of two countries' exports are identical than the index takes the value of 100, but if totally dissimilar than the index will take the value of zero (Finger and Kreinin, 1979).

$$S(ab,c)=\left\{\sum_i \text{MİN}\left[Xi(ac),Xi(bc)\right]\right\}100$$

This index is used in research of Yılmaz (2003) and Yılmaz and Ergun (2003), but in a different format as represented in the above formula. Note that the only difference is in the scale; in this representation the index vary between 0 and 1, and 0 stands for the similarity whereas 1 stands for the dissimilarity. The symbols in the formula are represented in the terminology Finger and Kreinin (1979) used.

$$S(ab,c)=\sum_i \left[(Xi(ac)-Xi(bc))/2\right]$$

Note that the index solely compares the patterns of exports, not the export volume (relatively) or total exports. Higher the similarity in patterns (higher the similarity in the distribution), higher the degree of rivalry.

In Yılmaz (2003) and Yılmaz and Ergun (2003), which investigate the Turkey's competitiveness in the EU, by employing the ES index, they have determined the rank of the countries that Turkey would compete in the case of acceptation to the EU.

## 2.15. Competitiveness in Price

There are indicators that display the competitiveness of the prices. For the competitiveness of a domestic sector with foreign countries in another foreign country is defined as follows (Kibritçioğlu, 1996):

$$PC_m^{i,n} = e^{m,i}\ P^i_m / e^{m,n}\ P^n_m$$

where:

$PC_m^{i,n}$ : International price competitiveness indicator of countries i and n in country m's market for a specific commodity

$P^i_m$ : Country i's sales price for a specific commodity in country m's market (in terms of i's currency)

$P^n_m$ : Country n's sales price for a specific commodity in country m's market (in terms of n's currency)

$e^{m,i}$ : Price of country i's currency in terms of country m's currency

$e^{m,n}$ : Price of country n's currency in terms of country m's currency

Assuming that i is the domestic country, there are three possibilities for *m*: (1) $m = i$, (2) $m = n$, or (3) $m$ = a third country. If $m = i$, then the Price Competitiveness (PC) indicator displays the import competitiveness. However, if $m = n$ or $m$ = a third country, then the PC displays the export competitiveness, either in country *n*'s market, or in the market of a third country. With the assumption of *i* representing the domestic country and $m = i$, the above formula becomes as follows:

$$PC_i^{i,n} = P^i_i / e^{i,n} \; P^n_i$$

## 2.16. Widely Used Export – Import Oriented Indicators

*Export Ratio*

Export ratio in the world or in OECD countries is also used as a performance metric. Higher values display a higher degree of competitive advantage. Although this metric seems simple and traditional, this may become the starting point of detailed analysis of a sector or a country. Porter's (1990) research is a considerable example, in the identification of leading sectors within a country, the export shares are considered initially and the identification procedure continues by comparing the country average export shares. There are of course other studies employ export ratio as a competitiveness measure or a benchmark criteria, among them; Demir (2001), DPT (2001a, 2001d), Filiztekin (2003)).

*Import Penetration Rate*

Import penetration ratio (IPR) compares the imports and the domestic demand. Lower values of this ratio (close to 0) represent the low import density in the associated commodity. Widely used IPR provides information about the market structure and composition (Demir,2001).

$$IPR_j = M_j / D_j$$

$$D_j = Y_j + M_j - X_j$$

where:

$IPR_j$: Import penetration ratio in commodity j
$X_j$: Total exports in commodity j
$Y_j$: Total production in commodity j
$M_j$: Total imports in commodity j
$D_j$: Total domestic demand for commodity j

Among the studies employ import penetration ratio are; Demir (2001), DPT (2001a, 2001c, 2001d, 2001f, 2001g, 2001h) and Filiztekin (2003). In Filiztekin (2003), this indicator is used for the benchmark purposes; he has compared the IPR indices of a several countries and interprets the fluctuations (or stability) of this indicator.

