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GLOBAL POWER FROM THE 18th TO 21st CENTURY: POWER POTENTIAL (VIP^2), STRATEGIC ASSETS & ACTUAL POWER (VIP)

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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 Nations 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. Does this mean that military technology and equipment is the predominant factor determining a nation's power. 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 e.g. Tellis et al (2000)]. Other factors are natural resources, education & skills and investment in R&D and technology development.

Waltz (1979) defined State power as the "extent that (one) effects others more than they affect [one]". 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 might or in modern terminology 'Strategic capability'. This includes defense equipment,

strategic technology 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.' The paper then goes on to discuss how to measure each of these elements in the simplest possible way and to define an index for measuring each. For the former, the paper presents a simple index the V# index of power potential (VIP^2),[1] and for the latter a measure of strategic/military assets/capability. The two are then combined to produce a single index of actual power (VIP). The next section 2 discusses the economic basis of national power. Section 3 formally defines the two indices, the VIP^2 and the VIP (V# index of Power). Those uncomfortable with algebra can skip this section. The former index has been calculated for about 110 countries.[2] Section 4 delves into the past centuries by constructing the VIP^2 index for the major powers in the 18th, 19th, and 20th centuries. The French, British and US dominance during the three centuries respectively emerges clearly. In post-war 20th century it finds that the USSR barely met the economic conditions for being classed as a 'great power' as its VIP^2 was less than that of the UK in 1913 when the latter had already been displaced by the USA. Section 5 presents and discusses the results for the Global and Regional Powers. Section 6 looks into the future by constructing growth scenarios. It then explores the issue of whether the current '*Uni polar World with a Multi-polar fringe'* will become bipolar, tri-polar or multi polar in the next 20 years. Section 7 concludes the paper.

[1] This is an elaboration of the index of 'power potential' proposed in Author (2004).
[2] Author(2005d).

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 may not sustainable over long periods, particularly in the globalized world of the 21st century. This was illustrated to some extent 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 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 may shorten during the 21st century. This will not, however, eliminate the need for military capability.

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 (section 2.3). 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 organizations, civil) in addition to the its National Policies.[3]

2.1 Commercial and Strategic Technology

There is need to distinguish between two categories of Technology; Commercial and Strategic.[4] 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 such as nuclear and aero-space, as well as technology for producing advanced weapons systems and defense equipment. 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 special skills, directed R&D as well as focused attention. It has either to be developed through national effort or acquired through strategic/military alliances.[5]

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

[3] The quality of institutions is an important determinant of growth. Social capital and related variables are also found to be significant.
[4] "Dual use technologies" represent the overlap between the two types.
[5] Historically countries have also acquired it through conquest (USSR-E Germany) or theft (A Q Khan, Pakistan – URENCO, Netherlands).

technological knowledge, those with higher technological capabilities have a greater ability to develop strategic technology and therefore greater power potential. Strategic technology also includes 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 'strategic' and at another stage as 'commercial' and vice versa.

2.2 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).[6]

The technological capability of an economy depends on many factors. Author (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. 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

[6] 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 a policy distortion prevents this from happening the economy's productive capacity will be reduced and this will be reflected in GDP at PPP.

disembodied 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 disembodied and neutral. 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. 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. 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 also much easier to define and measure than TFP, it is operationally a more useful measure of an economy's technological capability than TFP. 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. This is illustrated more formally in the next section.

3 INDEX OF POWER

3.1 Aggregate Production Function

At the heart of the modern theory of economic growth and development is the (aggregate) production function of an economy. The aggregate production function summarizes the supply capability of the economy that is its ability to produce a host of goods and services. The mix of goods and services actually produced depends on the pattern of domestic demand. The simplest algebraic representation of the aggregate production function is as follows:[7]

$$Y = T\,F(K, H, L)$$

Where Y is GDP, T is the level of technology or total factor productivity, F is a function of different factors of production such as K the stock of physical capital, H the stock of human capital (education & skills) and the size of the labor force. Here T represents the technological capability of the economy, assuming that technology is neutral and disembodied. Given this assumption the aggregate production function can be estimated for any group of economies and used to derive the level of technology for each country. This has indeed been done by many economists. This production function can be re-arranged to obtain per capita GDP:

$$y = T\,f(k, h)$$

Where $y = Y/L$ is the per capita GDP, $k = K/L$ is the amount of physical capital per person and $h = H/L$ is the average level of human capital.[8]

[7] Each of the variables will change over time i.e. T(t), a(t), b(t), K(t), H(t), L(t) and Y(t). For visual simplicity we have dropped the time subscript from all the variables.
[8] This requires an additional assumption of constant returns to scale that has been widely shown to be prevalent.

From the perspective of the current paper, namely to define and measure economic power, this assumption of neutral technical change and disembodied technology is highly restrictive and unnecessary. We therefore propose to use a more general and complicated representation of the aggregate production function that paradoxically simplifies the measurement of economic power:[9]

$Y = T F(aK, bH, L)$ and on re-arrangement $y = T f(ak, bh)$

Where a, b represent capital and labor biased technical change respectively. In addition technology is often embodied in capital, which makes the determination of K itself quite complicated. In this case, which is more realistic from our current perspective it is not only very difficult to measure T, but T no longer fully captures the level of technology of a country. In general therefore, y captures all the relevant aspects of knowledge and technological capability, whether embodied in physical capital or existing in the brains of workers/professionals (i.e. education and learned skills). Thus it is the simplest and best available index of general technological capability of an economy, in that per capita GDP across countries is highly (but not perfectly) co-related with the technological capability of countries.[10]

[9] Another dimension of complication would be to include a term for natural resource stocks, i.e. Y = T F((K, H, R), where R represents natural resources (e.g. oil, minerals). This can be an important element of economic power for major oil exporters like Saudi Arabia.

[10] Our guess would be that differences in per capita GDP capture at least 90% of the difference in technological capability.

3.2 Power Potential: VIP²

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):[11]

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

L is the population and α 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;

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

The *V# index of Power Potential* (VIPP) or **VIP²** in short, is the power potential of a country (as defined above) relative to the USA:

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

Or equivalently as

(2) $VIP^2 = (L/L_{usa})*(y/y_{usa})^{\beta}$, 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 α is non-zero, then

(b) If two countries have the same GDP but one is richer than the other (higher per capita income/GDP)[12] the richer country will be potentially more powerful. As per capita income is an indicator of general technological capability, this multiplies the power potential

[11] An alternative formulation could be $NPP = (Y^{1-\alpha})\, y^{\alpha}$.

[12] The other country therefore has a large population.

