United Nations Security Council Reform: A Proposal for Weighted Voting

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July 2005

Introduction

The United Nations (UN) is the foremost international body responsible for the maintenance of international peace and security. In the volatile aftermath of the September 11th terrorist attack on New York, never has the role of the UN, in particular its Security Council, been so pivotal to the peace and prosperity of nations since the end of the Cold War. However, the UN and its Security Council has so far failed to respond to the changed geo-political reality post 1945; the recent conflict in Iraq without Security Council approval brutally highlighting the need for reform of the Security Council and its voting system as part of a package of wider UN reform.

Why should economists be interested in SC reform? A core element of the economic discipline is the study of how resources should be allocated across agents. Thus economic theory offers a perspective on how votes, or more precisely voting power, should be allocated across collections of agents (nations) in international political organisations. Two of the three evaluative criteria employed in this study to assess candidate voting systems are drawn directly from the work of economic theorists in the field of social choice. These criteria are reinterpretations of the fundamental notions of equity and efficiency, which together motivate all economic thinking towards allocative problems. However, since the application of economic theory here is to an explicitly political situation, the analysis is necessarily inter-disciplinary. This is manifested by the use of a third evaluative criterion, functionality, which derives from the political science literature.

The approach to voting system design and evaluation employed here is explicitly analytic, thereby filling a lacuna in the academic literature on SC reform left by the entirely qualitative work in the Political Studies literature. Whereas qualitative work

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has summarised the dimensions of the debate, the analytical tools used here enable critical analysis and firm recommendations. It is hoped that the analysis herein can inform what is at present a shallow debate.

Section One begins by contextualising the later theory with the institutional details of the SC. Section Two continues by setting out the application of a-priori voting power analysis to the SC and uses it to generate a set of synoptic parameters that reflect the three evaluative criteria drawn from the work of economists and political scientists. A distinction is drawn between two competing notions of equity pertaining to two different electorates, and a genuine attempt is made to explore the trade-offs between equity and functionality that most theorists ignore.

Section Three uses the synoptic parameters to assess the current deficiencies of the Security Council as a voting body. Section Four investigates a proposal in Desai (2003) to implement weighted voting in the SC. A four-stage design methodology is used to construct a weighted voting reform proposal that outperforms the present SC voting system and all the tabled reform proposals, by all the evaluative criteria considered. The final section concludes

Section One – Background

The UN came into existence on 24th October 1945 with a mission to maintain international peace and security, and to achieve international co-operation in solving social, cultural, economic and humanitarian problems. The UN has grown from fifty-one founding members to a total of 191 members as of 2003, representing some 99.7% of world population.

The focus of this study is the United Nations Security Council (SC), which has evolved into the dominant political body of the UN. The SC is a task-orientated body, which makes binding decisions on a specific, well-defined, range of subject matter. Its mandate is specifically the maintenance of international peace and security, and to that end it can suspend economic and diplomatic relations between countries, impose blockades, and authorise the use of armed force.

Despite the UN membership almost quadrupling since 1945, the SC has undergone only one reform when, in 1965, it increased its membership from eleven to fifteen members. The SC is composed of five Permanent Members (PMs), hereafter the P5, who, as their name suggests, are ever present on the SC, and ten Non-Permanent Members (NPMs) who each serve two year overlapping terms. The P5 are China, France, Russia, the UK, and the USA, i.e. the major victors of the Second World War. The ten NPMs are elected to the SC by the United Nations General Assembly (GA), which is the main deliberative body of the UN, containing a delegate from each of the 191 member governments.

Elections to the SC are subject to the principle of equitable geographic distribution, which requires that a specific number of member-states be elected from each of five different caucusing groups (CGs) that together comprise the UN membership.[1] These CGs are the African Group (AF), Asian Group (AS), Eastern European Group (EE), Latin America and the Caribbean Group (LAC), and the Western European & Others Group (WEO). Appendix One details the precise membership of each group. At present, five NPMs must come from AF and AS, two from LAC, two from the WEO, and one from EE. There is an unwritten, but unbroken, agreement that of the five states elected from AF and AS, three should be from AF and two from AS. Each CG submits candidate countries to the GA for election to the SC. Groups such as AF work by near strict rotation and put forward one candidate state per available seat, with the GA left to rubber-stamp their decision. Other CGs such as the WEO are much more fragmented and generally submit more candidate states than available seats. The only voting guidance to GA members is that they should pay due regard to a candidate state's contributions to international peace.

Each SC member exercises a single vote. On procedural matters a minimum of nine members (60%) must vote in favour of a resolution for it to be passed. However, for all non-procedural matters, decisions are made by an affirmative vote of nine or more members *including the concurring votes of the PMs*. That is, each PM has a right of veto. By 'concurring' we note that each member has the right of abstention, and the abstention of a PM does not constitute an exercise of the veto. This study focuses entirely on the voting system used for non-procedural matters, as this is clearly the more salient.

Section Two – Theoretical Underpinnings

2.1 – A Theoretical Model of Voting

The approach to voting system evaluation and design taken here is to assess candidate voting systems against objectively chosen evaluative criteria that a good voting system should satisfy. This study specifies three such criteria: efficiency, equity and functionality. Here the theoretical modelling of voting bodies is briefly explicated in order to make these criteria precise. We derive the synoptic parameters used here from the theory of a-priori voting power, according to which a voting body is modelled as an n-person game.

Following Shapley (1962), we define a simple voting game as a pair $(N,\ W)$, where N is a set of the n members of the voting body. W is a collection of subsets of N and has the following properties:

i) $\varnothing \notin W$

[1] The USA is not a member of any caucusing group. However, it maintains very close links with the WEO and has been assigned to this group. Israel for many years was not a member of any grouping, but has recently achieved temporary membership of the WEO and has been assigned to that group.

ii) $N \in W$
iii) If $S \subseteq T \subseteq N$ and $S \in W$ then also $T \in W$

Sets in W are called winning coalitions and sets not in W are called losing coalitions, where a coalition is any non-empty subset of *N*. A voting body can be modelled as a class of simple games, called weighted voting games (WVGs).
A WVG is represented by a symbol $(q;\ w_1,\ w_2,\ ...w_n)$ where the non-negative numbers w_i are the weights of the *n* players, and the positive number *q* is called the quota of the game. A coalition S is winning iff $\sum_{i \in S} w_i \geq q$.

The SC can be modelled as a WVG as follows. Suppose, without loss of generality, that the weight assigned to each NPM is unity, and that the weight assigned to each PM is x. Then, by the voting rules described in the previous section, it must be that $5x + 4 \geq q$ and $4x + 10 < q$, which together imply that $5x + 4 > 4x + 10$, or $x > 6$. Without loss of generality, let $x = 7$, then $39 \geq q > 38$. Since any *q* in this range is sufficient, an integer *q* is chosen by setting $q = 39$. Thus the SC can be written as the WVG $(39; 7, 7, 7, 7, 7, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1)$.

2.2 – Voting Power Indices

A voting power index assigns to each member in a WVG a measure of their ability to influence voting outcomes. We employ the well-known Banzhaf Index (BZI) and Banzhaf Measure (BZM) (Banzhaf, 1965). The BZM is a measure of absolute voting power, while the BZI is a measure of relative voting power. Let a member *i* be said to be critical to a coalition if by switching his vote, he can change a coalition from a winning coalition to a losing coalition, that is, $i \in S,\ S \in W$ and $S - \{i\} \notin W$. If η_i is the number of times member *i* is critical, then the Banzhaf Measure (BZM) for that member is given by:

$$\beta_i' = \frac{\eta_i}{2^{n-1}} \qquad i = 1, ..., n$$

Normalising the sum of the individual BZM scores to one yields the Banzhaf Index (BZI) given by:

$$\beta_i = \frac{\beta_i'}{\sum_{i=1}^{n} \beta_i'}, \qquad i = 1, 2, ..., n.$$

The set of BZI scores generated for a given WVG is termed the β distribution of that game. One of the difficulties with using these measures is that they are derived from a model of voting in which members may only vote for or against (no abstention). It was noted earlier that SC members can exercise the right to abstain, and that the abstention of a PM is distinct from a vote against. The failure to allow for abstention reflects a failure of the voting power literature more generally. Felsenthal & Machover (1998) demonstrate that allowing for abstention has quantitatively significant effects, but it is not clear that it is equally significant from a qualitative perspective. Since the theoretical analysis of ternary games is in its infancy no attempt is made here to allow for abstention. Rather, we offer it as a suggestion for future research.

