

OCCASIONAL PAPER

**VIP<sup>2</sup>: A SIMPLE MEASURE OF A NATION'S (NATURAL) GLOBAL POWER**

**by**

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# 1 Introduction\*

The USA is often referred to as the most powerful Nation on Earth, particularly since the collapse of the USSR in 1990. It is well known that the US economy is the largest in the world. But does the size of an economy measure a Nation's power in a global context? During the cold war between the US and NATO and the USSR and Soviet Bloc the World was treated as being bi-polar, i.e. the two countries USA and USSR were recognized to be the two most powerful in the World of the time. The most visible part of their competition was in Space, Nuclear, Defense and other technology. The possession of advanced military equipment such as ICBMs, submarines, aircraft carriers, bombers and fighters was also an element of the relative power of these two nations. Since then complex models have been built to define and measure a Nation's Global Power. Economic and Technological factors play a major role in these models[see eg. Tellis et al(2000)]. Other factors are natural resources, education & skills and investment in R&D and technology development.

State power is the "extent that (one) affects others more than they affect [one]"[Waltz (1979)]. It is therefore a "combination of its capacity to resist the unwelcome influence of others and conversely to influence others to behave as it wants them to." International relations experts have been divided on the relative importance of economic strength and military might in the global power of a nation. We resolve this conflict by decomposing national power into two elements: (a) The 'power potential' of a country, which depends on economic strength and general technological capability, and (b) Military capability. This includes defense and strategic equipment and specific technologies needed for attaining military superiority. Together these define the Actual power of a country. International ambition and determination, the 'Will to power' play a role in transforming the 'power potential' into 'actual power.'

Virmani (2004, 2005) proposed a simple index of 'power potential'. In this paper we present the index (christened  $VIP^2$ ), discuss its rationale and calculate the value of this index for all the medium & large countries in the World. We also define an index of actual power (VIP) based on  $VIP^2$ , which requires a separate measure of Military capability.

The next section discusses the economic basis of national power. Section 3 defines the  $VIP^2$  (Virmani index of power potential). This index is then calculated for about 110 countries (appendix). Sections 4 and Section 5 present and discuss the results for the Global and Regional Powers. Section 6 gives a sensitivity analysis on the key parameter used on the index. Section 7 discusses the likely evolution of the  $VIP^2$  clubs. Section 8 analyses the implications for permanent, veto bearing membership of the UN Security Council. Section 9 concludes the paper.

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## 2 Economic Strength and National Power

An appreciation of the role of economic size and technological potential on the Global Balance of Power has grown since the Second World War. Prof. Paul Kennedy, in his Foreign Affairs article and subsequent book, 'The Rise and Fall of Great Powers' gave economics considerable weight in the evolution of the Global balance of power. He made the following points:

- Traditional Field of International Relations has not fully appreciated the role of economic strength, with the role of economic factors relatively neglected!
- Military power rests on and is sustained by economic power.
- The rise and fall of great powers can be traced to the change in their economic strength.
- Relative rather than absolute economic strength is the relevant variable.
- There may be leads and lags between the change in economic power, Military power and National Power.

Economic Power is the foundation of National Power. Economic Strength is the only sustained and sustainable basis for national power and Relative Economic Power is the basis for National Power. Even though military power disproportionate to economic power can be used to enhance national power for a certain period of time, this is not sustainable over long periods. This was illustrated by the break-up of the USSR, where the Military and Strategic competition could not be sustained by a declining economy. The role of economic factors in International Affairs is, likely to be much greater in the 21st century than it has been in previous centuries. With the growth of communication and the increased mobility of goods & services, labor, capital and technology, much technical knowledge is becoming the common heritage of mankind in reality. General technological capability is increasingly part and parcel of economic evolution, and 'economic factors,' therefore, encompasses this technology. The process of modernization and global economic integration has expanded the gains from economic co-operation between states, reduced the gains to the winner from war, and increased the potential losses to third parties from active war between states. The lags between the rise or decline of economic power and the rise or decline of great powers are also likely to shorten during the 21st century.

Tellis et al (2000) have developed a comprehensive and complex model for measuring power in terms of the ability of a State to achieve and sustain global hegemony. In their model military capability is the outcome of an interaction between national resources and national performance. National resources consist of five building blocks of power, technology, enterprise, human resources, financial/capital resources and physical resources. National performance contains three factors, infrastructural capacity, ideational resources and ideational resources that augment or detract from the utilization of these natural resources.

The factors mentioned in the Tellis model are all inputs into the productive capacity of an economy, though their economics nomenclature and definition may be different. Thus a country's natural resource (e.g. oil), physical capital stock (including the stock of infrastructure), human capital (education & skills) and technology (including management, marketing and entrepreneurship) are all inputs into the production of national output and are

formally included in the aggregate production function of the economy.<sup>1</sup> The Gross Domestic Product of a country, which is the output produced by all these inputs, given the external (e.g. technology denial) and internal (e.g. quality of governance, social divisions/conflicts) constraints facing economic agents, is therefore a summary index of its ‘national resources’ and ‘national capacity.’ Even more broadly the growth of a country’s GDP and the level it has reached reflects both the strengths and weakness of its Society (Social capital, religion, culture, family) and Institutions (Political, market regulating, Non-profit organisations, civil) in addition to the its National Policies.<sup>2</sup>

## **2.1 Commercial and Strategic Technology**

There is need to distinguish between two categories of Technology; Commercial and Strategic.<sup>3</sup> Commercial technology is part and parcel of normal trade, financial flows and movement of managers and skilled personal between open economies. FDI normally bundles two or more of these together. Any specific commercial technology (not available at a given time in the country) can therefore either be purchased from global markets or be attracted to the country through FDI (joint ventures etc.).

Strategic technologies are the technologies of power. They include military related technologies as well as nascent technologies that may play a critical role in future defense systems. Because of the uncertainty inherent in forecasting the future, less developed technologies may at one stage be classed as ‘commercial’ and at another stage as ‘strategic.’ By definition strategic technologies are critical to national power and are not traded on commercial considerations. General technological capability forms the foundation of strategic technology, but its development requires specific and focused attention. It has either to be developed through national effort or acquired through strategic/military alliances.

General technological capability therefore has a dual role: It is the foundation of the productive capability of the economy and also the foundation for the development of specific strategic technologies. Thus in the real world in which nations guard their strategic technological knowledge, those with higher technological capabilities have a greater ability to develop strategic technology and therefore greater power potential.

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<sup>1</sup>  $Y = F(K, H, R, T)$ , where Y is GDP, K is the stock of physical capital, H is the stock of human capital (education & skills), R represents natural resources (e.g. oil, minerals), and T is the level of technology (broadly defined).

<sup>2</sup> The quality of institutions is an important determinant of growth. Social capital and related variables are also found to be significant.

<sup>3</sup> “Dual use technologies” represent the overlap between the two types.