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 $\alpha = 0.5$ ($\beta = 1.5$).[13]

The power 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 (Author(2005d)..

3.3 Actual Power: VIP

'Actual power' depends on the amount and quality of strategic assets, including defense equipment, technology and skills, acquired by the country. Formally we can define the V# index of actual power (VIP) as a function (G) of power potential VIP^2 and the strategic assets K^s of the country (relative to the strategic assets of the benchmark USA K^s_{usa}):

(3) $VIP = G(VIP^2 , K^s / K^s_{usa})$

The function G allows for complementarities/synergy between economic and military/ strategic elements (e.g. investment in strategic technology that has positive spin-off on the civilian economy and vice versa) or substitutability. For purpose of application a simple (Cobb Douglas) form of G with parameter σ, seems adequate. That is,

(4) $VIP = (VIP^2)^{1-\sigma} (K^s / K^s_{usa})^{\sigma}$, $0 < \sigma < 1$.

If economic and strategic assets have equal weight in VIP, $\sigma = 0.5$. A lower (higher) σ means strategic assets have less (more) weight than economic. Note that if the strategic assets ratio is the same as VIP^2 then $VIP = VIP^2$ for every value of σ. Unless otherwise

[13] 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 α values from 0.25 to 0.75.

stated, we assume in our empirical analysis that VIP and VIP^2 have a high positive co-relation.

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 physical and human capital. Further as it is not a commercial tradable good or technology its value (price) is not equal to the actual cost at which it is acquired (which will be inversely related to capability & efficiency ϵ). These expenditures have to be adjusted for efficiency and price changes to make them comparable across countries and time. Formally this can be written as,

(5) $K^s_t = \epsilon_t E_t / p_t - \delta K^s_{t-1}$, where t represents time.

K^s_t is the stock of strategic technology, E_t is the expenditure on this technology and p_t is the price deflator, ϵ_t is an efficiency parameter and δ is the rate of depreciation of the stock. The stock of strategic assets is also subject to obsolescence. A technological breakthrough by one or more countries (e.g. the industrial revolution, atomic weapons) can make part or whole of the strategic assets of the rest of the countries obsolete, thus reducing their power (VIP) dramatically.

Strategic assets are a national 'public good.' Each government has to raise resources through taxation which can in general have a negative effect on growth of per capita GDP. The revenues raised have then to be allocated between different types of public goods such as strategic assets (E^s) and other public goods like roads (E^y) that have a positive effect on the growth of per capita GDP y. Thus the direct positive effect of greater expenditure on strategic assets can be partly off-set by the indirect negative effect on economic growth. Such trade-offs and costs can be minimized (lower p, higher ϵ) by acquisition of strategic assets through

an alliance with a more powerful country which already has such technology, skills and equipment. The latter will only provide strategic assets if the former is able to enhance its Power or Welfare in some way (e.g. provision of bases, supply of soldiers/ guerrilla fighters, oil contracts, help in anti-terrorist operations) or help offset the power of a rival (e.g. USA strengthening post-war Europe to counter the perceived threat from USSR).

Though estimation of the strategic assets of countries is beyond the scope of the current paper, it is useful to consider the relationship between power potential, strategic assets and actual power using equation (4). The following table illustrates the trade-offs:

Table 1: Power Potential (VIP^2), Strategic Assets and National Power (VIP)

Table: VIP, Strategic Assets and VIP^2				
S.No.	VIP^2	K^s/K^s_{us}	σ	VIP
1	100%	1.25	0.5	112%
2	100%	0.75	0.5	87%
3	75%	1.00	0.5	87%
4	75%	0.75	0.5	75%
5	75%	0.50	0.5	61%
6	50%	1.00	0.5	71%
7	50%	0.75	0.5	61%
8	50%	0.50	0.5	50%
9	100%	1.25	0.3	107%
10	100%	0.75	0.3	92%
11	75%	1.00	0.3	82%
12	75%	0.75	0.3	75%
13	75%	0.50	0.3	66%
14	50%	1.00	0.3	62%
15	50%	0.75	0.3	56%
16	50%	0.50	0.3	50%

The 3rd column shows the actual power VIP that results from the VIP^2 and strategic assets shown in the 1st and 2nd columns respectively. Thus for instance a great power with a VIP^2 of 75% and a strategic capability half of the dominant power, will have 60% of its actual power. A great power with a VIP^2 of 50% can attain only 87% of the VIP of the dominant power even if its strategic capability is equal (assuming $\sigma = 0.5$). A lower σ changes these results by only a small amount.

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.[14] The accumulated strategic knowledge (K^s), though it has deteriorated over time, has not been lost. Consequently the dissolution of the USSR has reduced the power potential of Russia much more than its actual power. 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 have skillfully used formal or informal alliances to attain a level of actual power far in excess of their power potential.[15] In general, however, GDP is highly correlated with country expenditure on strategic assets and consequently so is power potential with actual power.

4 HISTORICAL EVOLUTION OF POWER

Though formal testing is not possible it is useful to see how well the Index tracks the evolution of power relations in the past three centuries. As official data on GDP at

[14] 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 like a Soviet virtual state. The Warsaw pact was in the context of power more integrated than the current EU (see below).

[15] 48th ranked Pakistan has been one of the most successful users of formal and informal alliances (in the last 50 years) to enhance its actual power way above its 'power potential' (lower than Algeria's 47).

purchasing power parity from the World Bank and IMF is only available from 1975 onwards, we use the Kham-Geary purchasing power indices constructed by Angus Maddison (2003) for this purposes. These indices are however available only for selected years till 1950 after which annual data is available.[16] These are used to construct the Power Potential Index.[17]

The industrial revolution made most of China's and India's strategic assets obsolescent vis-à-vis the strategic assets of the European countries. Thus, even though India's (China's) power potential (VIP^2) was 3.2 (3) times that of France (the strongest power) in 1700 and 1.7 (3.7) times that of UK in 1820, India's (China's) actual power (VIP) became much smaller than that of many European nations. The failure of China and India to adopt the industrial revolution resulted in a sharp drop in the real value of their strategic capital, which dropped to a fraction of that of these countries, thus opening a massive gap between their power potential (VIP^2) and their actual power (VIP). We therefore leave out these two countries from the analysis based on VIP^2.

More generally in the 18th and 19th centuries when the European powers were willing to conquer, colonize and subjugate non-white people and treat them as an intermediate species, the role of military might was much greater than it is today. Thus the index of power potential VIP^2 may be less useful relative to the index of actual power VIP in the colonial era than it is today. In the globalized world of the 21st century the importance of economic factors is greater than it was in earlier centuries and the VIP^2 rankings are likely to be highly co-related with the VIP rankings.