*The Ratio of Exports to Imports*

This ratio compares the amounts exported and imported, in other words explores the trade balance. This simply calculated indicator is also widely used in the studies such as Turkish Industrialists' and Businessmen's Association (TUSIAD) (2002), Demir (2001), DPT (2001a, 2001d, 2001f, 2001g). However, it is quite difficult to evaluate the observed value for a specific industry. Values close to one represents a smaller gap between exports and imports, however exact inferences (such as higher values indicate a higher competitiveness) can only be drawn along with the other industry determinants.

Ratio of Exports to Imports = X/M

*Standardized Trade Balance*

Standardized trade balance (STB) is another indicator used for representing the trade balance. TUSIAD (2002) employs this indicator for evaluating the trade balance in machine manufacturing industry of Turkey. This indicator takes negative values in the case of imports

exceed exports. Values close to zero indicate a trade balance and deviations from zero indicate trade gap.

STB = (X – M)/(X + M)

*Exposure to Foreign Competition*

This coefficient represents the degree of openness of the economy to the international area. (Demir (2001), DPT (2001g, 2001h). The higher the value, the more open the economy to the international trade. This indicator represents the threat of imports, if exist. Among the studies, employ this indicator are Demir (2001), DPT (2001a, 2001c, 2001d, 2001f, 2001g).

Exposure to Foreign Competition = X/Y + (1- X/Y) * M/D

*Concentration Ratio*

Concentration ratio checks whether the total production exceeds the total domestic demand or not. Higher values state a higher level of concentration in the production. Almost every study performed by DPT includes this indicator in their competitiveness analysis section (namely DPT (2001a, 2001b, 2001c, 2001d, 2001f, 2001g).

Concentration Ratio =Y/D

## 3. SOME DATA SOURCES

For the majority of the indicators the reliable data sources are generally common. The countries can either obtain the data from local enterprises such as statistics departments or other research institutes, or from international organizations, which investigate the international rankings and performance of the countries with various purposes. Organizations such as Statistical office of the European Commission (EUROSTAT), International Institute for Management Development (IMD), International Monetary Fund (IMF), Organization for Economic Co-operation and Development (OECD), World Economic Forum (WEF), United Nations Conference on Trade and Development (UNCTAD), United Nations Industrial Development Organization (UNIDO) and United Nations Statistics Division constitute the latter group.

In some studies the data resources are summarized. The following represents specific examples of data and related sources.

*RULC:* IMF International Financial Statistics and OECD (Finland).

*External patent applications:* World International Property Organization (WIPO): Industrial Property Statistics.

*R&D Data estimates:* OECD Science and Technology Indicators.

*Export/Import Data by Commodities (SITC Codes):* United Nations International Trade Statistics Yearbook and UNCTAD Handbook of Statistics.

## 4. CONCLUSION

"Competitiveness and competition" have become the most popular concepts of the last decade in the business world, in the political arena and in the academic world. Business world has been preparing action plans for increasing their competitiveness, also funding various research projects serving that aim. Alike the business world, the governments have been starting out the projects for exploring and investigating their competitiveness and consequently using these studies as a remedy to overcome the deficiencies discovered. The academic world has performed an increasing amount of research projects, and conducted debates within these concepts, sometimes purely for academic interest and sometimes for consultancy purposes. Although there has been a huge amount of research and projects almost in every area (both in academic and non-academic), the definitions of the terms and the underlying methodology are still ambiguous and still quite open to debate.

In this study, the definition and the underlying perspectives of the competition, and the most widely preferred indicators in various research and projects are presented along with the associated discussions. Our starting point is identifying the perspectives (micro and macro perspectives) of the competitiveness from the point of traditional view and presenting the enhanced views. The major shortcoming of the traditional views is concluded as "the absence of the technology factor and the possible impacts of technological improvement".

In the second part of the study, composite measures that are employed for ranking the countries from different aspects and indicators most widely used for assessing the competitiveness of a specific sector are presented along with applications. Relative Unit Labor

Cost, Revealed Comparative Advantage, Total Factor Productivity, Trade Entropy Index, and Domestic Resource Cost are among the included indicators. Finally, some data sources are briefly stated, which are probably to be referred to in the studies employing presented indicators.

