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Abstract

The United Nations Security Council (UNSC) is critical to global peace and security, yet more than twenty years of negotiations over its reform have proved fruitless. We use recent advances in the theory of a-priori voting power to present a formal quantitative appraisal of the implications for democratic equity and efficiency of the "structural reforms" contained within eleven current reform proposals, as well as the separate effect of expansion of the UNSC membership. Only two reform proposals – the EU acting as a single entity, or a weakening of the veto power for Permanent Members – robustly dominate the status quo against our measures of equity and efficiency. Several proposed structural reforms may actually worsen the issues they ostensibly claim to resolve.

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"No reform of the UN will be complete without the reform of the Security Council"

- Former Secretary-General of the United Nations Kofi Annan

1. Introduction

The United Nations (UN) is the foremost international body responsible for the maintenance of international peace and security. The UN Security Council (UNSC) is its most powerful organ, with the authority to make legally binding resolutions to fulfil its mandate of maintaining international peace and security. To that end, it can suspend economic and diplomatic relations between countries, impose blockades, and authorize the use of armed force.

Our study appraises possible reforms to the UNSC. Since its beginnings in 1946, the UNSC has undergone reforms only once: in 1963, the UN General Assembly (UNGA) – which includes delegates from all UN member countries – voted to expand the UNSC from 11 to 15 members (UNGA, 1963).[1] Momentum for a second round of reform can be traced back to 1993, when an Open-ended Working Group (OEWG) was established to explore proposals for UNSC reform.[2] This Working Group, now often dubbed the "Never-ending Working Group", has entered its 23rd consecutive year of deliberations.

Many proposals for UNSC reform have been put forward. This paper presents, to our knowledge, the first formal quantitative study of the equity and efficiency properties of these proposals. We apply new formal equity measures developed in Gould and Rablen (2016) to understand the effects of eight "structural reforms" contained within eleven reform proposals currently under consideration by world leaders. A key aspect of the implementation is a computer simulation of the UNSC under each structural reform.

Under the present arrangements, the 15 UNSC members comprise five Permanent Members (PMs) – China, France, Russia, the United Kingdom, and the United States – that are ever-present and wield a veto on all non-procedural matters. The remaining ten members are elected Non-Permanent Members (NPMs), who serve time-limited two-year terms. The ten NPM seats are divided between five regional caucusing groups: one country from Eastern Europe (EE); two countries from each of the Western European and Others Group (WEOG),

[1]The reform did not come into effect until 1965, however.

[2]In full, the Open-ended Working Group on the Question of Equitable Representation and Increase in the Membership of the Security Council (OEWG, 1994). The call for the creation of the OEWG, UNGA (1993), followed an overwhelming response to an earlier UNGA Resolution, UNGA (1992), which invited members to submit written comments on a possible review of the UNSC.

the Latin America and Caribbean Group (GRULAC – *el Grupo Latinoamericano y Caribeño*) and Asia; and three countries from Africa.[3]

Two distinct sets of criticism are widely levelled against these arrangements: one relating to the *efficiency* with which they allow the UNSC to respond to its member's preferences, and another relating to the degree to which they achieve democratic *equity* in the allocation of power. [4]

On efficiency, critics argue that the UNSC is too often impotent, not least because a preference against a resolution by a single PM can override a preference for the resolution by all remaining members. For instance, the UNSC is presently under criticism for its inability to respond decisively to the conflict in Syria. The UNSC has also appeared slow to react to earlier conflicts, notably the 1994 genocide in Rwanda (Barnett, 2002). This lack of efficiency has sometimes led countries to bypass the UNSC in favor of alternative multilateral action. This is observed in the ongoing Syrian conflict, and in previous conflicts. For instance, in 1999 NATO undertook military action in Kosovo, and in 2003 the US and its allies invaded Iraq, on both occasions lacking a UNSC mandate.

On democratic equity, it is widely acknowledged that the UNSC needs to be seen as fair and legitimate in order to effectively fulfill its mandate (Frey and Stutzer, 2006; Stutzer and Frey, 2006; Marchetti, 2008; Cowling *et al*., 2010). Critics (e.g., Russett *et al*., 1996; Hammer, 2002; Schwartzberg, 2003; Annan, 2005; Blum, 2005) raise two distinct sets of issues, one relating to equity at the *country* level, and the other relating to equity at the level of *regions*. Assessing these claims, the study of Gould and Rablen (2016) finds that, at the level of countries, the *conjunction* of preferential voting power when a member of the UNSC *and* the right to be ever-present gives the PMs substantially too much representation. There is thus a need to dilute the representation of the PMs. At the level of regions, the authors also uncover significant levels of inequity – Asia and Africa are both substantially under-represented, while EE and the WEOG are both heavily over-represented. This implies a broader representational imbalance between North (EE and the WEOG) and South (Africa, Asia and the GRULAC).