[16] The data for the year 1760 and 1800 (1880) has been constructed by using the growth rate from 1700 to 1820 (1870 to 1913) to interpolate.
[17] These may not match for the WDI data. For instance the average VIPP for UK for 1975-1990 calculated using Madison data is 2% (1/50th) less than that using WDI data.

With conquest of Eastern Europe by the USSR at the end of the World War II, the Warsaw pact consisting of the USSR and Eastern Europe become what may be termed a 'Virtual State.' Though consisting of ostensibly separate nation states, it acted in its external dealings as well as among its members as a single state. The power potential of such a 'virtual state' can be approximated by treating it as a single State.

4.1 Multi-polar Centuries: 18th & 19th

Figure 1 shows the power potential of the major European powers as measured by the index VIP[2]. The UK is taken to be the benchmark nation so that the power potential is measured relative to it (i.e. it has an index value of 1 or 100%). The broad picture that emerges is that France had the strongest global power potential in the 18th century and the UK in the 19th century. The second fact that emerges is that even at the height of British power around the middle of the 19th century, both the declining power France and the rising power, the USA had between 70% and 75% of the power potential of the UK. Similarly in the 18th century the second ranked power had between 70% and 80% of its power potential (though the country in second position changed).

Third, the power potential index indicates that the World was inherently multi-polar for much of these two centuries, with even the 5th ranked power having between 55% (45%) and 65% of the power potential of the most powerful country in the 18th (19th) century. Balance of power strategies and diplomacy helped eliminate long debilitating wars within Europe [Kissinger(1995)] and thus increased their power vis-à-vis the rest of the world. Further, establishment of British predominance required exploitation of the economic resources (including labor & human capital) of the Empire and particularly of India. Agreements regarding 'spheres of influence' outside Europe may also have contributed to the

colonial conquest of Asia, Africa and Latin America, whose strategic assets had become obsolescent.

4.2 Bipolar or Uni-polar 20th Century?

In 1913 at the start of the 20th century the USA was clearly the dominant power (figure 1). The UK however still ranked second with Germany nipping at it heels at third rank after growing rapidly between 1880 and 1913. The USSR (3rd) and France (4th) had almost the same power potential, with Italy bringing up the rear (figure 1). The US rise between 1880 and 1913 was meteoric with its power potential more than doubling relative to the UK.

The USA has therefore clearly been the predominant power since the beginning of the 20th century. It is therefore interesting to note that the USA's share of World GDP was only 8.9% in 1870 and had risen to 19% in 1913. It rose to a peak of 28% in 1951 and declined thereafter to about 21% in 1975. It has been fairly stable between 21% and 22% between 1975 and 1990.

Figure 2 shows the power potential measured by VIP^2 with the USA as the benchmark[18]. The United Kingdom was still the second most powerful nation in the World in 1913 with a power potential about 42% of that of the USA. Combining the Indian economy (The Jewel of the Crown/British Empire) with that of the UK and treating the two as a 'Virtual State' results in a power potential of 49% (not shown). In other words a subjugated India contributed about 7% points or 1/6th to the power potential of the UK.[19] It has been noted by strategic analysts that the UK was perhaps the first power in history to yield its dominant position without a war. In the light of the rapid fall in its power potential

[18] These may not match for the WDI data. For instance the average VIPP for UK for 1975-1990 calculated using Madison data is 2% (1/50th) less than that using WDI data.
[19] This is not shown in the figure below.

(as measured by the VIP[2]) till 1913 and its subsequent decline to 20% by 1950, the UK seems to have acted very wisely. Germany's (West & East combined) power potential was down to about 75% of the UK's by 1950.

Figure 1: POWER POTENTIAL OF EUROPEAN POWERS IN 18th and 19th Century

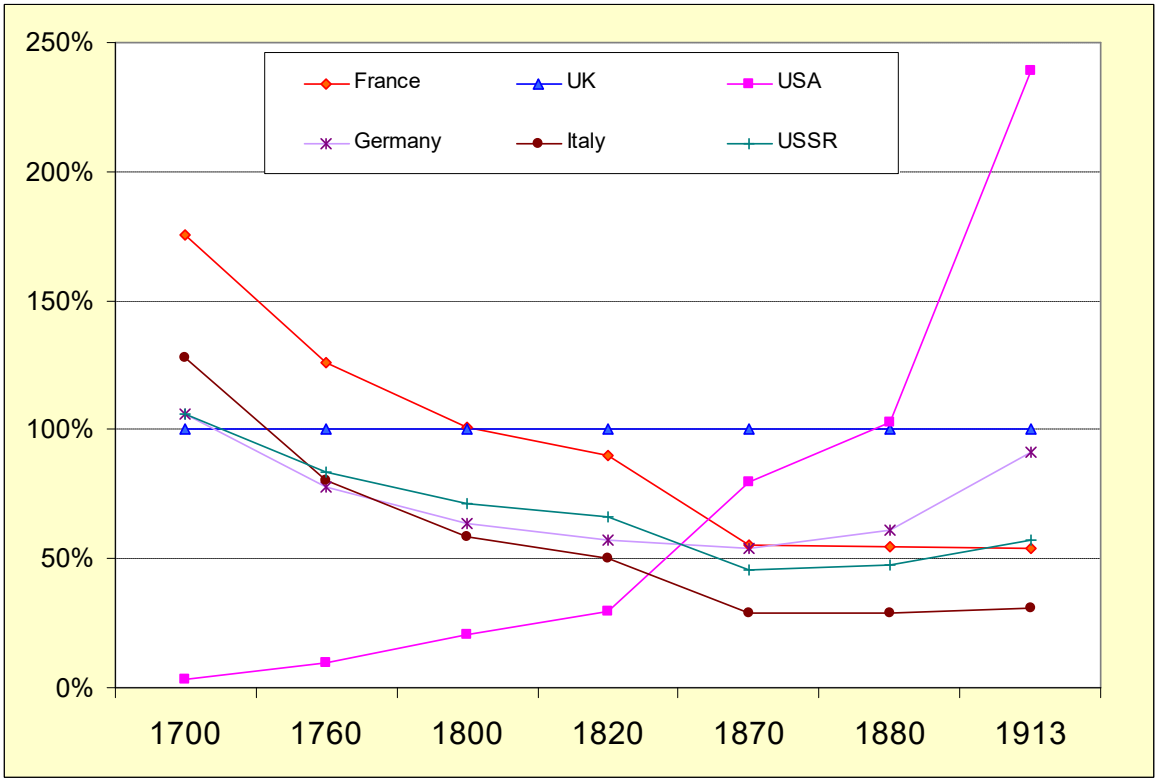
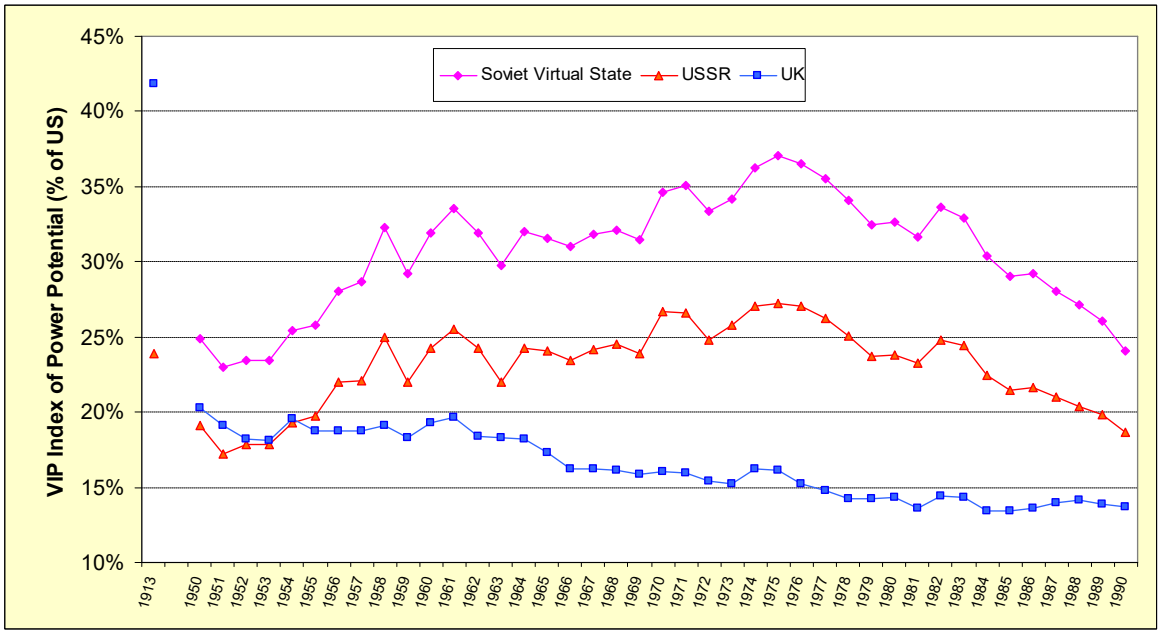