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**APPENDIX A**

The Growth Competitiveness Index is composed of three sub-indices: The technology index, the public institutions index, and the macroeconomic environment index. As the source, hard data and survey data are used. Survey data is obtained from Executive Opinion Survey and the answers can be on a scale of 1 to 7. On the other hand, the hard data is obtained various sources. Each hard data is converted to a 1-7 scale in order to make the two group of data types consistent. For this conversion the following formula is used.

6 x [(country value – sample minimum) (sample maximum – sample minimum)]+ 1

Note that, the sample minimum and sample maximum are the lowest and highest values of the overall sample.

The sample of countries is divided into two groups: the core groups and the non-core groups. Core groups are countries with more than 15 US utility patents registered per million population and non-core groups are all other countries. The weights within the Growth Competitiveness Index differ for these two groups.

For non-core groups: Growth Competitiveness Index = (1/3 technology index) + (1/3 public institutions index) + (1/3 macroeconomic environment index)

For core groups: Growth Competitiveness Index = (1/2 technology index) + (1/4 public institutions index) + (1/4 macroeconomic environment index)

The computation of these three indices is provided as in Figure A-1.

**Technological core economies**

Core technology index = 1/2 innovation subindex + 1/2 ICT subindex.

**Technological non-core economies**

Non-core technology index = 1/8 innovation subindex + 3/8 technology transfer subindex + 1/2 ICT subindex.

**1. Innovation subindex**

Innovation subindex = 1/4 Survey data + 3/4 hard data.

**Innovation survey questions**

What is your country's position in technology relative to world leaders?
Does continuous innovation play a major role in generating revenue for your business?
How much do companies in your country spend on R&D relative to other countries?
What is the extent of business collaboration in R&D with local universities?

**Innovation hard data**

US Utility Patents granted per million population (for latest available year)
Gross tertiary enrollment rate in (for latest available year)

**2. Technology transfer subindex**

Technology transfer subindex = 1/2 technology transfer Survey question + 1/2 technology-in-trade residual.
Is foreign direct investment in your country an important source of new technology?
Technology-in-trade residual in 1999

**3. Information and communication technology subindex**

ICT subindex = 1/3 ICT Survey data + 2/3 ICT hard data

**ICT survey questions**

How extensive is Internet access in schools?
Is competition among ISPs sufficient to ensure high quality, infrequent interruptions and low prices?
Is ICT an overall priority for the government?
Are government programs successful in promoting the use of ICT?
Are laws relating to ICT (electronic commerce, digital signatures, consumer protection) well developed and enforced?

**ICT hard data**

Number of mobile telephone users per capita
Number of Internet users per capita
Number of Internet hosts per capita
Number of telephone mainlines per capita
Number of personal computers per capita

Figure A- 1 Technology index components (Mcarthur and Sachs, 2001-2002)

Public institutions index = 1/2 contracts and law subindex + 1/2 corruption subindex.

**Contracts and law subindex survey questions**

Is the judiciary independent from the government and/or parties to dispute?
Are financial assets and wealth clearly delineated and well protected by law?
Is your government neutral among bidders when deciding upon public contracts?
Does organized crime impose significant costs on business?

**Corruption subindex survey questions**

How common are bribes paid in connection to import and export permits?
How common are bribes paid when getting connected to public utilities?
How common are bribes paid in connection with with annual tax payments?

Figure A- 2 Public institutions index (Mcarthur and Sachs, 2001-2002)

Macroeconomic environment index = 1/2 macroeconomic stability subindex + 1/4 country credit rating in March 2001 + 1/4 general government expenditure in 2000

**Macroeconomic stability subindex**

Macroeconomic stability subindex = 5/7 macroeconomic hard data + 2/7 macroeconomic survey data

**Macroeconomic environment hard data**

Inflation in 2000
Lending – borrowing interest rate spread in 2000
Real exchange rate relative to the United States in 2000 (1990–95 = 100)
General government surplus in 2000
National savings rate in 2000

**Macroeconomic environment Survey questions**

Is your country's economy likely to be in a recession next year?
Has obtaining credit for your company become easier or more difficult in the past year?