## 3 Index of Power

### 3.1 Productive Capability

The economic capacity of a country at any point in time is measured by its Gross Domestic Product (GDP). This represents its output of Goods and Services during the year. The same economy can produce different goods and service in different amounts, with the actual pattern of output depending on the pattern of demand. In general two economies can differ not only in their productive capacity but also in the pattern of demand. So how do we know that one economy is larger than another i.e. has greater productive capacity? The only way to compare the size of different economies is by valuing all goods and services produced in each, by using a common set of relative prices. Such a measure of a country's economy is referred to as Gross Domestic Product at Purchasing Power Parity (Y).<sup>4</sup>

The technological capability of an economy depends on many factors. Virmani (2004) has used the principle of OCCAM's razor to define technological capability in the simplest possible way. This is done by using the familiar concept of an aggregate production function.<sup>5</sup> When viewed from the perspective of productive capacity an economy consists of different productive resources such as unskilled labor, stocks of physical capital, human capital in the form of education & skills, natural resources such as oil & minerals dis-embodied technology (organizations) and technological capabilities embodied in capital goods and human beings. The aggregate production function shows how these resources can be combined to produce output i.e. it summarizes the productive capacity of the economy. The aggregate production function and the related concept of aggregate factor productivity can be used to define the general technological capability of an economy.

The concept of total factor productivity growth (TFPG) is commonly used in economics to measure technological change in an economy. Conceptually the level or value of total factor productivity (TFP) could represent the technological capability of a country. Its operationalisation, however, requires the assumption that technology is dis-embodied and neutral.<sup>6</sup> As we have indicated, technology is often embodied in capital and labor i.e. it is inseparable from the physical capital or the laborer/employee.<sup>7</sup> In addition, historically we observe that capital intensity (capital per unit of labor input  $k$ ), the education/skill level of the labor force (human capital per person  $h$ ) and technology ( $T$ ) move broadly in tandem as an economy develops. In other words, for new/better technology to be translated into higher output per person an appropriate compliment of better skills and more capital per person is also needed i.e. they form a package that together produces a higher level of productivity. Labor productivity or output per unit of labor is a summary measure of the level and quality of this package of technology, capital intensity and skill intensity. As it is much easier to define and measure than TFP, it is operationally a more useful measure of an economy's

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<sup>4</sup> If the economy is open and competitive it also follows that it is producing things in which it has a comparative advantage and importing those which others produce relatively efficiently. If the policy distortion prevent this from happening the economy's productive capacity will be reduced and this will be reflected in GDP at PPP.

<sup>5</sup> Familiar to economists and particularly macro-economists.

<sup>6</sup> That is the aggregate production has a form  $Y = T(t) F(K, H, R, L)$  in which the technology factor  $T(t)$  is separable from the factor inputs, capital( $K$ ), human capital ( $H$ ), natural resources( $R$ ) and unskilled labor ( $L$ ). In this case  $T(t) = \text{TFPG}$ .

<sup>7</sup> It has the form  $Y = F(A(t)K, B(t)L, H, R)$  or  $Y = F(A(t)K, B(h, t)L, R)$ . The definition and measurement of TFPG is very complex and difficult in this case.

technological capability than TFP.<sup>8</sup> Per capita Gross Domestic Product at purchasing power parity or GDP per person ( $y = Y/L$ , with  $L =$  population) can therefore be used as a summary measure of the ‘general technological capability’ of an economy.

### 3.2 Power Potential: $VIP^2$

A Nation’s power potential (NPP) can therefore be defined as the multiple of the size of its economy measured by the GDP at purchasing power parity ( $Y$ ) and its technological capability measured by its Per Capita GDP ( $y$ ):

$$NPP = Y * y^\alpha, \quad y = Y/L,$$

$L$  is the population and  $\alpha$  is a parameter that can have a value between 0 and 1. If we substitute  $Y = y * L$  in the above equation and put  $\beta = 1 + \alpha$ , we obtain;

$$NPP = L * y^\beta \text{ where } \beta \text{ is a parameter that can have a value between 1 and 2.}$$

The Virmani Index of Power Potential (VIPP) or  **$VIP^2$**  in short, is the power potential of a country (as defined above) relative to the USA:

$$(1) \quad VIP^2 = (Y/Y_{usa}) * (y/y_{usa})^\alpha, \text{ where } 0 \leq \alpha \leq 1$$

Or equivalently as

$$(2) \quad VIP^2 = (L/L_{usa}) * (y/y_{usa})^\beta, \text{ where } 1 \leq \beta \leq 2$$

A number of conclusions follow from these equations;

If  $\alpha = 0$  ( $\beta = 1$ ) then

(a) The power potential of a country is measured by its GDP (at purchasing power parity) relative to that of the USA. A country with a higher GDP is potentially more powerful than one with lower GDP. Implicitly population and per capita income (GDP) have equal weight.

If  $\alpha$  is non-zero, then

(b) If two countries have the same GDP but one is richer than the other (higher per capita income/GDP)<sup>9</sup> the richer country will be potentially more powerful. As per capita income is an indicator of general technological capability, this multiplies the power potential of a given GDP. Overall it also means that technology (per capita income) has a greater weight in determining power potential than population (number of people). In applying this index to measure the relative power of countries we assume that  $\alpha = 0.5$  ( $\beta = 1.5$ ).<sup>10</sup> The power

<sup>8</sup> Labor Productivity  $y = f(A(t)k, h, r, T(t))$ , where  $k = K/L$ ,  $h = H/L$ ,  $r = R/L$ . In this case it does not matter if  $T(t)$  is non-separable as shown or separable as follows:  $y = T(t) f(A(t)k, h, r)$ .

<sup>9</sup> The other country therefore has a large population.

<sup>10</sup> For this set of medium-large countries we estimated for 2002 the relationship between Per capita GDP measured at current exchange rate  $x$  and Per capita GDP at purchasing power parity  $y$ . On running a cross section regression for 2002 data we find the following relationship:  $x = A y^{0.5}$ . This was one of the reasons for selecting  $\alpha = 0.5$  after simulating the index for a range of  $\alpha$  values from 0.25 to 0.75.

potential of all countries with a GDP at purchasing power parity of more than \$ 15 billion in 2002 (WDI 2004) is estimated using this index.

### 3.3 Actual Power: VIP

‘Actual power’ will however depend (among other things) on the proportion of national resources spent on developing these strategic technologies and in translating them into weapons systems. As both these items are classified as Public goods the difference between actual and potential power will depend on the allocation of expenditure on public goods as a whole as well as on the allocation to different types of public goods. Strategic alliances with a more powerful country can achieve the same objective at lower resource cost if the more powerful country transfers strategic technology to the less powerful one. Clearly the more powerful country will only do this if the less powerful one is able to enhance its Power or Welfare in some other way (e.g. provision of bases, supply of soldiers/guerilla fighters, oil contracts, help in anti-terrorist operations).

In the national accounts expenditure on public goods like defense and strategic technology, is treated as current expenditure valued at current cost. From the perspective of national power it is more like an investment in capital equipment. Further as it is not a commercial tradable good or technology its value is not equal to the cost or notional price at which it is acquired. The shadow price of a strategic good for a country that does not have the capability to produce it is much higher than the cost expended by the country which has already produced it. If we are to compare the diverse range of investments by different countries we must use the same shadow price for all countries.<sup>11</sup> If the value of this investment over time can be correctly cumulated into a stock of strategic technology and equipment this would explain a substantial part of the difference between “potential” and “actual” power.