2.3 – Equity

An important dimension of the SC decisionmaking process is that the SC, as with other such intergovernmental bodies, forms part of a wider democratic process, since its members are delegates from individual member-state governments. If these governments can reasonably be assumed to act as representatives of their citizens then ultimate, but indirect, control over decisions rests not with national governments, but with the individual citizens of the member-states. An important characteristic of a voting system for a democratic body is that it should be equitable to all the citizens in its electorate in the sense that every individual citizen should have the same ability to influence the decisions of that body. This is often termed the One Person-One Vote (OPOV) rule. However, in the case of the SC it is informative to distinguish between the entire UN electorate and the SC electorate (for a given SC). The notion is that as well as being equitable with respect to its membership in any one year, the SC should also be equitable with respect to the UN electorate as a whole over time. To analyse the former, one treats the SC as if it were a fully representative body such as the GA, whereas to analyse the latter, one must explicitly model the SC membership as only a subset of the wider UN membership. To set a benchmark for the OPOV rule against which candidate voting systems can be tested it is necessary to model the SC as a multi-stage game. An appropriate game to model the SC in the context of the wider UN is the three-stage game described below.

In stage one, each UN member-state i ($i = 1, \ldots, m$) holds an election on the basis of OPOV and a simple majority decision rule. In stage two a delegate from each member-state i joins a CG and with ex ante accession probability (AP) p_i, is chosen to accede to the SC. In the third stage the chosen delegates from stage two attend the SC and vote on the basis of weighted voting according to the result of stage one in their respective member-states.

The indirect voting power (IVP) of each citizen over the overall outcome of a composite game is simply the product of their voting power in each stage, so the OPOV rule is attained by equalising IVP across all citizens. Let c_i, $i = 1, \ldots, m$ be the population of member-state i. Since Penrose (1946) it has been known that the voting power of a citizen of member-state i in the first stage approaches $\sqrt{\frac{2}{\pi}}\frac{1}{\sqrt{c_i}}$ when c_i is large.[2] It follows that

[2] This statement has now been rigorously proved in Felsenthal & Machover (1998), pp. 66-67. It is based on Stirling's approximation formula for $n!$: $n! \sim n^n e^{-n}\sqrt{2\pi n}$.

the IVP of each citizen after the first two stages is proportional to $\frac{p_i}{\sqrt{c_i}}$. Therefore the OPOV rule is obtained by setting the voting power of each member-state *i* in stage three proportional to $\frac{\sqrt{c_i}}{p_i}$. This is the Three-Stage Square Root Rule (TSSRR).

The importance of stage two in this model of the SC is that it captures the fact that that the amount of time spent by member states on the SC differs between member-states. For instance, the P5 have APs $p_i = 1$, whereas the average UN member, excluding the P5, has an AP of only $p_i = \frac{10}{186} \approx 0.054$. Equitability is not only a function of voting power while on the SC, but also time on the SC. The notion is that a member-state that is expected to make few appearances on the SC must be compensated by having a higher voting power than would otherwise be the case on those occasions that it is elected to the SC.

The second, more limited, notion of equity is that the SC should attain the OPOV rule only for its own membership at a given point in time. Here one supposes that stage one occurs only in states that are already members of the SC, thereby eliminating stage two. To attain the OPOV rule in this model requires voting power in the SC to be set proportional to $\sqrt{c_i}$. This OPOV result is known as the Penrose Square Root Rule (PSRR). One caveat with both the TSSRR and the PSRR is that they assume that the voting behaviour of citizens is independent within and across member-states. If voting within member-states is relatively homogenous, but there is polarisation between member-states then both the TSSRR and PSRR could systematically allow a minority to rule a majority (Sutter, 2000). However, the assumption of independent voting seems as plausible as polarised voting, though the reality is probably somewhere between the two.

To measure how closely the β distribution generated by a given voting system attains a corresponding set of equitable values $C_i \; i = 1,...,n$ we follow Felsenthal & Machover (2001) in employing four complementary measures. The first is Pearson's product-moment coefficient of correlation $(0 \leq \rho \leq 1)$, which detects a linear relationship between two series, taking its maximum value when they are perfectly linearly correlated, and a zero value when they are linearly uncorrelated. Attainment of the PSSR or TSSRR corresponds to $\rho = 1$. The Chi-Square coefficient $\chi^2 \geq 0$ is also employed, where the PSSR and TSSRR correspond to $\chi^2 = 0$. This measure can only be compared for voting bodies of the same number of members. These measures for the overall goodness of fit globally, can be supplemented by two measures which focus on the most extreme individual deviations. Max $|d|$ measures the individually most significant percentage deviation of β_i from its equitable value in either direction:

$$\text{Max } |d| = Max\left|\frac{\beta_i}{C_i} - 1\right|,$$

while Ran (d) is simply the range of $\frac{\beta_i}{C_i} - 1$, over the member-states. $i = 1, \ldots, n$:

$$\text{Ran } (d) = Max\left(\frac{\beta_i}{C_i} - 1\right) - Min\left(\frac{\beta_i}{C_i} - 1\right).$$

The Max $|d|$ and Ran (d) parameters are reported as percentages, simply by multiplying each value by one hundred. The 'ts' subscript is used to denote testing against the TSSRR.

Unfortunately, since composition of the SC changes from year to year, so do its equity properties. To overcome this, equity analysis is in each case performed on twenty different SC's, constructed as explained elsewhere in the text. The mean value for each parameter is reported along with its standard deviation across the sample.

2.4 - Functionality

A problem with attaining the PSRR is that it is based solely on population. A premise of this study is that a fully specified β distribution for the SC must be based on a broader set of variables than population alone. To make an objective determination of which variables should be reflected in the β distribution, this study draws on the notion of functionality in the political studies literature. The functional analysis of Claude (1971) centres on the way in which voting systems are structured so as to meet the functional requirements of the particular organisation. From a functionalist perspective the β distribution of the SC should take into account the fact that it makes legally binding decisions specifically within the area of international peace and security, and its context within the UN (Zamora, 1980). The UN, unlike its member-states, has no military force of its own, and relies on member-states for funding. Without the observance of the major world powers the UN quickly faces becoming irrelevant and being unable to command the resources it needs to fulfil its remit. It is well understood by political scientists that absent the threat of enforcement, the way in which decisions are made has a direct effect on the members' observance of them. On this evidence, the SC must use a β distribution that reflects the significance of a member-state to its functional requirements.

The first suggested criterion is population (c), as this forms the basis of the equity judgements above. A second criterion is laid down in the UN Charter, according to which the contributions of a member-state to UN peacekeeping (pk) should be taken into account. This would have the effect of ensuring that more voting power was given to those states who undertake the cost and burden of implementation. Ideally one could get a holistic measure of peacekeeping contributions by combining data on budgetary contributions and UN troop contributions for each member-state. However, this study simply uses current budgetary contributions because of a lack of comprehensive historical data on member-state troop contributions. Secondly, for the SCs decisions to carry weight they should have the support of the significant regional powers from around the world. Since large countries often tend to act as a centre of gravity for particular regions of the world, territory (terr) seems to be a relevant factor. Thirdly, the SC must have the support of the major economic powers to effectively implement economic sanctions and finance its peacekeeping operations, so GDP is also a relevant factor. Henceforth, the four variables identified here are termed as the 'weighting variables'.

Some member-states have argued that a state's human rights record and its colonial history, amongst other things, should also be reflected in the β distribution. These variables are not employed as they cannot be measured objectively and because it is not clear how long one must wait before forgiving a country for past misdeeds. Nevertheless, one could imagine that an ad-hoc procedure could be put in place to exclude a certain member-state from the SC if some super-majority of the UN membership expressed that desire in a vote in the GA.

Given that the β distribution should aim to attain *both* functional and equity requirements it is argued that, as a point of principle, deviations from the OPOV rule can, and should be entertained so long as they systematically reflect differences in the weighting variables, and thus contribute to the functionality of the SC. The question of how far one should be willing to systematically deviate from the OPOV rule is a matter of judgement and depends on the specifics of the organisation. Unlike a solely economic organisation such as the IMF, the UN is a champion of human rights, so has a duty to take the OPOV rule seriously. Thus, in the case of the SC, deviations from the OPOV rule, even if systematic, should be kept small.