Figure A- 3 Macroeconomic environment index (Mcarthur and Sachs, 2001-2002)

## APPENDIX B

World Competitiveness Yearbook totally consists of 321 factors. These factors are grouped under 20 sub-factors and these 20 sub-factors are grouped as 4 main factors (5 factors in each main competitiveness factors). IMD, works together with 52 partner institutions and obtain the data for 205 criteria (named as hard data). The remaining criteria's data are obtained from Executive Opinion Survey. However, note that, 127 criteria out of 205 are used for the ranking and the rest is referred solely for background information. Each criterion that is included in the ranking is first standardized and then the average of each sub-factor is calculated over these standard values. Afterwards, 20 sub-factors are equally weighted (by 5%) (Rosselet, 2003). The complete list (of factors) is provided in Table B- 1.

Table B- 1 Complete list of indicators in the Global Competitiveness Yearbook (DMI, 2002)

| **Economic Performance** | Domestic Economy | Gross domestic product (GDP) (US$ billions) |
|---|---|---|
| | | GDP (PPP) (US$ billions) |
| | | Private final consumption expenditure (US$ billions) |
| | | Private final consumption expenditure (%GDP) |
| | | Government final consumption expenditure (US% billions) |
| | | Government final consumption expenditure (Percentage of GDP) |
| | | Gross domestic investment (US$ billions) |
| | | Gross domestic investment (% GDP) |
| | | Gross domestic savings (US$ billions) |
| | | Gross domestic savings (% GDP) |
| | | Economic sectors (Breakdown as a percentage of GDP) |
| | | Real GDP Growth (% change) |
| | | Real GDP Growth per capita (% change) |
| | | Private final consumption expenditure - real growth (% change) |
| | | Government final consumption expenditure - real growth (% change) |
| | | Gross domestic investment - real growth (% change) |
| | | Gross domestic savings - real growth (% change) |
| | | Agriculture sector- real growth (% change) |
| | | Industrial production - real growth (% change) |
| | | Services sector - real growth (% change) |
| | | Resilience of the economy |
| | | GDP per capita (US$ per capita) |
| | | GDP per capita (ppp) (US$ per capita) |
| | | Private final consumption expenditure per capita (US$ per capita) |
| | | Government final consumption expenditure per capita (US$ per capita) |
| | | Gross domestic investment per capita (US$ per capita) |
| | | Gross domestic savings per capita (US$ per capita) |
| | | Forecast: Real GDP Growth (% change) |
| | | Forecast: Private consumption expenditure - real growth (% change) |
| | | Forecast: Gross domestic investment - real growth (% change) |
| | | Forecast: Inflation (% change) |
| | | Forecast: Unemployment (5 total labor force) |
| | | Forecast: Current account balance (% GDP/GNP) |