Formally this can be written as,

$$K_t^s = p_t E_t - \delta K_{t-1}^s ,$$

where at time t,  $K_t^s$  is the stock of strategic technology t,  $E_t$  is the expenditure on this technology valued at the shadow price  $p_t$  and  $\delta$  is the rate of depreciation of the stock. The Virmani index of actual power (VIP) could then be defined as,

$$VIP = VIP^2 * K^s / K_{us}^s$$

The former USSR spent a lot of resources on strategic technologies & goods (E) and thus attained a level of VIP that was much greater than its  $VIP^2$ .<sup>12</sup> This level of expenditure on one public good perhaps led to the neglect of others. The USSR was ultimately unable to sustain such high levels of public expenditures on strategic technology and collapsed under the burden. The accumulated strategic knowledge ( $K^s$ ) though it has deteriorated over time has not been lost. Though the economy of Russia is much smaller than the USSR and the

<sup>11</sup> This will be higher than the highest cost incurred by any country.

<sup>12</sup> Further its power potential was related not just to the economic size of the USSR but to economic size of the Warsaw pact which was more like a Soviet empire. The Warsaw pact was in the context of power more integrated than the current EU.

Warsaw pact, the reduction in the ‘power potential’ was greater than the reduction in the strategic capability ( $K^S$ ). Therefore the gap between its ‘power potential’ and its ‘actual power’ remains much larger than is usually observed among normal nation states.

Conversely, Japan after its defeat in World War II became a pacifist nation, which deliberately reduced expenditure on strategic technology, defense systems and forces. It also gave up any ambitions of being an independent power in Asia. Its ‘actual power’ is therefore lower than its ‘power potential.’ Post war Germany also has some of these characteristics. In addition some very small economies with low power potential (e.g. Israel, Pakistan) have skillfully used formal or informal alliances to attain a level of actual power far in excess of their power potential. In general, however, country expenditure on such technology/systems is highly correlated with GDP, and consequently so is actual power and power potential.

## 4 Global VIP<sup>2</sup> s

After calculating the Index of power potential for each country in the world for which GDP and population data is available in the World Bank WDI for 2003, we rank them from most powerful to weakest. We also use the IMF GDP data for 2004 and its projections till 2006, to calculate the index for all medium-large countries for 2005(appendix). For selected countries we extend the forecast up to 2008 and beyond. We define the Global VIP<sup>2</sup>s by using a cut-off value of the index of 5%.<sup>13</sup> This gives us 13 global VIP<sup>2</sup>s and one borderline case (table 1).

**Table 1: GLOBAL VIP<sup>2</sup> s IN 2005**

Economy	VIP <sup>2</sup> Rank							GDP Rank			Index of Power: VIP <sup>2</sup>						
	2003	2005	2007	2010	2012	2016	2023	2003	2005	2007	2003	2005	2007	2010	2012	2016	2023
<b>Global Powers</b>																	
United States	1	1	1	1	1	1	1	1	1	1	100%	100%	100%	100%	100%	100%	100%
Japan	2	2	3	3	3	3	4	3	3	4	28%	27%	26%	25%	24.8%	23.7%	21.8%
China	3	3	2	2	2	2	2	2	2	2	22%	25%	29%	34%	39%	48%	67%
<b>Regional Powers</b>																	
Germany	4	4	4	4	4	5	5	5	5	5	18%	17%	16%	15%	14.8%	14.1%	13.2%
France	5	5	5	5	7	7	7	6	6	6	13%	12%	12%	12%	11.7%	11.3%	10.8%
United Kingdom	6	6	6	6	6	6	6	7	7	7	13%	12%	12%	12%	11.7%	11.6%	11.3%
Italy	7	7	7	8	8	8	11	8	8	9	12%	11%	11%	10.2%	9.8%	9.2%	8.2%
India	9	8	8	7	5	4	3	4	4	3	7.8%	8.5%	9.3%	10.8%	11.9%	14.9%	22.3%
Canada	8	9	9	9	9	10	10	11	11	11	8.0%	7.8%	7.9%	8.0%	8.1%	8.2%	8.2%
Russia	11	10	10	10	10	9	8	10	9	8	6.0%	6.5%	6.9%	7.4%	7.7%	8.5%	9.7%
Spain	10	11	11	11	12	12	12	13	13	13	6.5%	6.4%	6.4%	6.5%	6.5%	6.6%	6.6%
Brazil	12	12	13	13	13	13	13	9	10	10	5.7%	5.8%	5.7%	5.7%	5.7%	5.5%	5.1%
Korea, Rep.	13	13	12	12	11	11	9	14	14	14	5.5%	5.5%	5.9%	6.4%	6.7%	7.4%	8.5%
Australia	14	14						16	17		4.8%	4.7%	4.8%	4.8%	4.9%	5.0%	5.0%

According to our index, China is now the third strongest power in the World and will displace Japan in second place in the next few years. The larger rich countries of Europe, Germany, France, UK and Italy are long time members of the global VIP<sup>2</sup> club and will remain more powerful than India for some time even though the latter’s economy is the fourth largest in the world.<sup>14</sup> India has just moved into 8<sup>th</sup> rank in the global VIP<sup>2</sup> club

<sup>13</sup> The alternative would be to take the top 10 or 15.

<sup>14</sup> In GDP at PPP, the only way to compare the size of the economy. Their GDP converted at the current exchange rate is much larger than India’s.

displacing G7 member Canada. Its GDP will become larger than Japan's in the next three years, and its power will exceed that of Italy a year or so later (see below). Its power potential is greater than that of Russia, which is in 10<sup>th</sup> place behind Canada. As noted earlier Russia's actual power is greater than its 'power potential' because of the historical legacy of the Soviet empire. The other members of the global power club are Spain, Brazil and South Korea. S. Korea's power potential is rising relative to that of Spain and Brazil and is likely to exceed it in the next five years.

The set of global VIP<sup>2</sup> s is not necessarily identical to the set of global powers. The latter would constitute a sub-set of the former. Countries with a VIP<sup>2</sup> of less than 10% cannot lay claim to being global powers and a cut-off value double this appears reasonable. The benchmark could therefore be 20%. By this criterion only China and Japan qualify today (in addition to the USA). Germany which was a potential global power till a decade ago is no longer one.

## 5 Regional Powers and VIP<sup>2</sup> s

The academic debate and general discussion of international relations often refers to regional powers. Is there any way of objectively defining these regional powers. We can use our index with a cut-off percentage of 1.5% to first define the set of Regional VIP<sup>2</sup> s ie the members of the regional VIP club. These are given in tables 2 and 3 below. Among the different regional groupings, unsurprisingly, Europe has the largest number of regional VIP<sup>2</sup>s (14), followed by Asia with 9 (including global powers). Latin America & Carribean (LAC) and N. Africa & Middle East have only three Regional VIP<sup>2</sup>s each, while Sub-saharan Africa has only one.

The 'regional powers' constitute a sub-set of the regional VIP<sup>2</sup> s. One sub-set that comes naturally to mind are those members of the global VIP<sup>2</sup> club whose Index is below the benchmark for a 'Global power' (table 1). By this criterion there are six regional powers in Europe, two in Asia and one each in North America and Latin America.<sup>15</sup>

### 5.1 Europe

Twelve of Europe's fourteen regional VIP<sup>2</sup>s are the known rich countries of Western Europe. Poland and Russia are the only two regional VIP<sup>2</sup>s from Eastern Europe. Russia has been placed in Europe because much of its GDP arises in that continent, even though much of its physical area lies in Asia. Germany, France, UK, Italy and Spain along with Russia can be classed as regional powers in Europe. The last could perhaps also be categorized as a regional power in Asia also.