We appraise eight proposed reforms to the UNSC rules ("structural" reforms) that appear within eleven recent reform proposals. We then analyze separately the impact of expanding

[3] See Appendix 3 for the full membership of each of the regional groups (excluding PMs). Of the PMs, China is a member in Asia, Russia in EE, and France and the UK in the WEOG. Technically, the United States is not a member of any regional group, but it attends meetings of the WEOG as an observer and is considered to be a member of that group for electoral purposes (UN, 2012a). For the purposes of this paper, therefore, we give the United States membership in the WEOG.

[4] Perhaps owing to disenfranchisement with the organization, many countries fail to pay their assessed contributions: as of the end of 2011, the UN was owed $454 million by member states (UN, 2012b).

the membership of the UNSC above the current 15 members through the addition of new NPM seats. We find disappointing results for the structural reforms considered: only two of the eight improve upon the status quo in both the equity and efficiency dimensions, one leaves efficiency unchanged and improves equity, three leave efficiency unchanged but worsen equity, and one strictly worsens both equity and efficiency. Enlarging the UNSC membership does permit an improvement in equity, but is no panacea, for it comes at the price of worsened efficiency. Moreover, the equity gains from expansion display diminishing returns, while the costs in terms of lost efficiency display increasing returns.

Of the eleven reform proposals we consider (which typically bundle one or more structural reform with some degree of expansion of the membership), we again find that only two are superior to the status quo in both the equity and efficiency dimensions. We show that a simple dominance criterion ranks all but three of the eleven reform proposals (by this criterion the remaining eight reforms may be disregarded).

The most promising structural reform we consider is to require two PMs to vote against a resolution for a veto to be constituted. This reform improves both equity and efficiency, but could only be a long-term aspiration due to political constraints. Overall, we fail to see that any of the reform proposals presently under consideration will (or should) break the reform impasse.

Earlier quantitative studies of UNSC reform include Volacu (2016), Hosli *et al*. (2011), Strand and Rapkin (2011), and O'Neill (1996). In the absence of a formal theoretical framework for measuring equity in such bodies, or for addressing issues relating to region- and country-specific notions of equity, these studies describe the implications of different reforms for the ratio between the voting power of a PM relative to a NPM. Although the equitable value of this ratio is not formally discussed, increases in its value are typically taken to signify increased inequity. As equity in the UNSC is a function of *how often* countries gain membership as well as the voting rights they exercise when a member, however, approaches that focus on only one of these dimensions give only a partial view. This point is of particular relevance as several of the reforms we shall consider vary only the probabilities of UN membership, leaving voting rights unchanged. In capturing both of these dimensions, the theoretical framework of Gould and Rablen (2016) permits, for the first time, a formal quantitative assessment of the equitability of UNSC reforms for both individual countries and regions, and of how equity interacts with efficiency.

As in Gould and Rablen (2016), we allow for countries to abstain in votes in the UNSC. In contrast, the studies cited above, and many precursors in the literature (e.g., Shapley and Shubik, 1954; Straffin, 1983, 1993), model the UNSC decision rule as permitting members to

vote for or against a resolution only. As discussed in Felsenthal and Machover (1997) and Freixas and Zwicker (2003), however, the UNSC decision rule cannot be faithfully represented in this way. The difficulty is that the UN Charter states that decisions over non-procedural matters are made by an affirmative vote of nine or more UNSC members, including the *concurring* votes of the PMs. A "concurring" vote has come to be understood, in practice, as either an affirmative vote or an abstention (see, e.g., Blum, 2005: 636), so a negative vote by a PM is distinct from an abstention.

Last, in analyzing reform of the UNSC, this paper contributes to a wider literature that uses measures of a-priori voting power to appraise reform options for international voting bodies. Examples include Felsenthal and Machover (2001, 2004, 2007) and Leech (2002a), who analyze reform of the Council of the European Union; Manno (1966), Newcombe, Wert and Newcombe (1971), and Dixon (1983), who analyze reform of the UNGA; and Leech (2002b), Leech and Leech (2013), and Rapkin and Strand (2006), who analyze reform of the IMF Executive Board.