To derive a formal measurement of functionality we construct a statistic which combines the information contained in the weighting variables.[3] Firstly, each variable is scaled so that each has has the same mean. The statistic we use is then:

$$V_i = \frac{gdp_i + terr_i + pk_i}{3c_i} \quad \forall \ i = 1, \ . \ . \ , m$$

[33] The population and GDP data we use are from The World Factbook at URL: http://www.odci.gov/cia/publications/factbook. Population estimates are for July 2003, and GDP for 2002. The GDP estimates are converted at purchasing power parity rates. The PPP technique reflects the real value of total output produced by a country, and thus has been advocated as the appropriate GDP measure for international organisations by Kelkar et al (2003). The UN Peacekeeping Budget contributions are based on assessed contributions to the UN General Budget. General Budget assessments are based on a member-states share of world GDP, with a heavy discount for member-states with low GDP per capita. The detailed method used here to calculate the UN Peacekeeping Budget follow the guidelines set out in General Assembly resolution A/RES/55/235.

The notion is that a member-state which, for instance, has a relatively high population, but has relatively low values of the remaining weighting variables should for purposes of functionality be under-weighted relative to the PSRR. A score $V_i > 1$ would indicate that member-state *i* should be over-weighted relative to the PSRR, whilst $V_i < 1$ would indicate the converse. A measure of the functionality of a voting system is then the Pearson correlation coefficient between the relative deviations from the PSRR $\left(\frac{\beta_i}{C_i} - 1\right)$ of the β distribution and V_i. The notion is that a member-state which, for instance, has a relatively high population, but has relatively low values of the remaining weighting variables should for purposes of functionality be under-weighted relative to the PSRR. The construction used here is simply $V_i = \frac{gdp_i + terr_i + pk_i}{3c_i} \;\; \forall \; i = 1, \; . \; . \; , m$, If deviations from the PSRR are systematic, one should expect them to display a strong and positive correlation with V_i. This measure is denoted ρ_f. Again, ρ_f is reported as a mean and standard deviation from twenty sample SCs.

There is a direct trade-off between the attainment of functionality and the TSSRR. Functionality theory specifically advocates that both the β distribution and the APs should be increasing functions of the weighting variables. However, to attain the TSSRR the β distribution would have to be distorted in favour of low scoring countries in order to compensate for their lower AP's. Aside from setting $p_i = p \;\; \forall i = 1, . . . , n$, the only other way to attain the TSSRR without distorting the β distribution is to expand the SC membership, such that $\lim_{n \to 191} \frac{\sqrt{c_i}}{p_i} = \sqrt{c_i} \;\; \forall i = 1, . . . , n$. However, this option is largely infeasible because the remit of the SC as the maintainer of international peace and security demands that it be sufficiently small to take quick decisions in periods of crisis (Zacher, 2003).

2.5 - Efficiency

The efficiency of a voting system refers to the efficiency with which it responds to the preferences of the members of a voting body. The first measure of efficiency is known as sensitivity, and can be defined both for the SC as if it were a stand-alone body, as well as for the composite (two- or three-stage) game as a whole.

For the stand-alone SC sensitivity is defined as the sum of the BZM across the *n* SC members, i.e. $\Sigma = \sum_{i=1}^{n} \beta_i'$. However, the average sensitivity measure $\overline{\Sigma} = \frac{1}{n} \sum_{i=1}^{n} \beta_i'$ is reported because invariably the analysis is of SCs of different numbers of members, for which Σ is not meaningful. The present SC voting system and all the reform proposals of

Section Three share the property that $\bar{\Sigma}$ is fixed. Thus this parameter is computed precisely.

A second measure of sensitivity, termed composite sensitivity (Σ_c) is the sum of the IVP of all the individual citizens of SC members (the SC electorate). Here the SC is treated as the SC as the two-stage game considered in deriving the PSRR. For each member-state *i*, let β_i' be *i*'s BZM in the SC then the IVP of a citizen of member-state *i* is $\left(\sqrt{\frac{2}{c_i \pi}}\right)\beta_i'$.

Summing across all citizens of SC members we have $\Sigma_c = \sum_{i=1}^{n}\left(\beta_i'\sqrt{\frac{2c_i}{\pi}}\right)$. Felsenthal & Machover (1998) show that maximising Σ_c has an interpretation in terms of the principle of majoritarianism. One property of a two-stage game is that it is always possible that a majority of the SC electorate will disagree with a decision made in the SC, since small majorities in favour of an action in many SC members could be more than counterbalanced by large majorities against action in a minority of SC members. When this occurs the difference between the size of the majority opposing the outcome and the minority supporting it is called the majority deficit of that decision. The mean majority deficit (MMD) is the a priori expected value of the majority deficit under a given voting system. Felsenthal & Machover (1998) have shown that for a given SC electorate, $MMD + \Sigma_c = \text{constant}$, so maximising Σ_c is equivalent to minimising the MMD. Since the MMD has a very clear interpretation, we report it in preference to Σ_c. However, since the SC electorate is not fixed in size between years, the MMD statistic itself is not comparable across different years. Therefore the MMD for each year is calculated as a percentage of the SC electorate of that year. The MMD for a given year *z* is:

$$MMD_z = \frac{\frac{\mu}{2^{n-1}}\frac{d_z!}{\mu!(n-\mu)!} - \Sigma_c}{2} \sim \frac{\sqrt{d_z} - \sum_{i=1}^{n}\left(\beta_i'\sqrt{c_{iz}}\right)}{\sqrt{2\pi}},$$

where μ is the least integer greater than $\frac{n}{2}$, d_z is the size of the SC electorate in year *z* and c_{iz} is the population of SC member *i* in year *z*.[4] The measure calculated is then $MMD(\%)_z = 100\left(\frac{MMD_z}{d_z}\right)$. Again this is reported as a mean and standard deviation from twenty constructed SCs.

[4] Since d_z is large the calculation of the MMD is by the approximation given.

A subtly different measure of efficiency is the Power of a Voting body to Act (PTA) measure of Coleman (1971). The PTA is defined as the proportion of all possible voting outcomes that give rise to a positive decision. That is:

$$PTA = \frac{\omega}{2^n},$$

where ω is the number of voting outcomes that lead to positive action. It can be argued that a decision rule should not have too high a PTA since there should be some protection for the status quo, but a low PTA can lead in the extreme to immobilism. A unanimity rule $q = \sum_{i=1}^{n} w_i$ gives a PTA of 2^{-n} while a simple majority rule $q = \frac{1}{2}\sum_{i=1}^{n} w_i$ gives a PTA of ½. The PTA is related to $\bar{\Sigma}$ since we can write $PTA = \frac{\omega\bar{\Sigma}}{\left(\frac{2}{n}\right)\sum_{i=1}^{n}\eta_i}$. Thus the PTA encompasses $\bar{\Sigma}$, but weights more highly voting systems that have high a priori probability of being decisive. Although $\bar{\Sigma}$ and the PTA generally complement each other, it is possible for a voting system to be sensitive but have a low PTA.

Section Three – Present Security Council

Having set out the theoretical modelling of voting systems and the synoptic parameters that can be used to assess their performance against the criteria of equity, efficiency and functionality, in this section the properties of the present SC are analysed in order to identify areas where reform is needed. As discussed earlier, the WVG $(39;7,7,7,7,7,1,1,1,1,1,1,1,1,1,1)$ is an appropriate model for the SC. The BZI of each PM is calculated at 0.1669, and for each NPM at 0.0165.[5] Thus each PM has ten times the relative voting power of each NPM.
The efficiency measures for the SC are:

$$\text{PTA} = 0.026 \qquad \bar{\Sigma} = 0.0207 \qquad \text{MMD}(\%) = \underset{(0.000049)}{0.00074}$$

The important result here is that the PTA is dangerously low, with only 2.6% of all possible voting outcomes leading to a positive decision. As a comparison, the PTA of the EU Council of Ministers under the Treaty of Nice has been calculated in Leech (2002a) as 0.0826, which the author regarded as unhealthily low. The very low PTA of the SC is a direct consequence of the the veto provision to the P5 and may go a long way to explaining why the SC has found itself bypassed on key decisions in recent years. The

[5] All computation of voting power in this study was performed using the on-line algorithm 'ipexact', which is written and hosted by Dr Dennis Leech of the University of Warwick. It can be found at http://www.warwick.ac.uk/~ecaae/ipexact.html.