Figure 2: POWER POTENTIAL OF THE USSR AND THE SOVIET VIRTUAL STATE



The power potential of the USSR in 1913, in contrast, was only 24%, enough to classify it as a Global Power ($\geq$ 20%). As a result of the two world wars its power potential had fallen to 17% by 1950 (figure 2). This would have lowered its status to a regional power ($\geq$ 5%), if it had not in the meantime acquired an 'empire' by incorporating Eastern Europe under the guise of the Warsaw Pact. Measured in terms of VIP[2] the power potential of the Soviet virtual state SVS consisting of the USSR & E. Europe was 25% in 1950 allowing it to retain its status as a great power second only to the USA. The power of the Soviet Virtual state (USSR) was on a rising trend till 1975 when it peaked at 37% (27%) in 1975. At this point Eastern Europe contributed 10% points or over 1/4th of the power potential. Historical evidence suggests that the rising power of the USSR from 1950 to 1975 led to greater assertiveness. As the USSR's own power potential and that of Eastern Europe started declining after 1975, the former's hold over the latter also weakened gradually. As disaffection grew among the people of Eastern Europe their contribution to the strength of the empire would in any case have declined from 10% towards zero (even if USSR had remained at 27%).

Figure 2 also shows that the power potential of the USSR (SVS) declined continuously since the mid-seventies to reach less than 20% (25%). Thus, in terms of power potential (only), the USSR had ceased to be a 'Global Power' at the time of its break up in 1990. Post-1990 economic research has shown that the Soviet economy was declining (relatively and perhaps absolutely in later stages) because of dysfunctional "socialist" policies of autarchy and centralized party/bureaucratic control. The USSR accelerated this decline by trying to maintain the illusion of bipolarity and strategic (near) parity with the

USA, through excessive public investment in strategic technology. This helped maintain its actual power above its 'power potential' but accelerated the decline in power potential.[20]

From this we reach several tentative conclusions about national power. (a) That an aspirant for 'great power' status must have a power potential of at least 35% of the predominant power. (b) A nation state must have a power potential of (at least) 40% to be a credible 'great power' and to maintain that status. (c) A rising power can be more assertive and credible than is perhaps warranted by the level of its power potential. (d) Acquisition of strategic assets is critical for a 'great power' with less than 50% power potential to challenge the dominant pole and to convert the world into a bipolar one. (e) The minimum cut-off level of 'power potential' for bipolarity may be higher in an open globally integrated economy, but may also be more sustainable.

[20] Ferguson (2001) has argued that the existence (non-existence) of a financial market helped the UK (hindered France) in its quest for Empire. India's developed capital market is an advantage, but this is offset by China's heritage of socialist ownership of assets and dictatorial control over financial intermediaries (Banks). In terms of our analysis in section 3, a capital market allows a State to borrow against future taxes and thus focus resources on a particular period of war or conflict.

5 Global & Regional Powers

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 (Author(2005d)). We define the Global VIP^2 as one with an index of 5% or more.[21] This gives us 13 global VIP^{2}s and one borderline case (table 2). The set of global powers is a sub-set of global VIP^2 s. A VIP^2 of 20% or 4 times the minimum appears reasonable for classification as a 'global power.' 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. The Global VIP^2 s that are not Global powers can be defined as 'Regional powers.' By this criterion there are six regional powers in Europe, two in Asia and one each in North America and Latin America (table 2).[22]

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^2 club and will remain more powerful than India for some time even though the latter's economy is the fourth largest in the world.[23] India has just moved into 8th rank in the global VIP^2 club displacing G7 member Canada. Its GDP will become larger than Japan's in the next three years. Its power potential is greater than that of Russia, which is in 10th place behind Canada. 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.

[21] The alternative would be to take the top 10 or 15.
[22] Leaving aside the three global powers, USA, China and Japan.
[23] In GDP at PPP, the only way to compare the size of two economies. Their GDP converted at the current exchange rate is much larger than India's.