The plan of the paper is as follows: Section 2 sets out the theoretical framework; Section 3 outlines the structural reforms contained in the reform proposals of UN members; Section 4 details the simulation analysis; Section 5 presents the results; and Section 6 concludes.

2. Equity and Efficiency in the UNSC

The UNSC in its current form (and under the structural reforms we consider) may be represented as a Council Voting Game (CVG), as proposed by Gould and Rablen (2016). In a CVG, an "assembly" assigns (by election or otherwise) a time-varying subset of its members to a "council". For the purposes of this paper the assembly should be interpreted as the United Nations General Assembly (UNGA), the main deliberative body of the UN containing all 193 of its members, and the council should be interpreted as the UNSC. We partition the UNGA into regional groups R_j, and we denote by a_{ij} the i^{th} country of region j. We allow for the (reformed) UNSC to have different membership categories, indexed by k. To encompass the various reform proposals, we distinguish membership categories by, for instance, the way in which membership is attained (by Charter – as applies to the category of PM – or by election), the length of term, the provision for immediate re-election, and voting rights.

2.1 Equity in the UNSC

We model democratic equity according to the approach developed in Gould and Rablen (2016). We therefore only sketch the approach here, and refer the interested reader to Gould and Rablen (2016) for further details.

Equity concepts

Our basic normative notion of democratic equity is that, from behind a veil of ignorance as to what a citizen's preference is, and to which country or region they belong, a citizen should be equally able to influence outcomes in the UNSC. This criterion is referred to in Gould and Rablen as the "equalization of voting power" criterion (for brevity, the EVP criterion). Crucially, we require that the EVP criterion hold *before* the assignment of countries to the UNSC occurs. That is, we require that expected voting power (before it is known which countries will vote in the UNSC) be equal across citizens. This notion of equity acknowledges that the democratic power of a world citizen in the UNSC depends not only on the voting rights of his or her country when it is a member of the UNSC, but also on *how frequently* his or her country is a UNSC member.

A strong interpretation of the EVP criterion requires it to hold for each and every resolution. This implies, for instance, that a country with a lower assignment probability in a given year must, by way of compensation, receive more voting power on the UNSC if it is assigned. We, however, employ the so-called weak form of the EVP criterion, which allows for deviations from the EVP criterion in any one ballot, so long as deviations offset across an infinite sequence of ballots. Intuitively, the weak form permits inter-temporal shifting of allocation probability and voting rights: a country with, e.g., a lower *average* assignment probability must be compensated for longer expected spells outside the UNSC by the exercise of greater voting power when a UNSC member.

The democratic decision-making process

To measure the proximity of the UNSC under each reform to the EVP criterion we embed the UNSC into a stylized democratic decision-making process that maps the preferences of citizens to UNSC decisions. To analyze differing notions of country-level equity (CE) and region-level equity (RE) we introduce two such decision-making processes: the "country" process (CDP) and the "region" process (RDP). Under the CDP countries on the UNSC are assumed a priori to represent only their national population, allowing us to investigate equity at the country level. Under the region process (RDP) countries are assumed a-priori to act on the UNSC as regional representatives, permitting us to investigate equity at the level of regions.

For a given resolution, the CDP comprises three stages. In Stage 1, a *national* ballot is held in each country. In Stage 2 a subset of countries is (randomly) assigned to the UNSC from each region. In Stage 3, the UNSC members vote in the UNSC according to the outcome of their national ballot in Stage 1. In contrast, in the RDP, a single *regional* ballot is held in each region in Stage 1. In Stage 2 a subset of countries is assigned to the UNSC from each region.

In Stage 3, the UNSC members vote as regional blocs on the UNSC, each bloc voting according to the outcome of the regional ballot in Stage 1.[5]

The rules of the national (regional) ballot in Stage 1 under the CDP (RDP) are as follows. Citizens may vote either {for, abstain, against} and the outcome space is {mandate to vote "for" on the UNSC (mandate for), no mandate, mandate to vote "against" on the UNSC (mandate against)}. In the event that "no mandate" obtains, the country (or regional bloc under the RDP) is assumed to abstain in the UNSC.

Following Gould and Rablen (2016) we employ a majority threshold rule of the following form: for "mandate for" to obtain, (i) more citizens must vote "for" than vote "against"; and (ii) at least a proportion $\tau \in [0,1]$ of all eligible voters must vote "for". For "mandate against" to obtain, (i) more citizens must vote "against" than vote "for"; and (ii) at least a proportion τ of all eligible voters must vote "against". In all other eventualities, "no mandate" obtains. We follow Gould and Rablen (2016) in choosing the value of the threshold parameter to be $\tau = ⅓$.