MMD(%) parameter, as with all those reported as a mean, is calculated from a sample composed of each year's SC for the last twenty years (1983-2003).

Testing the present SC voting system against the PSRR, the synopic parameters are:

$$\rho = \underset{(0.092)}{0.567} \qquad \chi^2 = \underset{(0.148)}{0.750} \qquad \text{Max } |d| \text{ (\%)} = \underset{(44.9)}{205.5} \qquad \text{Ran (d) (\%)} = \underset{(48.4)}{289.2}$$

Clearly the SC voting system is a considerable distance from the PSRR both globally and in specific incidences. The member-state most grossly over-weighted against the PSRR was invariably France, whilst the most heavily under-weighted state in the sample was India. It is transparent that the practice of maintaining only two levels of voting power generates severe inequities. For instance, by population, or any combination of the weighting variables, the USA should receive more voting power than the UK. Similarly, the situation on the 1983 SC when India and Malta shared the same voting power was highly inequitous by any reasonable measure. Structural inequities also exist, caused by the fact that different CGs use different selection processes. Even within a single CG the present SC selection process has occasionally resulted in highly inequitable representation. For instance, take the case of Panama and Chile in LAC. Both joined the UN as founder members in 1945 and have had eight years on the SC, but Chile is nine times larger, has nine times the GDP, and is five times as populous.

Across almost the entire sample, the UK and France are severely overweighted against the PSRR, and Russia moderately so, which might explain the claim that these member-states are unsuited for permanent membership. However, as argued earlier, deviations from the PSRR can be tolerated to some extent if they contribute to SC functionality. However, the relevant statistic is $\rho_f = \underset{(0.173)}{0.400}$, demonstrating that, on this evidence, the SC voting system trades-off a great deal of equity for a very miniminal return in terms of functionality.

The next issue is of how equitably the SC voting system treats the UN membership as a whole. To assess this one needs to test against the TSSRR, which requires one to specify the APs. Since this is a study of the a-priori properties of the SC voting system it is assumed that (excpeting the P5), all members within a given CG have an equal probability of been elected to the SC. An empirical approach might attempt to estimate the APs from historical data using logit/probit analysis. The synoptic parameters are:

$$\rho_{ts} = \underset{(0.121)}{-0.495} \qquad \chi^2_{ts} = \underset{(3.804)}{13.343} \qquad \text{Max } |d|_{ts} \text{ (\%)} = \underset{(683.9)}{2478.1} \qquad \text{Ran } (d)_{ts} \text{ (\%)} = \underset{(685.0)}{2572.3}$$

Clearly the SC voting system is a very long way from the TSSRR. As stated earlier, any functional SC voting system cannot attain the TSSRR, but nevertheless these results leave plenty of room for improvement. The major problem is that the PMs have ten times as much relative voting power as NPMs *and* spend on average 18.6 times as long on the SC. Thus against the TSSRR, the P5 are massively over-weighted, and the NPMs are massively under-weighted.

In terms of the SC structure, its size has been criticised because it has not grown in line with the expanding UN membership; 77 member-states have never served on the SC. In 1945 the twelve member SC constituted 23.5% of the UN membership, but to maintain that percentage would now require an SC of forty-five. One of the few areas of agreement between member-states is that the SC should be expanded to at least 20 members.

Given the analysis here, a strong reform proposal must improve the efficiency of the SC, and, in particular, it must increase the PTA. In terms of equity it should attain the PSSR and TSSRR more closely both globally and in terms of the most significant individual deviations. On functionality, it should manage to allocate voting power more systematically to those states that enable the SC to function effectively.

Section Four – Designing a Weighted Voting System

In this section we investigate a proposal in Desai (2003) that the SC should adopt a WVS. Of course, the present system of one-member one-vote (OMOV) with ad-hoc vetoes has been shown here to be, in effect, a form of weighted voting, but here we envisage a fully fledged WVS in which the voting power of each SC member is systematically determined by a consistent set of criteria.

4.1 – Why Weighted Voting?

The first question must be why the SC should adopt weighted voting. The argument from a functional perspective is that where, as in the SC, functional responsibilities are not shared equally among the SC membership, weighted voting is an apposite way to reflect those differences (Zamora, 1980). An OMOV rule may be appropriate to the GA, where non-binding resolutions place little functional responsibility onto member-states. The present SC voting system, by largely failing to account for differences in the weighting variables in its β distribution, has lost functionality to the point where it has been repeatedly undermined on the international stage. The comparable bodies in the EU, IMF and IBRD operate on the basis of weighted voting, leaving the SC looking somewhat outdated with its present voting system. Secondly, both notions of equity argue that voting powers should differ systematically between member states, which implies using differentiated voting weights.

Bowett (2001), in a study of many international bodies concludes that WVSs are most common in bodies with clear and acceptable criteria for allocating the votes. It is certainly true that one reason why the SC reform debate has become quagmired is the lack of consensus on the criteria for SC membership between member-states. This study has proposed a set of weighting variables based on the consideration of maximising the functionality of the SC in performing its remit. While any choice of variables is open to criticism, the method here is at least guided by a principle grounded in theory. An additional benefit from weighted voting is that voting power can be linked to organisation specific variables such as contributions to the UN peacekeeping budget, or to the UN peacekeeping forces. This would incentivise the payment of assessments, and ease the UN's problems in persuading member-states to contribute peacekeeping troops.

A counter argument might be that the UN has an explicit principle of sovereign equality between states. However, this principle appears to be coming less relevant in a more interconnected world, and in any case, the present system of PMs being distinguished from NPMs appears to have compromised commitment to this principle from the very outset. Secondly, the right of veto for PMs would almost certainly have to be relinquished. To guarantee each PM a veto would require either their voting weights or the quota to be adjusted in an ad-hoc manner every year once the composition of the NPMs had been determined. However, both these practices would be inherently unsatisfactory. In any case, there is a strong argument for eliminating the veto; it is clear that the veto is sufficiently distortionary that any proposal that does not tackle the issue in one way or another will have only a limited positive impact. Secondly, almost all UN members (except the P5) regard the selective right of veto as anachronistic and would like to see it abolished. It is widely recognised by political scientists that if the UN membership (excluding the P5) could agree on an acceptable reform proposal the P5 would go along with it (Laurenti, 1977). The problem to date has been that member-states cannot agree on a unified plan because each is making a proposal that is skewed towards their factional interest, and therefore unacceptable to other member-states. It might be hoped that a proposal stemming from a holistic and dispassionate view of SC reform could win more widespread support and would therefore be able to end the right of veto.

4.2 – Comparison Voting Systems

If the case for weighted voting is strong, this still leaves open the question of its exact form. The Bretton Woods weighted voting model used by organisations such as the IMF allocates each member-state a fixed amount of basic votes and then a member specific 'quota' allocation proportional to the financial contribution the member makes. The EU Council of Ministers will from 2005 use a triple majority WVS with decisions requiring the support of 62% of the EU population, a simple majority of EU states, and a 71.3% qualified majority of the votes. The UN has much more than an economic function, so the 'shareholder' system of the IMF would be inappropriate for the SC. There are also much more precise ways to achieve equity than simply adding a constant to each member's voting weight. The triple majority system of the EU Council of Ministers would not be practicable in the SC since the population criterion would give immense power to the states of China and India at the expense of all other states. Moreover, member-states would not have a fixed relative voting power vis-a-vis one another because the size of the SC electorate changes every year.

4.3 – Design Methodology

Given the designs discussed above are inappropriate, I argue that an appropriate WVS for the SC is a single-majority WVS designed according to the principles of efficiency, equity and functionality, with relative voting power determined by some construction of the weighting variables.

A first point is that because voting reform is only one component of the overall debate on SC reform, the proposal consists of both a proposed structure and voting system. Since it is the latter that is the principal focus of study, more emphasis is placed on it. My proposal for the reformed SC is developed through the four-stage process set out in Figure 4.1.

Figure 4.1 – Designing the Reformed SC

Stage One
Design the structure of the SC, including its size, regional composition, and its selection process.