Table 2: GLOBAL VIP[2] s IN 2005

Economy	VIP[2] **Rank**		GDP Rank		VIP[2]	
	2003	2005	2003	2005	2003	2005
Global Powers						
United States	1	1	1	1	100%	100%
Japan	2	2	3	3	28%	27%
China	3	3	2	2	22%	25%
Regional Powers						
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%
India	9	8	4	4	7.8%	8.5%
Canada	8	9	11	11	8.0%	7.8%
Russia	11	10	10	9	6.0%	6.5%
Spain	10	11	13	13	6.5%	6.4%
Brazil	12	12	9	10	5.7%	5.8%
Korea, Rep.	13	13	14	14	5.5%	5.5%
Australia	14	14	16	17	4.8%	4.7%

6 THE 21st CENTURY

6.1 Emerging Global Power: India

To outline the shape of the emerging future recall 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 40% of that of the USA in 2005.[24]

The potential for closing the power gap is illustrated in Figure 3, 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 (figure 3) and therefore the greatest opportunity for closing it.

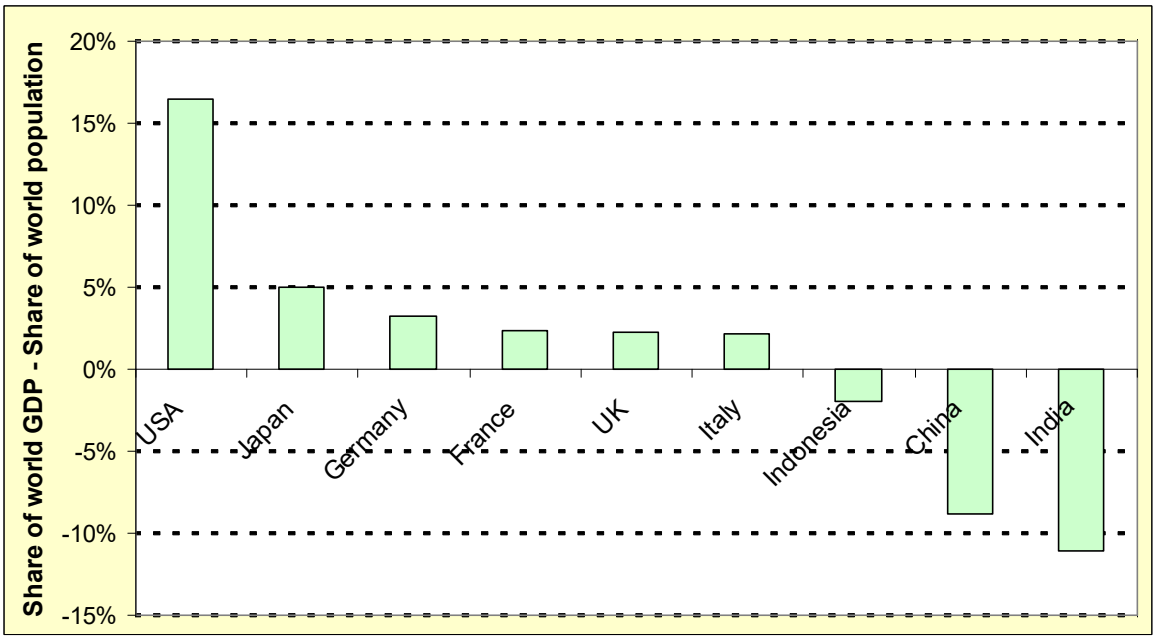
Population changes slowly over time and UN population projections till 2050 do not show major changes in relative population, with the exception of Russia and Japan whose population will decline by 25% and India whose population will increase to equal that of

[24] India 42% and China 37%.

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. Author (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 uni-polar world can 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. The demographic situation of other nation states makes it highly unlikely that any of them can compete with the USA for great power status in the next 50 years.

The only other possibility is for the European Monetary Union (EMU) or European Union (EU) to coalesce into a virtual State. This does not appear very likely in the next decade or two, because the larger countries of the EU (UK, France, Germany, Italy, and Netherlands) would have to emasculate themselves in the process of transferring power to the EU virtual State. On the contrary the people of these countries are currently moving in the opposite direction by rejecting moves for further integration and trying get back some of the powers ceded to the EU secretariat. Euro-optimists however expect that the movement towards integration will resume within 5 years and that the previous peak level of integration would be re-established in 10 years. Thereafter they project that an EU virtual state could be created within 15 years from now. Even the optimists concede, however, that the process of EU integration could be delayed because of the problems of EU expansion and the issue of admitting Turkey into the EU. Thus even an optimistic time line for the EU would be to target becoming a virtual state in about 20 years.