| | | |
|---|---|---|
| | International Trade | Current account balance (US$ billions) |
| | | Current account balance (% GDP) |
| | | Balance of trade (US$ billions) |
| | | Balance of trade (% GDP) |
| | | Balance of commercial services (US$ billions) |
| | | Balance of commercial services (% GDP) |
| | | Exports of goods (US$ billions) |
| | | Exports of goods (% GDP) |
| | | Exports of goods - real growth (% change) |
| | | Exports of commercial services (US$ billions) |
| | | Exports of commercial services (% GDP) |
| | | Exports of commercial services - real growth (% change) |
| | | Exports breakdown by economic sector (Percentage of total exports) |
| | | Imports of goods & commercial services (US$ billions) |
| | | Imports of goods & commercial services (% GDP) |
| | | Imports of goods & commercial services - real growth (% change) |
| | | Imports breakdown by economic sector (Percentage of total imports) |
| | | Trade to GDP ratio ((Exports + Imports) / (2 x GDP)) |
| | | Terms of trade index (Unit value of exports over unit value of imports (1995 = 100)) |
| | | Tourism receipts (International tourism receipts as % GDP) |
| | International Investment | Direct investment flows abroad (US$ billions) |
| | | Direct investment flows abroad (% GDP) |
| | | Direct investment stocks abroad (US$ billions) |
| | | Direct investment stocks abroad - real growth (% change) |
| | | Direct investment flows inward (US$ billions) |
| | | Direct investment flows inward (% GDP) |
| | | Direct investment stocks inward (US$ billions) |
| | | Direct investment stocks inward - real growth (% change) |
| | | Portfolio investments assets (US$ billions) |
| | | Portfolio investments liabilities (US$ billions) |
| | Employment | Employment (Total employment in millions) |
| | | Employment (% population) |
| | | Employment – growth (Estimates: percentage change) |
| | | Employment by sector (% total employment) |
| | | Employment in the public sector (% total employment) |
| | | Part-Time Employment (% total employment) |
| | | Unemployment rate (% labor force) |
| | | Youth unemployment (% labor force) |
| | Prices | Consumer price inflation (Average annual rate) |
| | | Cost-of-living index (Cost index of basket of goods in major cities, excluding housing (New York City = 100)) |
| | | Apartment rent (3-room apartment monthly rent in major cities, US$) |
| | | Office rent (Total occupation cost (US$/Sq.M per year)) |
| **Government Efficiency** | Public Finance | Central government budget surplus/deficit (US$ billions) |
| | | Central government budget surplus/deficit (% GDP) |
| | | Central government domestic debt (US$ billions) |
| | | Central government domestic debt (% GDP) |
| | | Central government foreign debt (US$ billions) |
| | | Central government foreign debt (% GDP) |
| | | Central government total debt - real growth (% change) |

| | | |
|---|---|---|
| | | Interest payment (Percentage of current revenue) |
| | | Management of public finances |
| | | Total reserves (Including gold and official reserves (gold = SDR 35 per ounce)) |
| | | General government expenditure (% GDP) |
| | Fiscal Policy | Collected total tax revenues (% GDP) |
| | | Effective personal income tax rate (% GDP per capita) |
| | | Collected personal income tax (On profits, income and capital gains, as % GDP) |
| | | Employee's social security contribution rate (Compulsory contribution as % GDP per capita) |
| | | Collected employee's social security contribution (Compulsory contribution as % GDP) |
| | | Real personal taxes |
| | | Average corporate tax rate on profit (% of profit before taxes) |
| | | Collected corporate taxes (On profits, income and capital gains, as % GDP) |
| | | Employer's social security contribution rate (Compulsory contribution as % GDP per capita) |
| | | Collected employer's social security contribution (Compulsory contribution as % GDP) |
| | | Real corporate taxes |
| | | Collected capital and property taxes (% GDP) |
| | | Collected indirect tax revenues (Taxes on goods and services as % GDP) |
| | | Tax evasion |
| | Institutional Framework | Real short-term interest rate (Real discount / bank rate) |
| | | Cost of capital |
| | | Interest rate spread (Lending rate minus deposit rate) |
| | | Country credit rating (Rating on a scale of 0-100 assessed by the Institutional Investor Magazine ranking) |
| | | Central bank policy |
| | | Exchange rate policy |
| | | Exchange rate stability (Parity change from national currency to SDR, 2002/2000) |
| | | Consensus about policy direction |
| | | Legal framework |
| | | New legislation |
| | | Government economic policies |
| | | Government decisions |
| | | Political parties |
| | | Transparency |
| | | Public service |
| | | Bureaucracy |
| | | Bribing and corruption |
| | Business Legislation | Integration into regional trade blocks |
| | | Customs' authorities |
| | | Protectionism |
| | | Public sector contracts |
| | | Export credits and insurance |
| | | Ease of doing business |
| | | Government subsidies |
| | | Subsidies |
| | | Competition legislation |