The stochastic process that assigns UNGA members to the UNSC in Stage 2 is termed the *assignment process*. For every year t, the assignment process induces a probability p_{ijkt} that country a_{ij} is assigned to the UNSC in membership category k. The *average* assignment probability of country a_{ij} on an infinite set of years $t \in T$ is given by $\bar{p}_{ij} = \mathbf{E}_{T,k}(p_{ijk})$.

2.2 Equity concepts – a formalisation

We denote the population of country a_{ij} as $q_{ij} \in \mathbb{N}$, and the population of region j as $q_j = \sum_{a_{ij} \in R_j} q_{ij}$. Let the absolute voting power of country a_{ij} under the CDP, if assigned to the UNSC, be signified by β_{ij}.[6] The absolute voting power of region j under the RDP we denote by β_j. We measure absolute voting power in the Stage 1 vote with the "Banzhaf measure for (j,k) simple voting games" given in Definition 3.4 of Freixas (2005).[7]

Under the assumption – termed uncorrelated preferences (UC) – that every world citizen votes independently, and is equally likely to vote for each of the given voting possibilities,

[5] As, in the context of region equity, we are specifically interested in understanding the representation of regions as cohesive entities it is appropriate in this context to disregard the possibility – which might be very real in practice – that countries assigned to the UNSC in Stage 2 of the RDP might break ranks and vote according to the preference of their own citizens rather than according to the outcome of the regional ballot. This point underscores the need to understand both country and region concepts of equity.

[6] The existing UNSC and the reforms to it we consider may all be analyzed without requiring country voting power to be time-variant.

[7] This measure assumes that each voting possibility is chosen with equal probability, which (as we shall subsequently comment on) transpires not to apply to the Stage 3 vote. In Stage 3 we instead we employ the "generalized Bz measure" of Lindner (2008), which allows for the (common) probability of voting "for" or "against" to differ from the probability of voting "abstain". Lindner's measure collapses to that of Freixas when every voting possibility is assigned the same probability.

Gould and Rablen (2016) prove that, for CE and RE to obtain, the following conditions must hold:[8]

$$\text{CE: } \frac{\bar{p}_{ij}\beta_{ij}}{\sqrt{q_{ij}}} \text{ is constant for all } a_{ij};$$

$$\text{RE: } \frac{\beta_j}{\sqrt{q_j}} \text{ is constant for all } R_j.$$

The condition for CE may be thought of as a probability-augmented version of Penrose's (1946) square-root rule: rather than requiring voting power when a UNSC member, β_{ij}, to be inversely proportional to $\sqrt{q_j}$, it instead requires that *expected* voting power, $\bar{p}_{ij}\beta_{ij}$, have this property. Unlike for countries, when considering region equity the assignment probabilities play no role as each region is always represented on the UNSC, and the identities of the countries that form the regional bloc are immaterial.

Under UC preferences Gould and Rablen compute that countries will vote "for" and "against" in the UNSC with an equal probability, given by 5/12 ≈ 0.42. The probability that the Stage 1 vote results in the "no mandate" outcome, leading a country to abstain in the UNSC, is therefore 1/6 ≈ 0.17. Thus, as seems realistic, abstention is chosen less often than either of the remaining voting possibilities. Under the RDP, regional blocs vote according to these same probabilities.

2.3 Measuring Deviations from Equitability

We wish to measure, in an objective sense, the proximity of the UNSC (under different reforms) to our two equity concepts. Accordingly, we adopt the metric $d(\mathbf{X},\mathbf{Y}) = \frac{1}{2}\sum|X_i - Y_i|$, where $\mathbf{X}$ and $\mathbf{Y}$ are unit-vectors, which corresponds to the widely-used *index of distortion*, commonly attributed to Loosemore and Hanby (1971). We then define proximity measures on the unit interval (where unity indicates maximal proximity, and zero the minimum possible proximity) for our two equity concepts as

$$||CE|| = 1 - d(\boldsymbol{v}^{CE}, \boldsymbol{\lambda}); \qquad ||RE|| = 1 - d(\boldsymbol{v}^{RE}, \boldsymbol{\lambda});$$

[8] The assumption of UC preferences is not to be understood as denying the possibility of preference correlation, but instead harks to Bernoulli's Principle of Insufficient Reason (BPIR), according to which voting alternatives should be assigned equal epistemic probabilities if there is no known reason for assigning unequal ones (see, e.g., Felsenthal and Machover, 1997, 2003). Indeed, were preferences actually uncorrelated within countries and regions, then these concepts would be almost arbitrary and we would not witness the fierce debates over regional and national representation that we indeed observe in the UNSC reform debate. For an extension of the framework given here to cases in which BPIR is not assumed see Gould and Rablen (2016).

where $\boldsymbol{v}^{CE}$ is the scaled 193 × 1 unit vector of the $\bar{p}_{ij}\beta_{ij}/\sqrt{q_{ij}}$, $\boldsymbol{v}^{RE}$ is the scaled 193 × 1 unit vector of the $\beta_j/\sqrt{q_j}$, and $\boldsymbol{\lambda}$ is the 193 × 1 unit vector of the constant 1/193.