↓

Stage Two
Given the design in Stage One, create a desired β distribution and AP distribution across all UN members.

↓

Stage Three
Compute the voting weight distribution that attains the chosen β distribution in Stage Two for a given SC.

↓

Stage Four
Given the voting weight distribution from Stage Three, set an appropriate quota level.

The approach to voting system design outlined in the final three stages is more advanced than that used in previous academic research into the UN, in that it uses the weighting variables to determine an appropriate β distribution and then computes back to the voting weight distribution needed to attain that β distribution. The conventional approach, typified by Newcombe et al. (1971) and Manno (1966) in their work on the GA, is to use the weighting variables to determine a voting weight distribution from which a β distribution can be generated. However, since the β distribution is not in general the same as the weight distribution, this design method can lead to a β distribution that is a distorted reflection of the weighting variables.

The problem of how to compute a set of voting weights that generate a pre-assigned set of voting powers is overcome using the iterative algorithm proposed in Leech (2003). The desired weights w^* can rarely be attained exactly because the BZI is defined on the set of rational numbers, not the real numbers (Leech, 2003). However, the voting bodies analysed here have enough members that the β vectors are sufficiently dense that one can achieve almost perfect convergence. Of course w^* is not always unique, but so long as the voting weights achieve the desired set of voting powers, their numerical values are of only superficial relevance. In any case, this phenomenon appears to die away as a function of the number of players (Leech, 2003).

Stage One requires an assessment of the appropriate structure for the SC. This is begun by using the theoretical notions behind the TSSRR. When the β distribution and AP distribution are increasing in the weighting variables the use of the voting system as a tool for attaining the TSSRR necessarily compromises attainment of the PSRR and functionality. However, one can appropriately use the structure of the SC as a tool to help attain the TSSRR. The TSSRR has two structural implications. Firstly one should make the SC as large as possible without compromising its ability to make quick decisions. Although this is a matter of judgement, we suggest that 25 members is the feasible upper limit. Secondly, one should keep the number of PMs on the SC to the minimum required for purposes of functionality.

The allocation of seats between the CGs should be based on the principle of equitable geographic distribution as this ensures that the dimensions of the UN membership are reflected in the SC membership. For the purposes of making a specific proposal we operationalise geographic equitability using a simple ‘double-average rule’ (DAR), which combines together information concerning the total number of countries, the total population, and the total territory of each CG (See Appendix One for details).

Combining the DAR and the second implication of the TSSRR supports limiting the PMs to one from each CG. The states to fill these seats are chosen according to the simple average of their weighting variables, after each series had been scaled to have the same mean. This analysis is detailed in Appendix Two. The chosen states are then Nigeria from AF, China from AS, Russia from EE, Brazil from LAC and the USA from WEO. The remaining UN members must share twenty seats allocated by the DAR as follows: six to AS, five to WEO, four to AF, three to LAC and two to EE.

To rectify the present heterogenities in selection methods to the SC it is proposed that each member-state have an explicit AP which states how often by rights it should appear on the SC. These probabilities could be realised by a suitably designed rotation system, or if one thought this undemocratic, the GA could simply be instructed to vote in such a way as to realise the APs as closely as possible over time. While the APs would never be achieved exactly, there would at least be no systematic bias. A minimum requirement of the APs is that for each member-state *i* we have $0 \leq p_i \leq 1$ and for each CG *j* we have

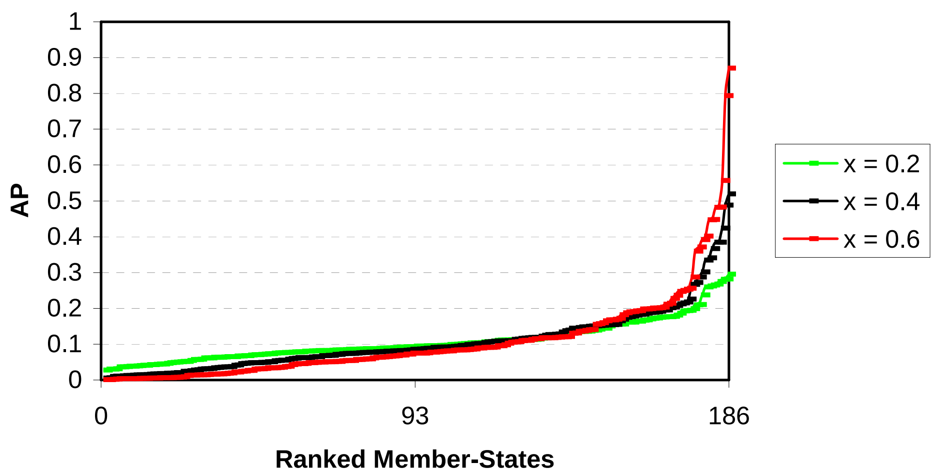
$1+\sum_{i=1}^{g_j-1} p_i = k_j$, where k_j is the number of seats allocated to CG *j* on the SC. That is, since AF has four seats and 53 member states, if one seat is taken permanently by Nigeria, the remaining APs must sum to three. As has been discussed, it is desirable for states deemed significant by the weighting variables to have more terms on the SC. A suggested functional for determining the AP of each member-state *i* (excluding PMs) in CG *j* is:

$$p_{ij} = \left(k_j - 1\right) \frac{\left(pop_i + terr_i + gdp_i + pk_i\right)^x}{\sum_{i=1}^{g_j} \left(pop_i + terr_i + gdp_i + pk_i\right)^x}, \; x : p_{ij} \leq 1 \; \forall i, j .$$

This rule determines a member-state's AP in relation to the other states in each CG. Thus the APs are highest for the most significant member-states in each CG, but the average level of the APs in each CG is determined entirely by the allocation of seats between CGs. A very similar AP distribution is generated if a logarithmic rather than power function specification is used.

An important aspect of this proposal is that the parameter x is interpretable as the parameter that controls the range of p_{ij} (Figure 4.2).

Figure 4.2 – AP Distribution for Different Choices of x



Setting $x = 0$ makes the AP of each member-state (excluding the PM) in a CG equal, though the numeric value of this AP will differ between CGs. The higher one sets x the more unequal the APs become. The principles behind functionality argue that the APs should be differentiated, implying $x > 0$. Herein I work under the assumption that $x = 0.5$. The importance of transparency of the x parameter is that any choice of parameter values in this study is open to criticism. However, the choice I present is only illustrative because the parameter x must ultimately be chosen by the member-states themselves according to their preferences between equality of representation and functionality. Most likely this would have to occur through a vote in the GA, where a proposed set of parameter values would be subject to a supermajority vote. In such circumstances, it is of great help if each parameter has a clear interpretation.

Stage Two requires the specification of an appropriate β distribution for the SC. This distribution assigns every UN member-state a value, which its BZI score will be set proportional to if it is elected to the SC. The absolute voting power (BZM) of a member-state on the SC is not a-priori determinate as it depends in a complex way on the other member-states that are also on the SC. This should not be of great importance since in reality states seem to care much more about their relative power vis-a-vis other states rather than their absolute power. Here we face the problem that there are an infinity of possible functionals that could be specified. To narrow the range of possibilities, use is again made of the concept of transparency. According to this principle, one should restrict the β distribution to one that nests the PSRR and TSSRR as special cases so that deviations from these principles can be made systematic. This suggests a simple modification of the square root distribution such as:[6]

$$\beta_i \propto \frac{\sqrt{pop_i + \delta(terr_i + gdp_i + pk_i)}}{\lambda p_{ij} + (1-\lambda)}. \qquad (1)$$

Here the PSRR corresponds to the special case $\delta = \lambda = 0$, whereas the TSSRR is given by $\delta = 0,\ \lambda = 1$. The δ parameter controls deviations from the PSRR towards reflecting the weighting variables other than population. A more complex rule would place a free parameter on each weighting variable, but that is beyond the scope of analysis here and is left as a direction for future work. The parameter λ controls the degree of distortion away from the PSRR introduced by the APs, and thus determines performance against the TSSRR. Specifically, the denominator is a linear transformation which transforms the APs to lie on the interval $[1-\lambda,1]$ where $0 \le \lambda \le 1$. If $\lambda > 0$ the APs do not distort the β distribution by their true extent. Firstly, in Figures 4.3 & 4.4 we examine, ρ and χ^2 for (1) over $\lambda \in [0,1]$ for three possible values of δ ($\delta = 0,\ 0.5,\ 1$). Since these statisitcs vary depending on the exact composition of the SC the values shown are the mean values from a test using twenty hypothetical SCs constructed to the specifications described. The standard deviations are not reported as they were highly insiginificant. The reason for the low standard deviations is that the proposal adjusts to accommodate the specific composition of the SC rather than assigning voting power arbitrarily. We can see a direct trade-off between attaining the PSSR and the TSSRR, which becomes more severe as λ increases.