Figure 3: GLOBAL IMBALANCE; GDP SHARE – POPULATION SHARE

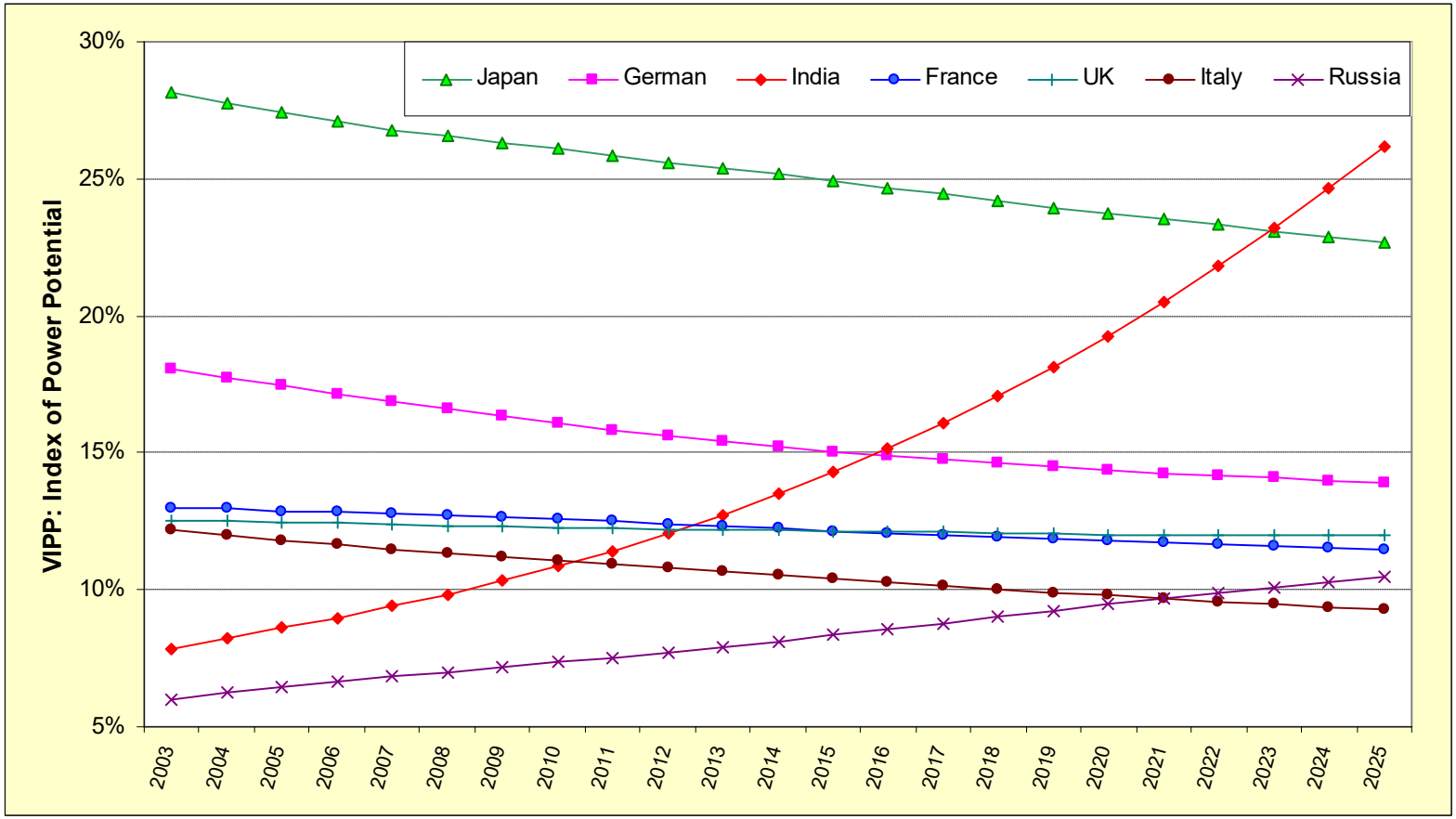


Figures 4 and 5 give the projected evolution of the Power Potential of some of the larger members of the global VIP[2] club. The growth rate assumptions are primarily those used in Author (2005a). A few minor corrections are made for the period 2006 to 2008 because new data is available from WDI and IMF WEO. Demographic and other factors are taken into account in a qualitative way in making the growth forecasts.[25] Shocks such as a major oil/energy crisis, political transformation/collapse would have to be taken account of by building alternative growth scenarios.[26]

One noteworthy change is the projected rise in India's power ranking over the next 25 years (figure 4). 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 global power along with China and Japan (in addition to the USA). As shown in Author (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 4).

[25] Other factors such as the slowing of growth as a country approaches the global technology frontier/production possibility frontier, are sought to be taken into account when making these projections.
[26] An oil shock would slow down the growth rate of oil importing countries such as China, India and Japan relative to the USA.

Figure 4: INDIA, AN EMERGING GLOBAL POWER



6.2 New Great Power: China

More dramatically, China will become the second strongest global power within this decade. In 15 years it will become a Great Power, reaching about 75% of the USA's power potential by 2025 (figure 5). The speed with which China is rising almost mirrors the speed with which the USA rose at the turn of the 20th century. In 1983 China's Power Potential (VIP^2) was the same as that of India. In 2006 its power potential will equal that of Japan. In another five years its power potential will equal that of the Soviet Virtual State (USSR + E Europe) at the peak of its power in 1975 (figure 5). Thus within 10 years the power potential of China will be greater than 40%. This will certainly classify China as a 'Great Power.' Does this mean that the World will become bi-polar within a decade?

First let us address the question of what is the minimum power potential (VIP^2) or actual power VIP needed for this purpose. A complete answer must await the detailed calculation of the strategic assets of Great Powers of the past and consequently their VIP. We can however shed some light by comparing the position of communist USSR in the 2nd half of the 20th century and of communist China at the start of the 21st century.

China is ruled by a Leninist communist party just as the USSR was after World War II. There are, however, several differences between the 21st century and the 20th century and between the two countries that suggest that China will have to have a higher power potential before the World becomes bipolar. The nature and extent of globalization is much greater in this century than it was in the previous one. The degree of economic interaction and interdependence among the major economies is far greater than before. In addition, globalization now extends to every other sphere of human activity such as society and politics. Second, the model of economic development followed by the two countries is

completely different.[27] The USSR followed an autarchic development model which minimized interaction with the rich, developed countries. China has since the mid-1980s followed a development model that fully uses the potential of globalization and global economic integration. The FDI-Export model adopted by it goes further and makes it heavily dependent for fast growth on the USA, Japan and EU, both directly and indirectly through HK, Taiwan and ASEAN. Third, the USSR by conquering East Germany acquired the strategic technology, skills and R&D facilities giving it a quantum jump in strategic technology. Though the USSR transferred some technology to China during the decade and half of socialist friendship it was not as deep and extensive. Thus China's strategic capability is much lower than that of the Soviet Virtual State at the same power potential (VIP^2). Unlike the USSR it is therefore unlikely to directly challenge the USA till it is much stronger.

In our judgment, China will be in a position to challenge US power in Asia when its power potential reaches 60% i.e. by around 2020. Even then the challenge is unlikely to be of a direct military nature, such as an invasion of Taiwan. However, the use of pressure to achieve the same objective is likely to rise progressively.

[27] Though China is ruled by a Leninist Communist party, as was post-war USSR, Mao put in place a highly decentralized system of economic management and development compared to the highly centralized system followed by the USSR. Thus, the movement to set up backyard electric furnaces in villages during his regime represented a degree of government decentralization unmatched by democratic regimes.