2.4.1 A composite measure

It is helpful for the purposes of comparison between reforms to have a single composite measure of equity. To present our main results we utilize a weighted measure of the form

$$E = \phi_{\text{CE}}||CE|| + \phi_{\text{RE}}||RE||,$$

where ϕ_i is the preference weight assigned to equity concept *i*, with $\sum_i \phi_i = 1$. If the preference weights over country and regional equity of world-leaders were known, we would clearly utilize these. As, however, these are not known, we weight these concepts equally to reflect this Bernoullian uncertainty: $\phi_{\text{CE}} = \phi_{\text{RE}} = ½$. We shall, however, discuss the qualitative changes to our main findings if these weights are made unequal.

2.4 Efficiency

Following Felsenthal and Machover (2007, 2009), we take the efficiency of a voting body to refer to the efficiency with which its decision rule responds to the preferences of world citizens. The more difficult, a-priori, it is for a resolution to pass, the lower the efficiency of the decision rule.[9]

Our formal measure of efficiency is based on the "power of a collectivity to act" (*PTA*) of Coleman (1971), which is the a-priori probability of a resolution being approved rather than blocked. Coleman defined his *PTA* measure only for voting games with two voting alternatives, i.e., {for, against}, however. As we also allow for countries to abstain in the UNSC we employ the ternary extension of Coleman's *PTA*, which is given in Freixas (2012) as $PTA = \omega/3^N$, where ω is the is the number of divisions of the *N* UNSC members for which a resolution is passed.[10] As our equity measures are scaled to the unit interval, but *PTA* lies on the interval (0, ½), we report 2*PTA* as our measure of efficiency.[11]

3. Proposed UNSC Reforms

Since the 1990s many different proposals for a second reform of the UNSC have been

[9] Felsenthal and Machover (2007, 2009) consider two further measures of efficiency: the absolute and relative sensitivity indices. As these typically correlate highly with *PTA*, however, we consider this measure only.

[10] For a good introduction to *PTA*, and its relationship to the Banzhaf index, see Leech (2002c).

[11] The minimum and maximum possible values of *PTA* in a proper game when there are *N* voters are $PTA_{\min} = 3^{-N}$ and $PTA_{\max} = ½\{1 - 3^{-N}\sum_{i=0}^{\lfloor 2^{-1}N \rfloor} N!(i!)^{-1}((N-i)!)^{-1}\}$. $PTA_{\min}$, which converges to zero with *N*, is attained under the unanimity decision rule in which, for a resolution to pass, all members must vote in favor. $PTA_{\max}$, which converges to ½ with *N*, is attained under the simple majority decision rule in which the simple majority is taken over all members that do not abstain.

made.[12] A difficulty, however, with taking these reform proposals themselves as the unit of analysis is that most bundle changes to the UNSC's rules (what we term "structural" reforms) with expansion of the UNSC membership.[13] Analysis of reform proposals is, therefore, unable to isolate the effects due to the structural reform component from those due to expansion.

A more informative approach – one which allows us to disentangle the effects of the structural reforms separate from the effects of expansion – is to take individual structural reforms as the unit of analysis. Accordingly, we analyze eight structural reforms (Appendix 1) contained within eleven reform proposals put forward by various actors within the UN (Appendix 2).[14] While we shall discuss each of these structural reforms below, note that – to eliminate any effects due to expansion – each structural reform in Appendix 1 holds the size of the UNSC constant.

The earliest proposal for structural reform we consider is the creation of a new membership category that gives permanent membership of the UNSC, but not the right of veto (Permanent Non-Veto Member – PNVM). The "*2+3*" reform proposal, which, according to Davis (2010: 23), was put forward in 1995 by the Non-Aligned Movement (NAM), was one of the first to embrace the *PNVM* structural reform.[15] The creation of a PNVM category is also the only structural reform in the reform proposal, *G4*, of the "Group of Four" (G4), comprised of Brazil, Germany, India and Japan (G4, 2006); and the 1997 reform proposal of Ismail Razali (*Razali*), then Chair of the OEWG (OEWG, 1997).