[6] I also considered a function that multiplied the three weighting variables in the bracket, and a rule with summed the square roots of each individual weighting variable in the numerator. The latter was almost indistinguishable in its properties from (1), while the former quickly lead to massive inequities and was not pursued further.

Figure 4.3 – Linear Correlation with PSRR (ρ) for Three Values of δ

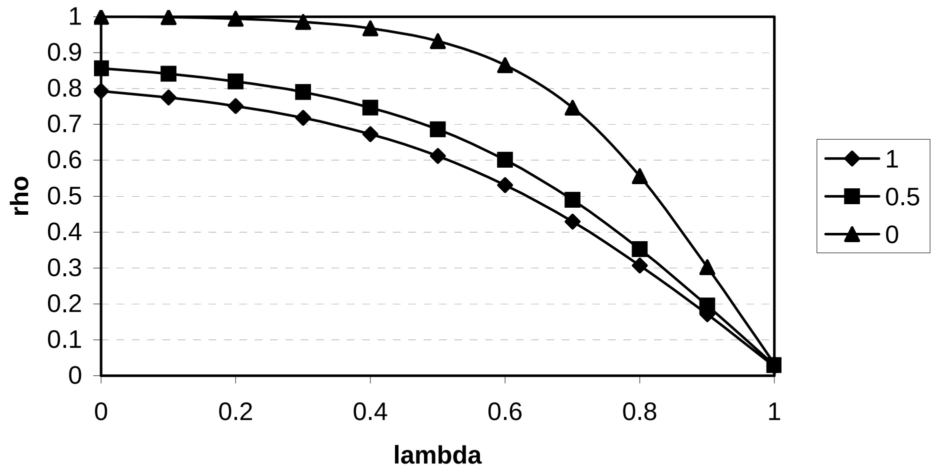
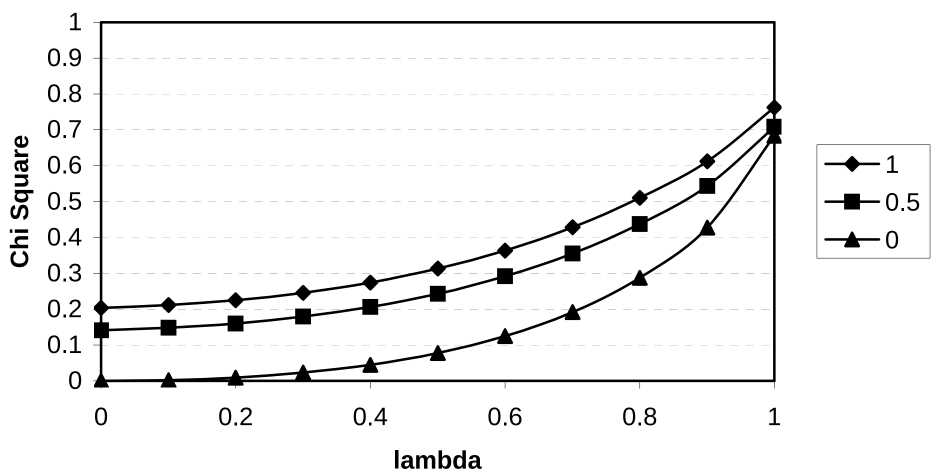


Figure 4.4 – Chi-Square Parameter Against PSRR (χ^2) for Three Values of δ



Testing against the TSSRR we obviously recover the same trade-off, but in reverse.

It has been argued that the β distribution should not in general be used as a tool to attain the TSSRR, because this compromises both functionality and the PSRR notion of equity. Instead the SC structure has been used to help attain the TSSRR, leaving the β distribution to attain the PSRR with only systematic deviations. On this basis we work herein with $\lambda = 0$, but in this particular case it would seem that the trade-off is initially sufficiently benign that any choice $0 \le \lambda \le 0.2$ would be appropriate. Again the GA could determine what is acceptable according to the weight member-states place on the PSSR, TSSRR and functionality respectively.

The second set of analysis examines how well (1) attains the PSRR as we vary the weight placed on the non-population weighting variables. That is, in Figures 4.5 & 4.6 , we examine (1) over $\delta \in [0, 2]$ for three possible values of λ ($\lambda = 0,\ 0.5,\ 1$).

Figure 4.5 - Linear Correlation with PSRR (ρ) for Three Values of λ

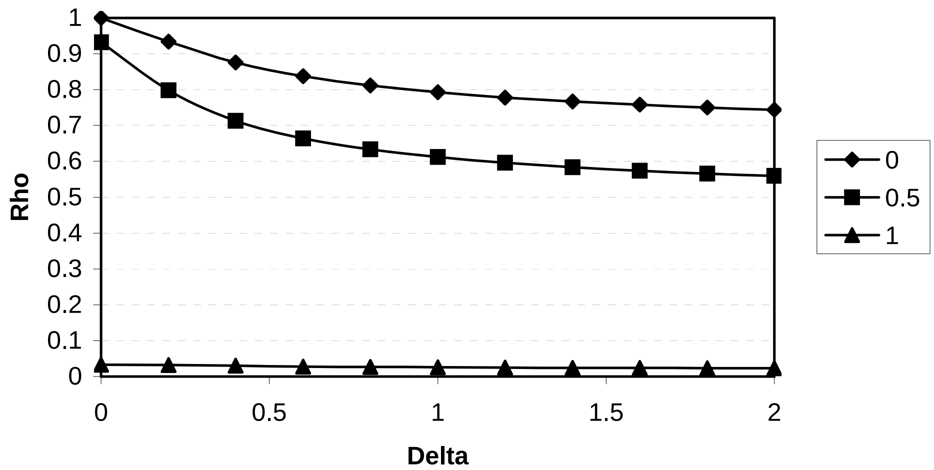
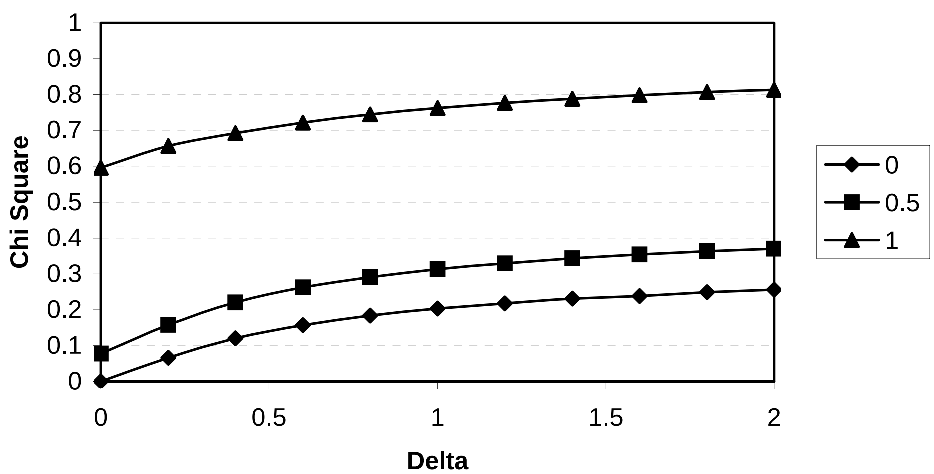


Figure 4.6 - Chi-Square Parameter Against PSRR (χ^2) for Three Values of λ



On this evidence, equity considerations can be sensitive over small values of δ but quickly become relatively insensitive. Since it has been argued that the β distribution should reflect all the weighting variables for functional purposes we should only consider $\delta > 0$. However, as the SC must also take equity seriously, δ ought to be given no higher a weighting than is population, implying $0 < \delta \le 1$. However, at this stage we leave δ's precise determination is to be made jointly with that of the quota. Theoretically speaking, it would be desirable to also set λ simultaneously with the quota. However, it is fixed here to make the analysis and its graphical presentation easier. A more extensive analysis would repeat the steps detailed below for different values of λ, and this might better inform its determination.