| | | |
|---|---|---|
| | | Product and service legislation |
| | | Price controls |
| | | Parallel economy |
| | | Foreign companies |
| | | Creation of firms |
| | | Labor regulations |
| | | Unemployment legislation |
| | | Immigration laws |
| | | Legal regulation of financial institutions |
| | | Confidentiality of financial transactions |
| | | Cross-border ventures |
| | | Foreign investors |
| | | Foreign financial institutions |
| | | Access to local capital markets |
| | | Access to foreign capital markets |
| | | Investment incentives |
| | | Investment protection schemes |
| | Societal Framework | Justice |
| | | Personal security and private property |
| | | Protection of the private sphere |
| | | Risk of political instability |
| | | Social cohesion |
| | | Serious crime (Number of murders, violent crimes or armed robberies per 100,000 inhabitants) |
| | | Income distribution - lowest 20% (% household incomes going to lowest 20% of households) |
| | | Income distribution - highest 20% (% household incomes going to highest 20% of households) |
| | | Discrimination |
| | | Females in parliament (% total seats in Parliament) |
| | | Female positions (% total legislators, senior officials and managers) |
| | | Gender income ratio (Ratio of estimated female to male earned income globally) |
| | | Harassment and violence |
| **Business Efficiency** | Productivity | Overall productivity (PPP) (Estimates: GDP (PPP) per person employed, US$) |
| | | Overall productivity (GDP per person employed, US$) |
| | | Overall productivity - real growth (Estimates: % change of real GDP per person employed) |
| | | Labor productivity (PPP) (Estimates: GDP (PPP) per person employed per hour, US$) |
| | | Labor productivity (GDP per person employed per hour, US$) |
| | | Agricultural productivity (PPP) (Estimates: Related GDP (PPP) per person employed in agriculture, US$) |
| | | Agricultural productivity (Related GDP per person employed in agriculture, US$) |
| | | Productivity in industry (PPP) (Estimates: Related GDP (PPP) per person employed in industry, US$) |
| | | Productivity in industry (Related GDP per person employed in industry, US$) |
| | | Productivity in services (PPP) (Estimates: Related GDP (PPP) per person employed in services, US$) |
| | | Productivity in services (Related GDP per person employed in services, US$) |
| | Labor Market | Compensation levels (Estimates: Total hourly compensation for manufacturing |

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|---|---|---|
| | | workers (wages + supplementary benefits), US$) |
| | | Unit labor costs in the manufacturing sector (% change) |
| | | Remuneration in services professions (Gross annual income including supplements such as bonuses, in US$) |
| | | Remuneration of management (Total base salary plus bonuses and long-term incentives, US$) |
| | | Working hours (Average number of working hours per year) |
| | | Labor relations |
| | | Worker motivation |
| | | Industrial disputes (Working days lost per 1,000 inhabitants per year (Average 1999-2001)) |
| | | Employee training |
| | | Labor force (Employed and registered unemployed) |
| | | Labor force (% population) |
| | | Labor Force Growth (% change) |
| | | Female labor force (% total labor force) |
| | | Foreign labor force (% total labor force) |
| | | Skilled labor |
| | | Finance skills |
| | | Brain drain |
| | | Foreign high-skilled people |
| | | International experience |
| | | Competent senior managers |
| | Finance | Banking sector assets (% GDP) |
| | | Financial assets of institutional investors (US$ billions) |
| | | Credit |
| | | Number of credit cards issued (Per capita) |
| | | Credit card transactions (US$ per capita) |
| | | Investment Risk (Euromoney country credit-worthiness scale from 0-100) |
| | | Venture capital |
| | | Banking services |
| | | Retail Banking (Population /number of bank offices) |
| | | Banking regulation |
| | | Stock markets |
| | | Stock market capitalization (US$ billions) |
| | | Value traded on stock markets (US$ per capita) |
| | | Listed domestic companies (Number of listed domestic companies) |
| | | Stock market index (% change on index) |
| | | Rights and responsibilities of shareholders |
| | | Financial institutions' transparency |
| | | Insider trading |
| | | Cash flow |
| | | Factoring (% merchandise exports) |
| | Management Practices | Adaptability |
| | | Ethical practices |
| | | Credibility of managers |
| | | Corporate boards |
| | | Shareholder value |
| | | Customer satisfaction |
| | | Entrepreneurship |
| | | Marketing |
| | | Social responsibility |
| | | Health, safety & environmental concerns |