Nearly all governments wish to abolish or limit the right of veto, which is viewed as an unfair and anachronistic legacy of the Second World War (Fassbender, 2004; Schwartzberg, 2003). It is widely believed, however, that the five PMs would resist any such change (Weiss and Young, 2005). The position of the African Union (AU) is, therefore, that although it opposes the right of veto, if some countries are to have the right of veto, then this right must be extended. Accordingly, the *AU* reform proposal (AU, 2005) has as its structural reform the

[12] See, e.g., Hassler (2013), Cox (2009) and von Freiesleben (2008) for recent qualitative reviews of these reform proposals.

[13] The UNSC has not increased in size in line with the growth in UN membership: the ratio of UNSC members to UN members has gone from 13.5 per cent in 1966, to only 7.8 per cent in 2012. Accordingly, there is widespread agreement on the need to expand the membership of the UNSC (although by what degree is hotly disputed).

[14] We focus on the structural reforms associated with reform proposals that are sufficiently concrete to be simulated. This rules out some recent, but vague, reform proposals such as those found in OEWG (2008) and in UfC (2010), and the two NAM reform proposals discussed in Weiss (2005: 18). We also ignore a number of structural reforms associated with UNSC reform proposals made by academics, notably Model C (Hoffmann and Ariyoruk, 2005), Model X (Hoffmann, 2006), the REP proposal of Hartwig (2008), and the reform proposals found in Russett, O'Neill and Sutterlin (1996), Schwartzberg (2003) and Strand and Rapkin (2011). We do this as, so far as we know, none of these reform proposals is under detailed consideration by UN members.

[15] For more on the origins of this reform proposal, see Fassbender (2004: 346) and Bourantonis (2005: 49).

extension of the right of veto to eleven UNSC members (*Veto+*). As a fallback position, the AU has joined with several other states (Italy, Mongolia, Singapore and Tunisia), to advocate particular structural reforms aimed at weakening the right of veto. In particular, we analyze the Weak Veto reform proposal, (*WV*), which contains as its structural reform that at least two PMs must vote against a resolution for it to necessarily fail (*Veto–*).[16]

A further structural reform we consider is the redefining of the existing regional groups (*Regional Redefinition – RR*). In 2003, the then UN Secretary-General set up the High-Level Panel on Threats, Challenges and Change (HLP). The Panel's report (HLP, 2004) contains two different reform proposals – HLP_A and HLP_B – each incorporating a modified set of regions. While HLP_A additionally allows for PNVMs, HLP_B instead features two new structural reforms. First, it calls for a new category of long-term NPM seat (*Term+*) with a four-year term. Second, it proposes that the long-term NPM membership category allow immediate re-election (*Renew*) – at present, NPMs must allow one year before seeking re-election. Allowing renewable membership is also the principal structural reform in the reform proposal of the Uniting for Consensus (UfC) group headed by Italy, denoted *UfC* (UfC, 2005). In 2007 Panama put forward a reform proposal (*Panama*) that also allows for renewable membership, but with the twist that any member elected to the UNSC for four consecutive terms would acquire PNVM status (Panama, 2007).

We consider two further structural reforms, each associated with Italy (which plays an especially active role in the UNSC reform debate). In Italy (2005) it published a reform proposal (*Italy*) that, as its structural reform, creates a new category of seat that rotates among the members of each regional group (*Rotate*). A more radical structural reform – regional members (*RM*) – is to create a category of seat held by a region, rather than by any individual country. In this vein, Italy has advocated the creation of a permanent European Union (EU) seat on the UNSC, endowed with the right of veto (the *EU* reform proposal).[17] In April 2011 this idea received the backing of the European Parliament, which passed a resolution stating that "...a seat in an enlarged UNSC remains a central, long-term goal of the European Union" (European Parliament, 2011).[18]

Last, as in any appraisal exercise, we consider the "do nothing" structural reform, named *Present*. The reform proposal associated with *Present* we refer to as *Status quo*.

[16] Fassbender (2004: 351) and Wouters and Ruys (2005: 22) discuss further the origins of this reform proposal.
[17] See, e.g., Kirkup (2009).
[18] The EU already enjoys observer status in the UNGA under Resolution A/65/L.64/Rev.1 (UNGA, 2011). As an observer the EU has the right to speak at UNGA meetings and to present proposals agreed by EU members, but not the right to vote on resolutions and other substantive matters. Note that our specification of the *EU* reform proposal assumes that the veto for the EU replaces the separate vetoes presently wielded by France and the UK. It is unclear whether this is also envisaged by the European Parliament, or whether it seeks an EU seat in addition to the France and the UK retaining their existing PM status.