If all the members of the EU including the regional powers listed above had surrendered their entire power to the EU (voluntary emasculation), they would no longer be regional VIP<sup>2</sup>s. The EU would thereby become a 'virtual state' with a VIP<sup>2</sup> of about 80% i.e. a global power second only to the USA. The World would then be bipolar (neither uni-polar nor multi polar).<sup>16</sup>

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<sup>15</sup> Leaving aside the three global powers, USA, China and Japan.

<sup>16</sup> A common stand on WTO negotiations or a common tariff should not be confused with being a 'virtual state.' Any group of independent Nations can have a common stand on one ore more issues (G8, G4, G20, G5). Even though the EUs stand may have a greater degree of permanence because they are institutionalized, there is no EU govt. deciding on or acting on these issues without the approval of member States.

Table 2: Global Ranking of Europe Region VIP<sup>2</sup> s

Country	VIP <sup>2</sup> Rank		GDP rank		VIP <sup>2</sup>	
	2003	2005	2003	2005	2003	2005
<b>Regional Powers</b>						
Germany	4	4	5	5	18%	17%
France	5	5	6	6	13%	12%
United Kingdom	6	6	7	7	13%	12%
Italy	7	7	8	8	12%	11%
Russia	11	10	10	9	6.0%	6.5%
Spain	10	11	13	13	6.5%	6.4%
<b>Other regional VIP<sup>2</sup>s</b>						
Netherlands	17	17	19	24	3.9%	3.7%
Poland	21	19	24	23	2.2%	2.3%
Belgium	18	20	29	30	2.3%	2.4%
Austria	22	26	33	34	2.0%	2.0%
Sweden	27	27	34	35	1.9%	1.9%
Switzerland	26	28	36	37	1.9%	1.9%
Norway	30	31	42	42	1.6%	1.6%
Greece	31	32	37	36	1.5%	1.5%

Table 3: Global Rank of Other Regional VIP<sup>2</sup> s

Region/Country	VIP <sup>2</sup> Rank		GDP rank		VIP <sup>2</sup>	
	2003	2005	2003	2005	2003	2005
<b>ASIA</b>						
<b>Global Powers</b>						
Japan	2	2	3	3	28%	27%
China	3	3	2	2	22%	25%
<b>Regional Powers</b>						
India	9	8	4	4	7.8%	8.5%
Korea, Rep.	13	13	14	14	5.5%	5.5%
Australia	14	14	16	17	4.8%	4.7%
<b>Other VIP<sup>2</sup>s</b>						
Taiwan, China	16	15	17	16	4.0%	4.5%
Thailand	24	22	21	19	1.9%	2.2%
Indonesia	23	25	15	15	2.0%	2.1%
Hong Kong, China	32	30	41	40	1.4%	1.6%
<b>Latin America &amp; Carribean</b>						
Brazil(regnl power)	12	12	9	10	5.7%	5.8%
Mexico	15	16	12	12	4.2%	4.2%
Argentina	19	18	23	22	2.3%	2.5%
<b>Sub-Saharan Africa</b>						
South Africa	20	21	20	21	2.3%	2.4%
<b>N Africa &amp; Middle East</b>						
Turkey	25	23	18	18	1.9%	2.1%
Iran (IIR)	28	24	22	20	1.8%	2.1%
Saudi Arabia	29	29	28	28	1.6%	1.7%

If EU member States surrendered half their power to an elected EU govt. with complete and unfettered right to exercise these powers, EU would be a global power with the second highest VIP<sup>2</sup> (about 40%). But the individual power of Germany, France, UK & Italy would become less than that of Canada and India, though it would still be more than that of Brazil and S. Korea (except for Italy's).

## 5.2 Asia

Though Asia has nine members in the regional VIP<sup>2</sup> club, one of these is politically a part of China and another is claimed by it. This leaves only seven countries in the club, almost half the number in Europe. Among the seven, four countries are also members of the global VIP<sup>2</sup> club.

Of these China and Japan are potential global powers. India is clearly a regional power, while S. Korea is also a potential regional power. The other three members of the Asian regional VIP<sup>2</sup> club are Australia, Thailand and Indonesia. Of these three, Australia could also be considered a regional power as its Index was only marginally less than the cut-off level for the global VIP<sup>2</sup> club and is likely to exceed the cut-off in a few years.<sup>17</sup>

As ASEAN's economic integration is minimal compared to the EU it would be highly premature to discuss its possible emergence as a regional power, even though its VIP<sup>2</sup> would be above the benchmark we have set (i.e. about 6.5%).

## 5.3 Other Regions

The LAC region has a total of three nations who qualify as members of the regional VIP<sup>2</sup> club, of which one, Brazil is a member of the global club. The other two are Mexico and Argentina, with the former a competitor of Brazil. Brazil's power potential is, however, currently half that of Italy's and 68% of India's. It is projected to be half that of India in about six years (& more than half of Italy's). The only reason for considering Brazil for permanent membership would be if it represents the whole of LAC instead of itself.

South Africa is the sole member of the Sub-saharan Africa regional VIP<sup>2</sup> club with an Index less than that of Argentina. The index for the three members of the middle-east regional club, Turkey, Iran and Saudi Arabia have an even smaller power potential index than South Africa. One noteworthy fact is that two countries, often mentioned as regional powers, Egypt and Nigeria do not meet even the less stringent criterion of membership in the regional VIP<sup>2</sup> club. Nor does Nigeria, whose power potential index is a small fraction of that of S. Africa. Talk of Nigeria being a permanent member of the UNSC therefore appears to be divorced from reality.

Brazil is the only regional power in LAC, while Africa and the Middle East have no countries that meet the regional power threshold of a VIP<sup>2</sup> of 5%. South Africa's power potential is 2/5<sup>th</sup> that of Brazil's. There is thus even less justification for South Africa to have a permanent seat on the UNSC than there is for Brazil. If it was representing the whole of Africa or at least Sub-Saharan Africa a case could be made.

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<sup>17</sup> Pakistan's power potential is less than Egypt's and neither country meets the benchmark for being classed as regional VIP<sup>2</sup>. The low rank of Pakistan (48), below Egypt (46) and Algeria (47) and just above Vietnam (51) and Bangladesh (52) suggests that it has enhanced its actual power above its 'potential,' through the use of alliances. Similarly Egypt's importance to the USA/West increased with its peace treaty with Israel.