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|---|---|---|
| | Attitudes and Values | Globalization |
| | | Attitudes toward globalization |
| | | Relocation threats of production |
| | | Relocation threats of R&D facilities |
| | | Image abroad |
| | | National culture |
| | | Flexibility and adaptability |
| | | Values of society |
| **Infrastructure** | Basic Infrastructure | Land area (Square kilometers ('000)) |
| | | Arable area (Square meters per capita) |
| | | Urbanization |
| | | Population - market size (Estimates in millions) |
| | | Population under 15 years (% total population) |
| | | Population over 65 years (% total population) |
| | | Dependency ratio (Population under 15 and over 64 years old, divided by active population (15 to 64 years)) |
| | | Roads (Density of the network) |
| | | Railroads (Density of the network) |
| | | Air transportation (Number of passengers carried by main companies) |
| | | Quality of air transportation |
| | | Distribution infrastructure |
| | | Water transportation |
| | | Maintenance and development |
| | | Energy infrastructure |
| | | Total indigenous energy production (Millions MTOE) |
| | | Total indigenous energy production per capita (Millions MTOE per capita) |
| | | Total indigenous energy production (% total requirements in tons of oil equivalent) |
| | | Total final energy consumption (Millions MTOE) |
| | | Total final energy consumption per capita (Millions MTOE per capita) |
| | | GDP and energy consumption (Real GDP growth minus energy consumption growth) |
| | | Energy intensity (Amount of commercial energy consumed for each dollar of GDP in kilojoules) |
| | | Energy imports vs. merchandise exports (Energy imports as a percentage of merchandise exports in US$) |
| | | Self-sufficiency in non-energy raw material (Trade balance per capita in US$) |
| | | Electricity costs for industrial clients (US$ per kwh) |
| | Technological Infrastructure | Investment in telecommunications (% Percentage of GDP) |
| | | Fixed telephone lines (Number of main lines per 1000 inhabitants) |
| | | International fixed telephone costs (US$ per 3 minutes in peak hours to USA (for USA to Europe)) |
| | | Mobile telephone subscribers (Number of subscribers per 1000 inhabitants) |
| | | Mobile telephone costs (US$ per 3 minutes in peak hours (local)) |
| | | Adequacy of communications |
| | | New information technology |
| | | Computers in use (Worldwide share / Source: Computer Industry Almanac) |
| | | Computers per capita (Number of computers per 1000 people / Source: Computer Industry Almanac) |
| | | Internet users (Number of internet users per 1000 people / Source: Computer Industry Almanac) |