A summary of the structural reforms and their associated reform proposals is given in Table 1:

Structural Reform	Associated Reform Proposals
PNVM seats (*PNVM*)	*2+3*, *G4*, *HLP$_A$*, *Panama*, *Razali*
Renewable seats (*Renew*)	*HLP$_B$*, *Panama*, *UfC*
Regional members (*RM*)	*EU*
Regional rotating seats (*Rotate*)	*Italy*
Region re-allocation (*RR*)	*HLP$_A$*, *HLP$_B$*
Increase term length (*Term+*)	*HLP$_B$*, *Panama*
Expand right of veto (*Veto+*)	*AU*
Weaken right of veto (*Veto–*)	*WV*
Do nothing (*Present*)	*Status quo*

Table 1: Structural reforms and associated reform proposals

4. Simulation

To measure proximity to CE requires estimates of the $\bar{p}_{ij}$ under each structural reform. We obtain these estimates through computer simulation of the UNSC assignment process (under each structural reform, and at each degree of expansion) over 100,000 simulated years. In this section we detail our implementation of this simulation exercise.

We model the UNSC assignment process for all members excluding the PMs (for whom $\bar{p}_{ij}$ = 1) by first giving each country a probability, $\rho_{ij} \in [0,1]$ (where $\sum_{a_{ij} \in R_j} \rho_{ij} = 1$), with which it will be assigned to the UNSC if (i) it competes with all other members of its region; and (ii) only a single seat is being assigned.

We construct empirical estimates of the ρ_{ij} from the analysis of Dreher *et al*. (2014), which estimates empirically the determinants of election to the UNSC as a NPM, accounting for the two-stage process by which such members presently are elected.[19] These authors show that three country characteristics systematically predict UNSC election: population, gross national income per capita, and waiting time since last serving on the UNSC. The estimated coefficients for these three variables are used in a straightforward way to compute estimates of the ρ_{ij}.[20] The resulting estimates are shown in Appendix 4.

[19] In the first stage, the regions make nominations to the UNGA and, in the second stage, the UNGA votes. See Dreher *et al*. (2014) for a detailed account of the UNSC election process.

[20] Because the Dreher *et al*. dataset ends in 2006, we obtain estimates of country populations and gross national incomes per capita (current USD) for 2012 from the CIA World Factbook (see https://www.cia.gov/library/publications/the-world-factbook/index.html#). We update Dreher *et al*.'s variable measuring waiting time since last serving on the UNSC to 2012 using historical membership data from the UNSC Web site (http://www.un.org/Docs/sc). To produce the estimates in Table 1, these data, along with the coefficient values for population, gross national income per capita, and waiting time since last serving on the UNSC reported in their Table 3a, are fed into their equation (5), where we assume that the sum in the

The precise details of the simulation model that our empirical estimates of the ρ_{ij} are fed into to yield estimates of the $\bar{p}_{ij}$ will not be of interest to all readers, so these are relegated to Appendix 3. The set of $\bar{p}_{ij}$ we obtain in this way are given in Appendix 4.

4.1 Structural reforms and expansion

We would like to identify the effects of each structural reform, *s*, in isolation of the effects of expansion. We therefore create the CVG C_s associated with each structural reform *s*. For example, C_{PNVM}, is created from $C_{Present}$ by reducing by one the number of NPM seats for Africa, Asia, GRULAC and the WEOG in the present UNSC, and adding one new PNVM seat for each of these regions. To then observe separately the effects of expansion, we increase the size of the UNSC under each structural reform by adding new NPM seats one-by-one until $N = 30$.[21] We are obliged to specify how each additional seat is assigned to a region. As the response of our measures varies greatly depending upon this factor, if additional seats are assigned to regions according to a deterministic pattern, this introduces a cyclical form of noise into our results that obscures almost entirely the underlying trend. To uncover the trend, therefore, we assign each new seat to a region in a probabilistic manner (in a manner we explain precisely in Appendix 3). Accordingly, we split the 100,000 simulated elections performed across different partitions of seats to regions. Our reported results are the average values given by this process. [22]

4.2 Voting power and decision rule

At present, the UNSC decision rule requires, as a necessary condition, that nine of 15 members, i.e., 60 percent, vote in favor of a resolution for it to pass. Although it is conceivable that this 60 percent threshold might be altered as part of a reform of the UNSC, the benchmark analysis is performed here under the assumption that the 60 percent threshold remains unchanged. We shall, however, comment on the implications of allowing this threshold to change.