Figure 5: THE END OF A UNI-POLAR WORLD

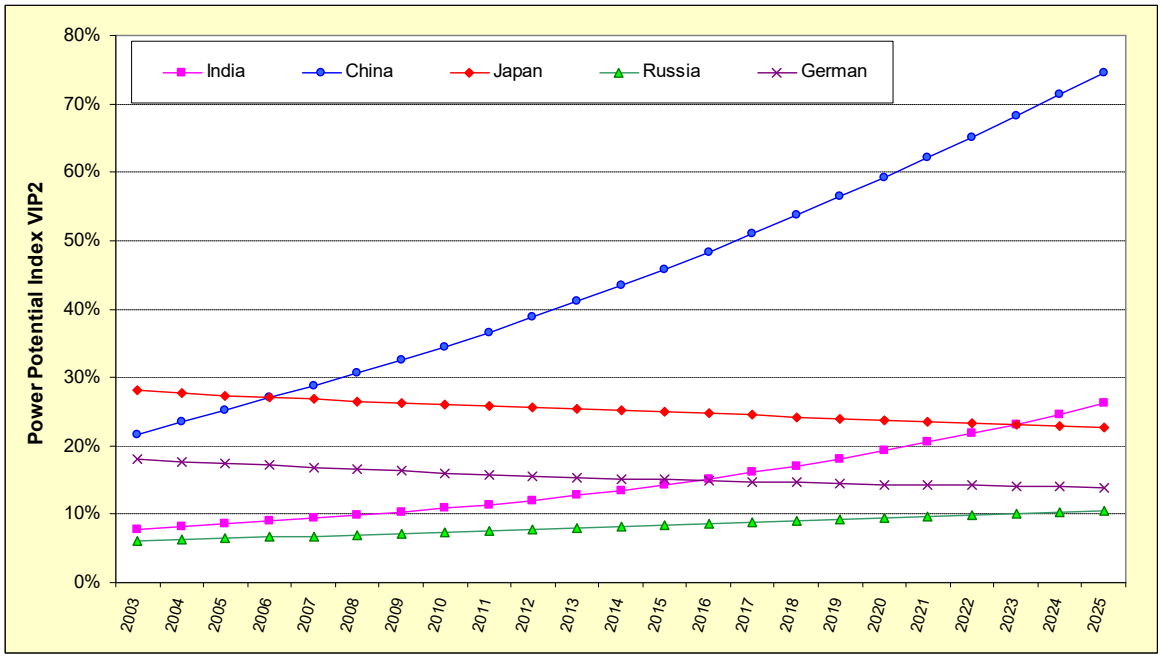
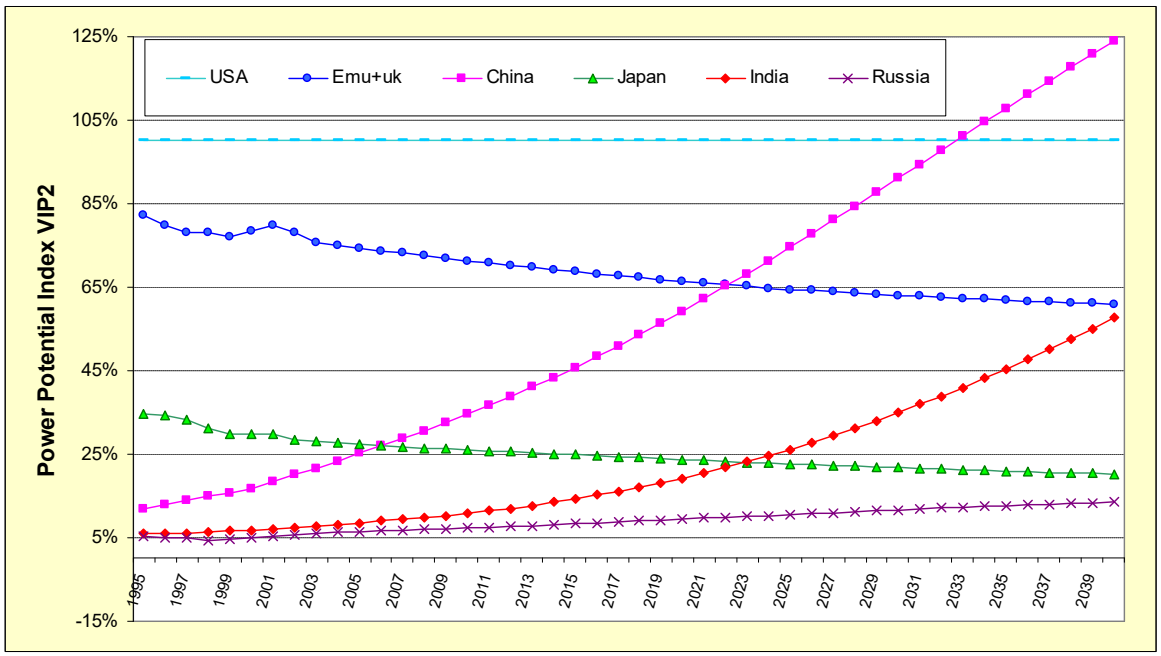


Figure 6: EMERGENCE OF TRI-POLARITY OR MULTIPOLARITY?



With China's power potential reaching 74% by 2025 and the third ranked power, India having a power potential of only 26% (1% less than that of the USSR at its peak) the World is likely to become Bi-polar (Author(2004)). What this means is that China would very likely challenge the USA in the economic and geo-political context and could conceivably initiate a creeping annexation of the South China Sea. China's ruling party, about a year ago, talked about the 'peaceful rise of China.' This statement has however, been hedged since then, apparently because it is not intended to apply to Taiwan. One of the key tests of the ruling Chinese communist party's intentions will be whether it applies to a rising India the same principles and approaches that it expects the USA, Japan and the EU to apply to a rising China. If it takes a positive approach to India's rise (e.g. on permanent membership of UNSC, founding of EAEC, NSG clearance of India-USA nuclear agreement), then it can rightly expect the same positive approach from others.[28]

6.3 Tripolar or Multi polar World?

There are two hypothetical developments that can result in a tri-polar or multi-polar World instead of a bi-polar one in 25 years. From the history of the USSR and current day Russia it is apparent that it is possible for a country to achieve a level of power (VIP) that is much larger than its power potential (as measured by VIP^2) through acquisition and development of strategic technology. India's power potential of 26% in 2025 will be higher than the average power potential of the USSR (23%) from 1950 to 1990 and equal to the power potential of the Soviet virtual state in 1955 when it became the second pole in a bipolar world. The only way India can achieve a level of strategic technology necessary for

[28] In seminars on China-India comparison, Chinese scholars frankly talk about 'competition and co-operation' between the two countries, while Indian scholars mention only 'cooperation'. No Chinese will however admit that "competition" includes proliferation of nuclear technology (e.g. atomic weapons design, medium-long range missiles and technology) to Pakistan.

becoming a credible third pole by 2025, without reducing its long term power potential, is through transfer of strategic technology and equipment from the USA and other advanced democratic countries.

Another development that can result in a tri-polar or multi-polar world around 2025 is if the emergence of China and India on the global scene forces the residents of the large countries of the EU to reconsider their stand on EU integration. Twenty years from now they may decide to constitute an EU government, based on direct elections by EU citizens, with complete powers to act on all matters connected with international relations (Defense, foreign affairs). Such an EU would be a global power. The power potential of the European Monetary Union countries plus UK is in 2005 a little less than 75% and is projected by us to decline somewhat to about 60% (Figure 6). However, the power potential of an EU virtual state would be about equal to that of China in 2025.