## 6 Sensitivity of VIP<sup>2</sup> to Parameter

The choice of the value of 0.5 for the technology weighting parameter is based on judgment. It is therefore use full to test the sensitivity of our results on the VIP<sup>2</sup>. We do this by measuring the impact of a change in  $\alpha$  from 0.5 to 0.55 (i.e. by 10%) on the VIP<sup>2</sup> for the set of Global VIP<sup>2</sup>s. The results are summarized in Table 4. The elasticity of VIP<sup>2</sup> with respect to the parameter  $\alpha$  is given in column 2 and the per capita GDP at purchasing power parity in column 3. It is seen that the elasticity is inversely related to the per capita GDP. The elasticity is negative up to a threshold level of income (around 2/3<sup>rd</sup> of US income) and positive above it. Thus VIP<sup>2</sup> decreases/increases with  $\alpha$  below/above the threshold. Thus below the threshold, if  $\alpha$  is raised above 0.5 (as assumed), the VIP<sup>2</sup> of poorer countries will fall proportionately more than for richer countries. Among the set of global VIP<sup>2</sup> s India's relative position worsens (improves) most as  $\alpha$  increases (decreases), followed by the relative position of China and Brazil.

Another way of looking at the same results is as follows. The elasticity for high income countries is fairly small with most falling in the range of 0 to - 0.18. The elasticity is significantly lower for middle income countries, ranging from -0.2 to -1. The elasticity in the case of low income countries is below -1. This suggests that the band of uncertainty in measuring power potential using our index VIP<sup>2</sup> is considerably higher in the case of low income countries and this uncertainty declines as a country's per capita income rises.

**Table 4: Elasticity of VIP<sup>2</sup> with respect to  $\alpha$**

Country	Elasticity VIP <sup>2</sup> wrt $\alpha$ 2005	Per capita GDP (relative to USA)	Population (relative to USA)	Per capita GDP at PPP	Pop 2005
Canada	-0.11	80%	0.1	31865	32.2
Australia	-0.12	78%	0.1	31006	20.3
Netherlands	-0.14	73%	0.1	28906	16.4
Japan	-0.16	75%	0.4	29807	127.9
Germany	-0.17	71%	0.2	28392	60.2
France	-0.17	72%	0.3	28433	82.6
UK	-0.17	71%	0.2	28365	59.7
Italy	-0.18	69%	0.1	27390	22.7
Taiwan	-0.18	70%	0.2	27792	57.8
Spain	-0.26	59%	0.1	23392	41.9
Korea, S	-0.35	49%	0.2	19316	48.4
Russia	-0.64	27%	0.5	10535	142.1
Mexico	-0.69	24%	0.4	9610	104.9
Brazil	-0.76	21%	0.6	8216	181.4
China	-0.91	14.8%	4.4	5897	1304.6
India	-1.18	8.1%	3.7	3216	1096.9

Given the higher uncertainty in the measure of power potential of poorer countries, we hypothesize that alliances, formal or informal, can make much more difference to their actual power than they do for high income countries.

## 7 Potential Global Powers

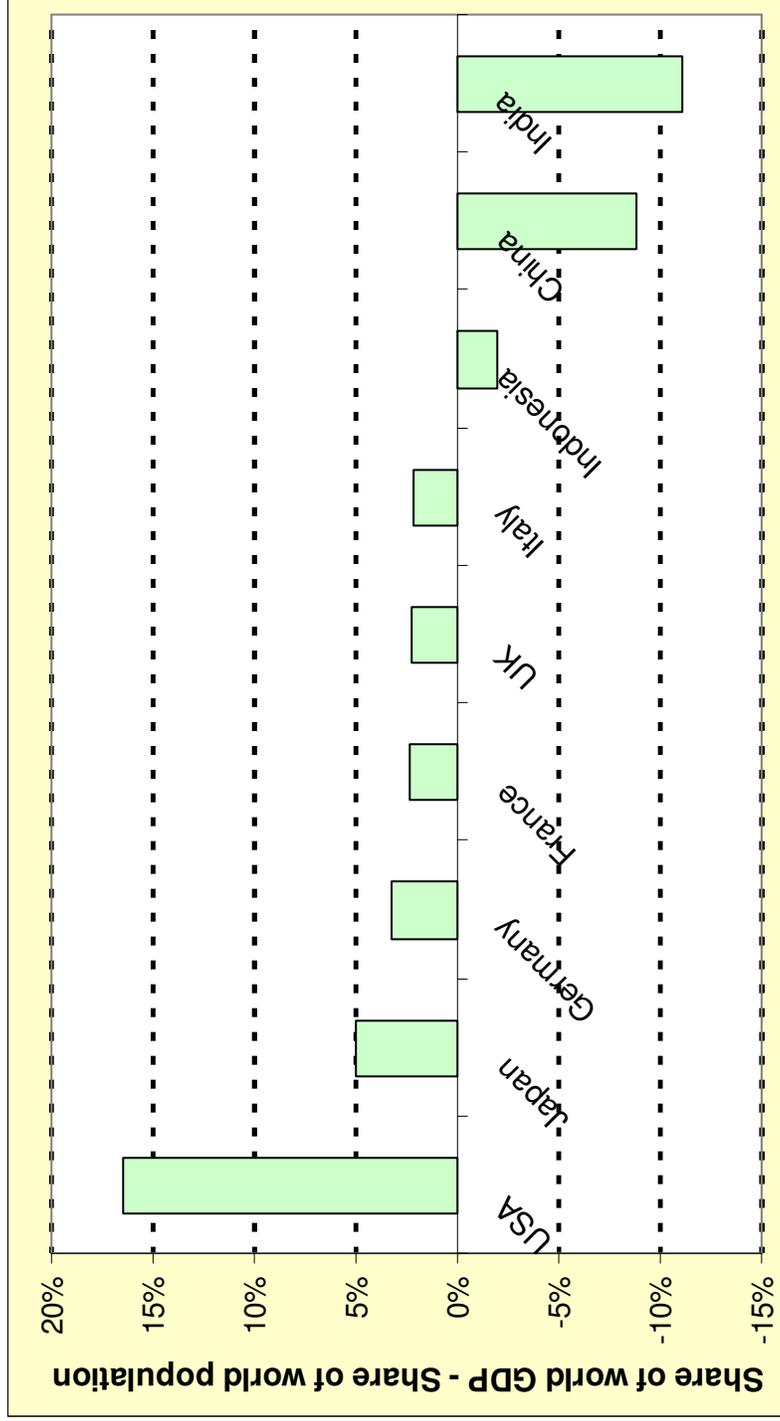
A comparison of Table 1 and 4 also brings out clearly that India and China are still relatively poor countries and their high rank in the global power club is due to their large population (relative to the USA & other countries) and despite their relatively low per capita income. The other side of this coin is that they have the greatest potential for increasing power, by raising their per capita income. For instance, if Russia's and Brazil's per capita income was raised to the level of the USA, their 'power potential' would still be 50% and 60% that of the USA respectively. In contrast China and India's power potential would equal that of the USA if their per capita income was **about 50%** of that of the USA **today**.

The potential for closing the power gap is illustrated in Figure 1, which shows all countries with the greatest gap between their share of world GDP at purchasing power parity and their share of World population. India, China and Indonesia have the largest negative gap, while USA, Japan and Germany have the largest positive gap followed by France, UK and Italy. The other countries in the global power club such as Russia and Brazil have negligible gaps and are consequently not shown here. Indonesia is still not a member of the global power club, and will only become a serious contender once it reaches there in the next two decades or so. Among the members of the global power club, India and China have the greatest gap (table 4 & figure 1) and therefore the greatest opportunity for closing it.