Stage Three of the design is to generate the voting weights that generate a β distribution proportional to (1) for each member of the proposed SC. This is done using the iterative algorithm described in Section Two. Unfortunately the task of analysing a SC game over a parameter space is immensely time consuming. This is principally because the desired voting weights are functions of the quota, so a new set of voting weights must be computed for each new quota value. This is a potentially important practical drawback to this design method. Instead of testing twenty games, ten of the sample SCs are averaged into one by ranking each member from each CG by the simple average of their (scaled) weighting variables and then averaging across each rank for each CG. The sample game then represents an 'average' SC composition. The principal drawback of this approach is that small deviations from this average SC might change our results substantially. Our experience is that the PTA and $\overline{\Sigma}$ are typically sensitive to small changes in the set of voting weights, so the matter is of some concern. Unfortunately, a systematic appraisal of these effects over many possible SC compositions must await a proper treatment.

The computed voting weights are not uninteresting in themselves. Figure 4.7 shows that China, with the highest apportioned relative voting power, sees its weight increase towards unity as the quota rises, whereas for all other members it falls towards zero (Figure 4.8 uses the USA as an example). The clear convergence on linearity beyond a given quota is a mysterious result first documented by Leech & Machover (2003).

Figure 4.7 – Voting Weight for China

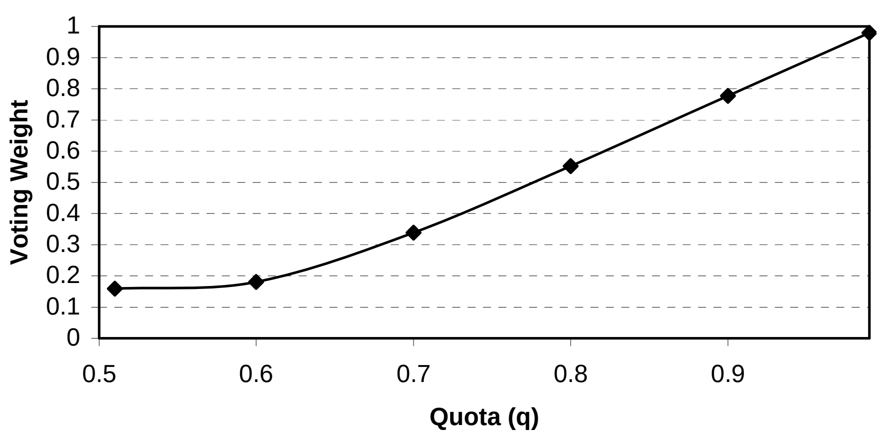
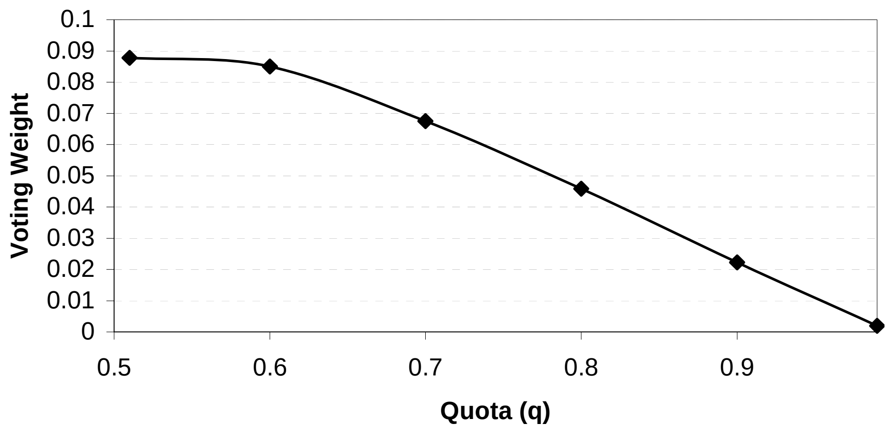


Figure 4.8 – Voting Weight for USA



Stage Four requires us to find suitable values of the quota q and δ that together generate an efficient , equitable and functional SC. If this proves impossible, it is necessary to go back and try a different β distribution. To examine the properties of (1), we computed the voting weights for the 'average' SC for different quota levels at intervals of 0.1 over the interval 0.5 to 0.9, varying δ at intervals of 0.5 on $[0,2]$. For each set of weights we then computed the PTA, $\bar{\Sigma}$ and MMD statistics(Figures 4.9-4.11).

Looking at the results for the PTA, $\bar{\Sigma}$ and the MMD(%), we can see that all are essentially telling the same story. For any level of the quota upwards of 0.6 both the PTA and $\bar{\Sigma}$ are very sensitive to small deviations on $\delta \in (0, 0.5)$, but thereafer, raising δ has negligible effects. In our opinion, setting $\delta < 0.5$ would marginalise the role of the weighting variables (excluding population) too much. On this evidence, and bearing in mind the importance that should be attached to the equity analysis, a value $\delta = 0.5$ is suggested as a reasonable compromise vlaue. Again, if the UN member-states cared more about functionality than equity they could set δ higher.

Given $\delta = 0.5$, there is an interval $q \in [0.6, 0.7]$ where a quota could be set. In this range the PTA and $\bar{\Sigma}$ are declining steeply, and the MMD is rising steeply, so it seems preferable to err on the low side. That said, we have argued that the PTA should not be set too low, since member-states demonstrate in the way they design voting systems that they put a premium on having preventative power to protect their national interests. For definiteness $q = 0.65$ is chosen. Since the appropriate quota will change from year to year, in practice the UN members could agree on a PTA and/or $\bar{\Sigma}$ threshold, and then the quota would be adjusted each year so as to attain that threshold.