If neither of these developments take place, the World will still become Tri-polar in about 30 years, with India as the weakest pole (figure 6). Though the power potential VIP^2 of China is projected to be greater than that of USA in 30 years, its actual power VIP is likely to remain less for several decades because of the accumulated strategic assets of the USA.

7 CONCLUSION

In this paper we presented a simple index of Power Potential, the VIP^2 © 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 great power (40%) 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.

The paper also shows that in terms of power potential the World ceased to be bipolar sometime between 1975 and 1985. Thus the World can in our view currently be best described as "***uni-polar with a multi-polar fringe***" constituted by the middle powers such as UK, France, Germany, Russia, Japan, China and India (by analogy to the market structure, 'monopoly with a competitive fringe'). This situation is likely to last for another ten to fifteen years, when China becomes a 'great power'. Therefore this constrained uni-polarity will have prevailed for forty years before a bipolar world emerges.

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 75% of the USA's while the sum of Japan and India's power potential would be 2/3rd of China's. Author (2005a) forecast that the world would become bipolar by 2025 and Tripolar by 2050. This paper suggests that such a projection could induce behavior that results in a tri-polar or multi-polar world by 2025. This is supported by recent developments in US-India relations. The bold decision of President Bush to remove restrictions on the flow of commercial

nuclear power technology to India and to facilitate the flow of Dual use and Strategic technology could transform power relations in Asia and the World.[29] If followed to its logical conclusion this could raise India's actual power (VIP) above its power potential (VIP^2), leading to a Tripolar world by 2025. More realistically, it could accelerate the arrival of a tri-polar World. 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.

The following Policy implications emerge from the analysis of the paper:

1) Maximization of economic growth will maximize Power Potential.[30] Since Deng's market revolution, China's Leninist ruling party has absorbed this lesson fully and has been acting on it. India's democratic ruling elite has for too long ignored this lesson. Further, acceleration of economic growth in India will not only increase its power but also (unlike in China) eliminate poverty faster (Author(2005c)).
2) Investment in Strategic Technology must be commensurate with the Power Potential of the Economy so as to convert the 'potential' into actual power.[31] Too little investment will result in the potential remaining unrealized and aggressive powers will be tempted to exploit this weakness. Excessive investment in strategic assets can raise actual power in the short run but can undermine long term power potential by diverting funds from other essential public goods & services.

[29] Just as President Nixon's opening to China did. 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. India should not however let this go to its head. Size gives India an advantage, but the large number of poor people reduces the influence & respect that it enjoys. Though projections indicate that poverty (as currently defined) will be eliminated in 15 to 20 years analysts should be realistic, remembering both the strength and weakness.
[30] To find an answer to the question of how to do these in India please see Author(2005c).
[31] The global balance emerging from such a policy by all countries would result in a "natural balance of power" (Author(2004)) Such equilibrium among the major powers is therefore likely to be more stable.

3) Alliances (formal or informal) with a country having a large, high quality stock of strategic capital can be highly beneficial to a relatively poor country with a lower level of general technological capability and strategic assets but large stock of under utilized brains. Such a partnership can lower the financial and time cost for the latter of building strategic assets and improving their quality. The growth of strategic capital can therefore be accelerated resulting in faster rise of VIP.

4) The previous point has two implications for India:

   a. A strategic partnership with the US, the dominant power (uni-pole), can be beneficial to India if it gives India access to US strategic technology. A US spokesman's statement on March 25, 2005 in Washington that the USA would "..help India become a World Power," has a value for India if it means that the USA is willing to *supply India the Strategic technology to ensure that India's actual power (VIP) matches or exceeds its growing power potential (VIP^2)*.[32] This is not, however, a commercial transaction where financial price equals marginal revenue. The US president has authorized such a statement because he perceives a strategic benefit to the USA from having a natural and stable balance of power in Asia. The USA can also benefit in the medium-long term from India's large stock of young but under utilized brains.[33]

   b. A strategic partnership between India and each member of the *democratic, multi-polar fringe* (Japan, UK, Germany, France, and Russia) can also be mutually

[32] President Bush's commitment to supply the requisite technology to India is confirmed by informed strategic analysts in Washington as is the resistance of the bureaucracy.

[33] See Rummel(1994) and Ray (1998) for the hypothesis that Liberal Democracies do not wage War against each other. In our view the probability of War between liberal democracies is indeed likely to decline in the 21st century for the theoretical reasons given in this thesis. Thus it is in the interest of democracies to collaborate both to strengthen each other and to jointly promote democracy through out the World.

beneficial, particularly if it involves joint R&D and production. This is because these countries' strategic assets, though inferior to that of the USA, are superior to India's. They also have some technologies that match those of the USA in quality and/or cost and are therefore competitive. Increasing the number of competitors levels the playing field for the buyer. In the medium term they too can benefit from India's high stock of young under utilized brains.[34]

5) Acquisition of technology or skills from others is <u>not</u> a substitute for, but a complement to indigenous development for a potential Global power or aspiring Great Power. Acquisition of strategic assets (materials, equipment, technology, skills) from others must be used to, (a) Fill gaps and cover weakness in domestic capability. (b) Speed up indigenous development of strategic assets and improve the effectiveness and quality of strategic R&D. (c) Widen the ambit of strategic R&D into frontier areas not accessible previously.

6) The dominant power will try to reduce the flow of strategic technology from it to the potential challenger. As shown above China will be strong enough to challenge US power by 2025. The US government has therefore taken steps over the last few years to stop such flows from the US, EU and Japan. In response China has been emphasizing that it is a middle-income country whose per capita income will not equal the USA's for 50 years or more. This paper shows that as for global power relations are concerned the relevant comparator is either the power potential VIP^2 or the actual Power VIP, not the relative per capita income.

[34] See Rummel(1994) and Ray (1998) for the hypothesis that Liberal Democracies do not wage War against each other. In our view the probability of War between liberal democracies is indeed likely to decline in the 21st century for the theoretical reasons given in this thesis. Thus it is in the interest of democracies to collaborate both to strengthen each other and to jointly promote democracy through out the World.

7) As long as the EU does not become a “virtual state” it is not a global power and its incentive for stopping the flow of strategic technology to China will be much lower than that of the USA. On the other hand if the EU becomes a “virtual state” it will be a rival of China and its incentive to restrict the flow of strategic technology to China will rise sharply.

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