Population changes slowly over time and UN population projections till 2050 do not show major changes in relative population, with the exception of Russia and Japan whose population will decline by 25% and India whose population will increase to equal that of China. Thus the major increases in power potential will come only through increases in per capita income relative to USA's. China and India have been among the ten fastest growing countries in the world for the past 25 years. Virmani (1999a b) had forecast that that they are likely to be among the 3-5 fastest growing economies in the next two decades. Thus, the current unipolar world can only become bipolar or tripolar over the next 25 to 50 years if either or both of these countries continue to grow at a much faster rate than the USA. Otherwise it will remain unipolar, as there are few signs of the European Union turning into a virtual State that could act as another pole. The reason is that the larger countries of the EU would have to emasculate themselves in the process of transferring power to the EU virtual State and the people of these countries are not likely agree to do so in the next few decades.

Table 1 (also) gives the projected evolution of the Power Potential of members of the global VIP<sup>2</sup> club. The growth rate assumptions are primarily those used in Virmani (2005). A few minor corrections are made for the period 2006 to 2008 because new data is available from WDI and IMF WEO. As noted China will become the second strongest global power and continue to catch up with the USA, reaching about 50% of the USA's power potential by 2025.

Figure 1: GLOBAL IMBALANCE; GDP SHARE – POPULATION SHARE



The other noteworthy change is the projected rise in India's power ranking over the next 25 years. India will become more powerful than Italy in about **five** years, and France and UK in about **seven** years. In about **10 years (2016)** it is projected to become more powerful than Germany. **By 2022** India's power potential will exceed 20%, making it a (potential) global power along with China and Japan (in addition to the USA). As shown in Virmani (2005b) and reflected in our projections, no other country has the potential to join the ranks of global powers over the next 25 years. **Within 20 years** India's power potential will exceed that of Japan (figure 2).

## 8 Global Power & UNSC

Virmani (2004) has argued that the 'natural balance of power' as measured by relative size of GDP (at PPP) or 'power potential' is a possible basis for reform of the UN Security Council. In principle either the  $VIP^2$  or GDP (at purchasing power parity) could be used as benchmark or criterion for membership of the UNSC. As Permanent veto yielding membership of the security-council at the time the UN was formed was based on victory in WW II,  $VIP^2$  would appear to be the favored criterion. The inclusion of China in the original UNSC and recent calls for regional representation in an expanded UNSC on the other hand imply that population should get greater weight. This suggests the use of the GDP criterion, which gives greater weight to population.

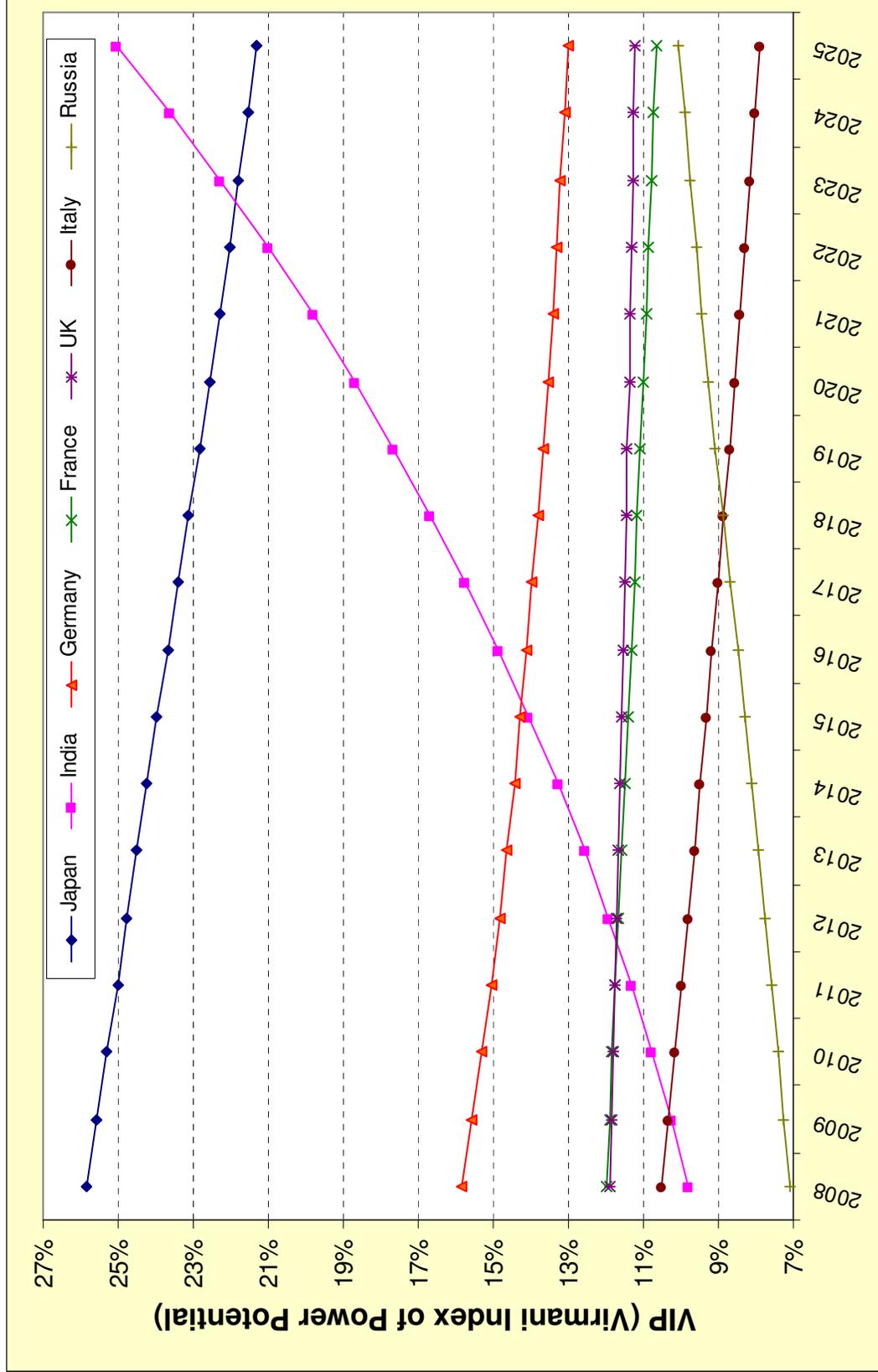
To be considered for *UNSC permanent membership with veto power*, either a country's GDP (at PPP) or its  $VIP^2$  or both must be greater than the GDP/  $VIP^2$  of the lowest ranked member of the current UNSC, namely Russia. Using the data for 2005, only four countries, Japan, Germany, Italy and India, satisfy both criteria. Canada's  $VIP^2$  is higher than Russia's but its GDP is lower.