| | | |
|---|---|---|
| | | Secure servers (Number of secure servers per million inhabitants) |
| | | Internet costs (Internet access basket for 20 hours at peak times, (US$)) |
| | | Suitable Internet access |
| | | Information technology skills |
| | | Technological cooperation |
| | | Development and application of technology |
| | | Funding for technological development |
| | | High-tech exports (US$ millions) |
| | | High-tech exports (% manufactured exports) |
| | | Data security |
| | Scientific Infrastructure | Total expenditure on R&D (US$ millions) |
| | | Total expenditure on R&D per capita (US$ per capita) |
| | | Total expenditure on R&D (% GDP) |
| | | Business expenditure on R&D (US$ millions) |
| | | Business expenditure on R&D per capita (US$ per capita) |
| | | Total R&D personnel nationwide (Full-time work equivalent (FTE)) |
| | | Total R&D personnel nationwide per capita (Full-time work equivalent (FTE) per 1000 people) |
| | | Total R&D personnel in business enterprise (Full-time work equivalent (FTE)) |
| | | Total R&D personnel in business per capita (Full-time work equivalent (FTE) per 1000 people) |
| | | Basic research |
| | | Science degrees (% of total first university degrees in science and engineering) |
| | | Scientific articles (Scientific articles published by origin of author) |
| | | Science in schools |
| | | Interest in science and technology |
| | | Nobel prizes (Awarded in physics, chemistry, physiology or medicine and economics since 1950) |
| | | Nobel prizes per capita (Awarded in physics, chemistry, physiology or medicine and economics since 1950 per million people) |
| | | Patents granted to residents (Number of patents granted to residents) |
| | | Securing patents abroad (Number of patents secured abroad by country residents) |
| | | Patent and copyright protection |
| | | Number of patents in force (Per 100,000 inhabitants) |
| | | Patent productivity (Patents granted to residents / R&D personnel in business ('000s)) |
| | Health and Environment | Total health expenditure (% GDP) |
| | | Public expenditure on health (% total health expenditure) |
| | | Life expectancy at birth (Average estimate) |
| | | Healthy life expectancy (Average estimate) |
| | | Medical assistance (Number of inhabitants per physician and per nurse) |
| | | Health infrastructure (meets the needs of society) |
| | | Urban population (Percentage of total population) |
| | | Human development index (Combines economic - social - educational indicators / Source: Human Development Report ) |
| | | Alcohol and drug abuse |
| | | Paper and cardboard recycling rate (% apparent consumption) |
| | | Waste water treatment plants (% population served) |
| | | Carbon dioxide emissions (CO2 industrial emissions in metric tons per one million US$ of GDP) |
| | | Ecological footprint (Area units per person, hectares of biologically productive |

| | | |
|---|---|---|
| | | space) |
| | | Sustainable development |
| | | Pollution problems |
| | | Environmental laws |
| | | Quality of life |
| | Education | Total public expenditure on education (% GDP) |
| | | Pupil-teacher ratio (primary education) (Ratio of students to teaching staff) |
| | | Pupil-teacher ratio (secondary education) (Ratio of students to teaching staff) |
| | | Secondary school enrollment (% relevant age group receiving full-time education) |
| | | Higher education achievement (% population that has attained at least tertiary education for persons 25-34) |
| | | Educational assessment (PISA survey of 15-year olds) |
| | | Educational system |
| | | University education |
| | | Illiteracy (Adult (over 15 years) illiteracy rate as a percentage of population) |
| | | Economic literacy |
| | | Education in finance |
| | | Qualified engineers |
| | | Knowledge transfer |

## APPENDIX C

The complete list of the indicators is as follows:

Table C- 1 Complete list of competitiveness indicators (DTI 2002)

| | | |
|---|---|---|
| **Results** | Macro-environment | Macroeconomic stability |
| | Output / productivity | GDP per head |
| | | Labor productivity |
| | Employment | Employment rate |
| | Quality of life | Quality of life |
| **Investment** | Physical capital | Business investment |
| | | Government investment |
| | Information and communications technology | Connecting to the digital market place |
| | | E-commerce |
| **Innovation** | Science And Technology | Publications and citations |
| | | Government spend on R&D |
| | | Business spend on R&D |
| | Technology commercialization | Business spend on innovation incl. R&D |
| | | UK's patenting performance |
| | | Proportion of firms that innovate |
| | | Sales from new or improved products |
| | Knowledge Transfer | University licensing, spin-outs & start-ups |
| | | Sources of information for innovation |
| | | Joint publishing by universities and industry |
| | Receptiveness To Foreign Ideas | Internationalization of R&D |
| | | Technological alliances between firms |
| **Skills** | Human Capital | Adult literacy and numeracy |
| | | Intermediate and higher-level skills |
| | | Lifelong learning |
| | | Management skills |
| | | ICT understanding in companies |
| **Enterprise** | Entrepreneurship | Entry and exit rates |
| | | Fast growing firms |
| | | Attitudes to risk-taking |
| | Finance | Venture capital |
| | | Parallel markets |
| | | Main equity markets |
| **Competitive markets** | Product market | Openness to trade and foreign investment |
| | | Prices |
| | Labor market | Unemployment |
| | | Diversity of employment opportunities |
| | | Industrial relations |
| | | Labor market regulation |