Figure 4.9 – PTA Against the Quota for Five Values of δ

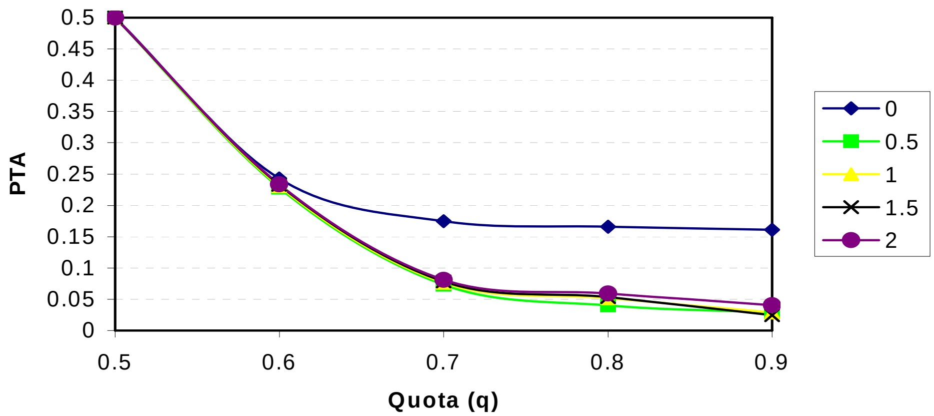


Figure 4.10 - $\bar{\Sigma}$ Against the Quota for Five Values of δ

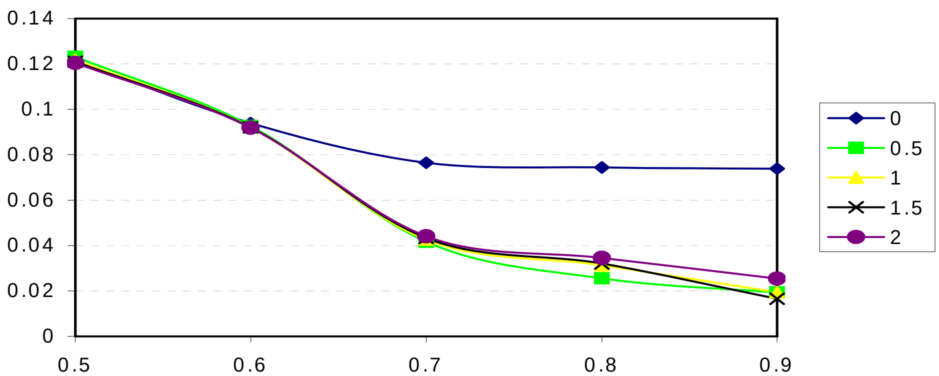
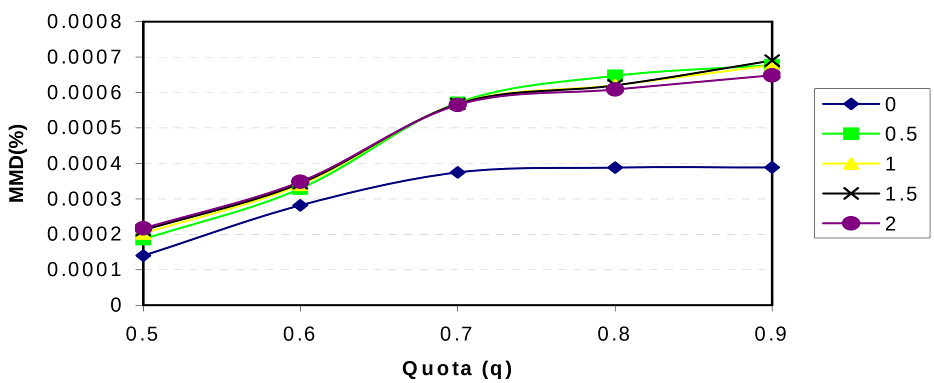


Figure 4.11 – MMD(%) Against the Quota for Five Values of δ



4.4 – Synoptic Parameters

The formal synoptic parameters for the proposal above are:

$$PTA = 0.133 \quad \bar{\Sigma} = 0.064 \quad MMD(\%) = 0.0000463$$

$$\rho = 0.855 \quad \chi^2 = 0.141 \quad \text{Max } |d|(\%) = 101.1 \quad \text{Ran (d) } (\%) = 138.7$$

$$\rho_{ts} = -0.468 \quad \chi^2_{ts} = 1.819 \quad \text{Max } |d|_{ts}(\%) = 560.3 \quad \text{Ran } (d)_{ts} (\%) = 649.5$$

$$\rho_f = 0.985$$

The PTA is some five times higher, $\bar{\Sigma}$ some three times higher, and the MMD(%) some 37% lower than in the present SC. Similarly the equity performance against the PSRR is better by all measures than any of the reform proposals considered and the present SC. Further, by design, the deviations from the PSRR are almost perfectly correlated with the weighting variables, demonstrating that no equity is being lost that is not being traded off against functionality gains. On the TSSRR the proposal is still some way off, but the individual deviations are now in the hundreds rather than the thousands of percentage points. We show in a sister paper (Rablen, 2003) that this proposal also outperforms all of the reform proposals tabled by member-states by our evaluative criteria.

Conclusion

This study has presented an analysis of the debate on SC reform using the analytical theory of a priori voting power. Using a consistent set of evaluative criteria drawn from both the economics and political science literature it has sought to identify deficiencies in the present SC voting system and develop an alternative proposal using a WVS.

The analysis of Section Three analysis suggests that the present SC, when modelled as a multi-stage composite weighted voting game, is severely deficient from all of the efficiency, equity, and functionality perspectives. It has been argued that the SC is a voting body suitable for the application of weighted voting in line with the EU Council of Ministers and the decision-making bodies of the IMF. Weighted voting allows recognition of the differences between nations with respect to the weighting variables, thus promoting functionality and attainment of the OPOV rule for each citizen of the UN member-states.

Using the principle that the SC should be as equitable as possible to all UN members without compromising its ability to function, a 25 member SC with no increase in the permanent membership has been recommended. Secondly, it is proposed that each member-state be assigned an explicit AP on the basis of its weighting variables to eradicate structural inequities in the present SC selection process and ensure that the more significant states in each CG are given more terms on the SC.

It has been shown that that by distributing relative voting power according to a simple extension of the PSRR that nests the PSRR and TSSRR as special cases, and selecting an appropriate quota, one can design a voting system that, for the 'average' SC of the proposed structure, can attain the desiderata considerably better than does the status quo. This result is taken to be a reflection both of the inherent advantages of using a fully-fledged WVS, and of taking a holistic and dispassionate approach to SC reform. Moreover, the proposal contains a number of free parameters that can be manipulated to alter the voting power distribution in accordance with the preferences of member-states; the specific parameter values chosen here need only be illustrative.
However, this study has not demonstrated optimality, for there might be other voting systems that perform unambiguously better than our proposal by the synoptic parameters.

A great many extensions to this study are possible. Firstly there is a great deal more computationally intensive research to be performed to understand the efficiency properties of the proposal over more parameters, and for a wider range of each parameter. Similarly, one would like to test over a sample of hypothetical SCs to get a more precise idea of the average efficiency performance of the proposal over different compositions of the NPMs. As suggested in the text, if one is willing to use more free parameters, a class of more complex β distributions could be studied to obtain more precise effects. Secondly, a major weakness of the study is that the voting game used to model the SC does not take into account the right of abstention, placing doubt on the meaningfulness of the results. While our intuition suggests that the qualitative findings of this study are sound, one would certainly prefer to know for sure.

On equity, the existence of a trade-off between attaining the TSSRR and the PSRR warrants further debate as to which notion is the most relevant for the SC to attain. Secondly, there is scope for equity to be examined at the level of CGs rather than individual member-states. For instance, one might want to know whether Africa as a continent has a fair relative voting power on the SC compared to other continental regions. These questions could be tackled by a simple extension of the theory of voting power to allow for bloc voting by CGs on the SC. It would also be interesting to see how changing the assumption of independent voting behaviour, and consequently using a different model of equity, would change the results.

Finally, this study has rested heavily on a priori analysis, leaving enormous scope for an explicitly empirical, or a-posteriori, analysis. As has been suggested, stable aspects of the institutional design of the SC such as the familiarity amongst the P5 may make them more powerful than a-priori analysis suggests, while empirical work on historical representation on the SC could answer the question of how inequitable the SC has been to the UN members in practice. Nevertheless, we hope this study can be of use to those actors who must make SC reform a reality.

Appendix One

The double-average rule (DAR) is used to operationalise the principle of equitable geographic distribution. The rule assigns to each CG $j = 1, . . . , v$ a score, with the representation on the SC being proportional to that score. The DAR itself is given by:

$$DA_j = \frac{\dfrac{g_j}{191} + \dfrac{1}{2}\left(\dfrac{cpop_j}{\sum_{i=1}^{v} cpop_i} + \dfrac{cterr_j}{\sum_{i=1}^{v} cterr_i} \right)}{2},$$

where g_j, $cpop_j$ and $cterr_j$ are the number of member-states, the population, and the combined territory of CG *j* respectively. The DAR assigns each CG a value that is approximately proportional to its share of the UN membership, but adjusts away from exact proportionality to reflect the fact that the average population and territory of the states in each CG are different.

Appendix Two

Ten Highest Scoring Member-States in each CG

AF	
Nigeria	46,899,296
DRO Congo	42,158,920
Algeria	41,780,117
Sudan	40,059,483
South Africa	39,796,401
Egypt	37,995,634
Ethiopia	31,545,149
Libya	23,335,342
UR Tanzania	21,025,525
Niger	17,684,571

AS	
China	665,226,353
Japan	451,150,938
India	387,502,807
Indonesia	103,188,489
Pakistan	56,210,450
Iran	51,541,107
DPR Korea	43,608,761
Bangladesh	42,534,688
Saudi Arabia	39,107,343
Kazakhstan	39,101,242

EE	
Russia	298,938,104
Poland	27,036,794
Ukraine	25,973,215
Romania	13,589,294
Hungary	9,833,371
Czech Republic	9,498,273
Belarus	7,824,173
Bulgaria	4,906,614
Serbia	4,742,557
Slovakia	4,274,418

LAC	
Brazil	194,114,359
Mexico	82,138,668
Argentina	60,353,752
Colombia	32,440,908
Peru	26,613,515
Venezuela	22,094,367
Chile	18,324,206
Bolivia	15,622,424
Ecuador	8,029,849
Paraguay	7,109,927

WEO	
USA	923,697,256
Germany	245,849,035
Canada	193,427,238
France	192,831,986
UK	171,216,536
Italy	142,485,287
Australia	136,533,638
Spain	81,515,583
Netherlands	45,301,589
Turkey	43,871,029

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