If the current (2005) power potential and GDP is the basis for veto bearing permanent membership of the UN Security Council, Japan has the strongest case, given that it has the highest power potential and largest GDP. Germany has a stronger case than India or Italy because its power potential is much higher, even though its GDP is lower than India's. Among the last two India has a better case than Italy, given its significantly higher GDP and only one rank lower power potential. UNSC reform does not however occur very frequently. The issue of UNSC reform has come up after fifty years and choices made today could remain in place for another 25 years or more. Therefore any additions to the UNSC must take account of the likely evolution of power potential over this period. As shown by the projections in figure 2 (and table 1), India's claim to permanent membership of the UNSC is stronger than that of Germany's as its GDP is already larger than Germany's and its power potential will exceed Germany's in **about 11** years and Japan's in **about 18** years. . India's GDP will become larger than Japan's in **the next few** years and is projected to be 1.5 times Japan's in 10 years. Given a time horizon of **20** years, India has a stronger case than Japan. India's case becomes even stronger if giving representation to the poor of this world is an additional criterion, as India with about half the World's poor is in the best position to represent them. This is partly offset for Japan if reward for UN contributions is given weight.<sup>18</sup>

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<sup>18</sup> China is highly likely to veto Japan's permanent membership (with veto power) and be neutral/abstain in the case of India. The other veto bearing members would probably not veto either country (if only the two were being considered for veto power).

Figure 2: INDIA, AN EMERGING GLOBAL POWER



## 9 Conclusion

In this paper we presented a simple index of Power Potential, the VIP<sup>2</sup> © that can be easily applied to any one of the 200 or so countries for which GDP and population data is available. The index measures potential power relative to the USA, which is therefore has an index value of 100%. We specify benchmark values of the index for a country to be considered a global power (20%) or a regional power (5%). We find that there are currently two potential global powers, China and Japan in addition to the undisputed & unique USA. Germany, which was a potential global power till a decade ago, is no longer one.

As expected the largest number of regional powers are found among the rich countries of Europe, namely Germany, France, UK, Italy and Spain (somewhat more surprisingly). Canada another rich country meets the grade, while Australia just misses it today but is likely to meet it in a few years. Asia is clearly a rival to Europe in that it now has two global powers and three regional powers, India, S. Korea and Australia. Brazil is the sole regional power in Latin America, while no country in Africa or middle –east meets the criterion.

Projecting into the future, the number of global powers will increase from three to four in less than 20 years, with the addition of India. At that point China's power potential would be about 65% of the USA's while the sum of Japan and India's power potential would be 3/4<sup>th</sup> of China's. Virmani (2005) forecast that the world would become bipolar by 2025 and tripolar by 2050.<sup>19</sup> Recent developments in US-India relations suggest that the US will support faster economic and technological development of India, so that India's rise to global power is accelerated. This will delay the onset of a bipolar world and accelerate the arrival of a tripolar one. In other words the period of bi-polarity will be shortened, an outcome that is in the mutual interest of both the USA and India.

Thus the bold decision of President Bush to remove all restrictions on the flow of commercial nuclear technology to India and to facilitate the flow of Dual use and Strategic technology could transform power relations in Asia and the World just as President Nixon's opening to China did.<sup>20</sup> It must be remembered, however, that after the first opening, it took China 10 years to emerge from its isolation, 20 years to make its mark in the global economy and 30 years to become a global power. During this period it did not let future power go to its head and worked modestly and diligently to acquire the economic and technological where withal from every country including the USA.<sup>21</sup>

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<sup>19</sup> A game theoretic approach suggests other possibilities. For instance one speculative scenario could be for India and Japan to unite in an alliance to make the World Tripolar in 2025. If we add Russia and S Korea to this alliance, the aggregate power potential almost equals that of China. Such an alliance is even more fanciful. There is little likelihood of this scenario fructifying, however, as long as Japan remains closely tied to the USA, in the US-Japan defense pact. Another even more speculative scenario could be for China, Japan and India to combine to challenge US power in Asia. This scenario is even less likely as long as China remains a one party communist party ruled state that nurses strong historical grievances against Japan.

<sup>20</sup> This will in my view, be one of the decisions that mark President Bush's (and his Indian counterpart Dr Man Mohan Singh's) place in history.

<sup>21</sup> There is a lesson in this for India. Size gives it an advantage that smaller less populated countries do not possess, but the large number of poor people reduce the influence & respect that it enjoys. Though projections indicate that size will increase and poverty as currently defined will be eliminated in 15 to 20 years. Analysts should be realistic, remembering both the strength and weakness.

Finally the emergence of China and India on the global scene may force the residents of the large countries of the EU to reconsider their stand on EU integration. Twenty years from now they may decide to set up an elected EU government based on direct elections by all citizens of the EU with complete powers to act on all matters connected with international relations (Defense, foreign affairs, international economic relations). Such an EU would be a global power and the world would be tripolar in 2025 and quadri-polar in 2050.

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## 11 Appendix I: VIP<sup>2</sup> of 112 Countries

Table A1: Global Ranking by the Virmani Index of Power Potential (VIP <sup>2</sup> )								
	VIP <sup>2</sup> rank		GDP rank		VIP <sup>2</sup>		GDP, PPP(mi)	
	2003	2005	2003	2005	2003	2005	2003	2005
<u>N America</u>								
USA	1	1	1	1	100%	100%	10923376	11780533
Canada	8	9	11	11	8.0%	7.8%	970326	1027421
<u>Europe</u>								
Germany	4	4	5	5	18%	17%	2291007	2346285
France	5	5	6	6	13%	12%	1654018	1712405
United Kingdom	6	6	7	7	13%	12%	1610579	1693698
Italy	7	7	8	8	12%	11%	1563332	1582092
Russia	11	10	10	9	6.0%	6.5%	1323839	1497208
Spain	10	11	13	13	6.5%	6.4%	920292	979184
Netherlands	17	17	19	24	3.9%	3.6%	476454	487945
Poland	21	19	24	23	2.2%	2.5%	434626	507713
Belgium	18	20	29	30	2.3%	2.4%	294001	323570
Austria	22	26	33	34	2.0%	2.0%	243458	266116
Sweden	27	27	34	35	1.9%	1.9%	239576	265706
Switzerland	26	28	36	37	1.9%	1.9%	224557	245233
Norway	30	31	42	42	1.6%	1.6%	171850	190290
Greece	31	32	37	36	1.5%	1.6%	220148	247535
Ireland	34	33	47	47	1.4%	1.5%	150725	174166
Denmark	33	34	43	45	1.4%	1.5%	169508	186303
Portugal	35	37	40	41	1.2%	1.2%	189303	206075
Finland	37	39	49	51	1.1%	1.2%	143951	159573
Ukraine	41	40	31	29	0.9%	1.2%	265534	332741
Czech Rep	40	41	44	43	1.0%	1.1%	166877	187241
Hungary	43	43	48	48	0.8%	0.9%	147705	166531
Romania	50	49	46	46	0.6%	0.7%	158234	183257
Slovak Republic	55	56	58	59	0.4%	0.4%	72730	83443
Luxembourg	58	58	87	87	0.3%	0.3%	27910	31167
Kuwait	60	60	72	73	0.3%	0.3%	43248	47783
Slovenia	62	62	75	76	0.2%	0.3%	38204	43407
Croatia	63	63	67	68	0.2%	0.3%	49249	55883
Belarus	65	64	64	62	0.2%	0.3%	59803	70518
Lithuania	68	65	73	72	0.2%	0.2%	40420	48616
Latvia	76	77	93	91	0.1%	0.1%	23836	28266
Estonia	80	79	101	101	0.1%	0.1%	18318	21457
Cyprus	81	83	106	109	0.1%	0.1%	14874	16656
Bosnia, Herzegovin	83	85	92	90	0.1%	0.1%	24703	28327
Iceland	90	90	<u>113</u>	<u>113</u>	0.1%	0.1%	9029	10428
Macedonia, FYR	102	101	109	110	0.1%	0.1%	13922	15899
Albania	105	103	107	106	0.0%	0.1%	14526	17179

<b>Table A1: Global Ranking by the Virmani Index of Power Potential (VIP<sup>2</sup>)</b>								
	<u>VIP<sup>2</sup> rank</u>		<u>GDP rank</u>		<u>VIP<sup>2</sup></u>		<u>GDP, PPP(mi)</u>	
	<u>2003</u>	<u>2005</u>	<u>2003</u>	<u>2005</u>	<u>2003</u>	<u>2005</u>	<u>2003</u>	<u>2005</u>
<u>Asia</u>								
Japan	2	2	3	3	28%	27%	3567804	3697387
China	3	3	2	2	22%	25%	6446033	7693663
India	9	8	4	4	7.8%	8.5%	3078024	3527323
Korea, Rep.	13	13	14	14	5.5%	5.5%	861042	934875
Australia	14	14	16	17	4.8%	4.7%	589116	629856
Taiwan	16	15	17	16	4.0%	4.5%	545437	629858
Thailand	24	22	21	19	1.9%	2.2%	470992	558941
Indonesia	23	25	15	15	2.0%	2.1%	721533	802314
Hong Kong	32	30	41	40	1.4%	1.6%	185250	217541
Malaysia	39	35	35	33	1.1%	1.2%	235662	280258
Philippines	38	38	25	25	1.1%	1.2%	352191	405532
Singapore	46	44	55	55	0.8%	0.9%	104046	124111
Pakistan	48	48	26	26	0.7%	0.8%	311258	368273
New Zealand	49	50	57	57	0.6%	0.7%	90538	101085
Vietnam	53	51	38	38	0.5%	0.6%	202502	243545
Bangladesh	52	52	32	32	0.5%	0.5%	244402	286447
Kazakhstan	56	55	56	56	0.4%	0.5%	99254	123307
Sri Lanka	67	67	59	58	0.2%	0.2%	72654	84144
Turkmenistan	77	78	85	84	0.1%	0.1%	28881	34896
Azerbaijan	86	81	84	82	0.1%	0.1%	29782	38024
Bahrain	87	86	111	112	0.1%	0.1%	12888	15044
Uzbekistan	84	87	71	71	0.1%	0.1%	44638	49265
Nepal	98	99	78	79	0.1%	0.1%	35015	39820
Cambodia	100	100	88	88	0.1%	0.1%	27856	31091
<u>Latin America &amp; Carribean</u>								
Brazil	12	12	9	10	5.7%	5.7%	1375756	1555413
Mexico	15	15	12	12	4.2%	4.2%	937836	1058063
Argentina	19	18	23	22	2.3%	2.4%	445148	520588
Colombia	36	36	27	27	1.2%	1.1%	298799	339492
Chile	45	45	45	44	0.8%	0.8%	162067	186926
Peru	51	53	51	50	0.5%	0.5%	142791	163760
Venezuela	54	54	53	52	0.4%	0.5%	126279	153908
Dominican Rep	64	68	65	65	0.2%	0.2%	59622	64007
Costa Rica	70	71	74	75	0.2%	0.2%	38469	43414
Guatemala	72	73	66	67	0.2%	0.1%	51056	56732
Uruguay	75	76	86	86	0.1%	0.1%	27987	33471
El Salvador	79	82	83	85	0.1%	0.1%	31237	34307
Panama	87	87	98	98	0.1%	0.1%	20452	23460
Paraguay	84	88	89	89	0.1%	0.1%	26430	29064
Trinidad,Tobago	93	92	107	107	0.1%	0.1%	14132	16759
Bolivia	100	101	95	95	0.1%	0.1%	22800	25977
Honduras	106	106	99	101	0.0%	0.0%	18572	21060

<b>Table A1: Global Ranking by the Virmani Index of Power Potential (VIP<sup>2</sup>)</b>								
	<b>VIP<sup>2</sup> rank</b>		<b>GDP rank</b>		<b>VIP<sup>2</sup></b>		<b>GDP, PPP(mi)</b>	
	<u>2003</u>	<u>2005</u>	<u>2003</u>	<u>2005</u>	<u>2003</u>	<u>2005</u>	<u>2003</u>	<u>2005</u>
<u>Sub-Saharan Africa</u>								
South Africa	20	21	20	21	2.3%	2.4%	474137	528279
Nigeria	66	66	50	49	0.2%	0.2%	143238	165749
Equatorial Guinea	82	70	112	100	0.1%	0.2%	12599	22267
Sudan	74	74	61	61	0.1%	0.2%	64088	77205
Ecuador	73	75	69	69	0.1%	0.1%	47362	54536
Ghana	78	80	70	70	0.1%	0.1%	46253	53670
Angola	92	84	82	78	0.1%	0.1%	31701	42776
Cameroon	91	92	80	80	0.1%	0.1%	34077	39428
Mauritius	95	95	110	111	0.1%	0.1%	13795	15847
Ethiopia	99	96	68	66	0.1%	0.1%	48780	60423
Uganda	96	97	77	77	0.1%	0.1%	36827	43350
Botswana	97	98	105	107	0.1%	0.1%	15010	17096
Congo, Dem. Rep.	106	104	76	74	0.0%	0.1%	37026	44240
Kenya	104	105	81	83	0.1%	0.1%	33099	36849
Zimbabwe	103	106	90	97	0.1%	0.0%	25335	25700
Cote d'Ivoire	108	108	91	92	0.0%	0.0%	24857	27696
Mozambique	110	109	98	98	0.0%	0.0%	20984	25520
Guinea	109	110	104	105	0.0%	0.0%	16582	18538
Senegal	111	111	103	103	0.0%	0.0%	16875	19869
Tanzania	112	112	97	94	0.0%	0.0%	22300	26523
<u>N Africa &amp; Middle East</u>								
Turkey	25	23	18	18	1.9%	2.1%	478891	565189
Iran (IIR)	28	24	22	20	1.8%	2.1%	464394	547111
Saudi Arabia	29	29	28	28	1.6%	1.7%	297967	336845
Israel	42	42	52	53	0.9%	0.9%	133981	150959
Egypt (EAR)	44	46	30	31	0.8%	0.9%	266853	303825
Algeria	47	47	39	39	0.7%	0.8%	194389	222727
Morocco	57	57	54	54	0.4%	0.4%	120578	135682
Tunisia	59	59	60	60	0.3%	0.3%	70863	82522
Bulgaria	61	61	63	64	0.3%	0.3%	60483	70313
Oman	69	69	79	81	0.2%	0.2%	34960	38960
Syrian Arab Rep	71	72	62	63	0.2%	0.2%	62165	70384
Lebanon	89	91	95	95	0.1%	0.1%	22820	26177
Jordan	93	94	94	93	0.1%	0.1%	22929	26809
Yemen, Rep.	113	113	102	104	0.0%	0.0%	17044	18897

Data Sources: For GDP at purchasing power parity and population or Per capita GDP: World Bank, World Development Indicators, 2005 (2003 data) and IMF WEO, April 2005 (for 2005 projection). Rest of the data is from Virmani (2005) and authors calculations.