As the UNSC is expanded above 15, however, it is only possible to retain exactly the ratio 9/15 = 0.6 when *N*, the number of UNSC members, is divisible by five. One option, when *N* is not divisible by five, is to set the threshold number of members required for a decision to

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denominator is over all countries in the region (i.e., their "E_{jt}" – the set of countries competing for the seat – is assumed to be R_{jt}).

[21] We do not analyse the cases $N > 30$ as there is broad agreement among UN members that, in order to be able to perform its role effectively, the UNSC must have a limited number of members (e.g., Zifcak, 2006). The largest UNSC expansion advocated in the reform proposals we consider is 11 new members (*AU*), bringing total membership to $N = 26$ countries.

[22] Precisely, we realize marginally more than 100,000 periods, but discard the very earliest periods. This is necessary as we begin with a UNSC containing just the PMs (with the remaining seats vacant). Hence, it requires a number of years before the elected UNSC becomes filled with members. The number of initial years we discard corresponds to twice the maximum term length.

pass, Q_N, such that the fraction Q_N/N is made as close as possible to 0.6. This, however, again introduces noise into the results that obscures the underlying trend. Instead we adopt a probabilistic approach that sets the threshold to the closest integer values either side of $0.6N$ in such a way that the mean value of the threshold is $0.6N$. Specifically, if $0.6N$ is an integer then $Q_N = 0.6N$; otherwise $Q_N = \lfloor 0.6N \rfloor$ with probability $\lceil 0.6N \rceil - 0.6N$, and $Q_N = \lceil 0.6N \rceil$ with probability $0.6N - \lfloor 0.6N \rfloor$. Again, our reported results are averages over 100,000 iterations of this probabilistic process at each degree of expansion. With the threshold thus specified, we compute the absolute voting power of each category of UNSC membership using the method of generating functions (see, e.g., Freixas, 2012).

5. Results

Our main results are shown in Figure 1. On the horizontal axis is our composite equity measure *E*, and on the vertical axis is our efficiency measure *2PTA*. As, however, *2PTA* becomes very close to zero as the UNSC is expanded, we show the logarithm of *2PTA* for visual ease.

The left-most point of each line in Figure 1 records the equity and efficiency of the unexpanded (15-member) UNSC under each structural reform. As we then incrementally expand the membership of the UNSC, one member at a time, we form the locus of points given by each line in Figure 1. Thus, the right-most point of each line corresponds to the maximally expanded UNSC with 15 additional members (30 members in total). Comparison of the left-most points of each expansion line therefore reveals the pure effect of each structural reform separate from the effects of expansion. Comparison of the lines away from the left-most point reveals the separate effect of expansion of the UNSC under each structural reform.

The equity and efficiency measures for each UNSC reform proposal appear in Figure 1 as a point estimate, marked "×".[23] To help interpret the findings in Figure 1 we show separately, in Figure 2, the two components of our summary equity measure (CE and RE) under each structural reform.

5.1 Structural reforms

We begin with an appraisal of each structural reform (with no expansion). We say that

[23] Note that, in Figure 1, not all reform proposals lie on a line associated with a structural reform. There are two reasons for this. Most straightforwardly, some reform proposals combine more than one structural reform, and therefore appear somewhere between the relevant lines. A second reason is that some reform proposals have expansion proportions (in terms of the proportion of new NPM seats that are allocated to each region) that are different from the "optimal" proportions we employ in the simulation (see Appendix 3).

structural reform *i* "dominates" *j* if it holds that $2PTA_i > 2PTA_j$ and $E_i > E_j$, and that structural reform *i* "weakly dominates" *j* if one or both of these inequalities is weak. In Figure 1 we shade the space that is dominated by *Present* (the "south-west" corner), and the space that dominates *Present* (the "north-east" corner).

We see in Figure 1 that one structural reform, *Veto+* (under which six existing NPM seats are replaced by six new PM seats), is strictly dominated by *Present*. The effect of *Veto+* upon efficiency is deleterious: it reduces the a-priori probability of a resolution being approved from one per cent at present to just 0.2 per cent. *Veto+* also leads to a fall in overall equity: Figure 2 shows that RE is improved, but CE is worsened. The improvement in RE arises as *Veto+* gives four of its six new vetoes to countries from the under-represented regions of Africa and Asia. The worsening against CE, which transpires to be the dominant effect, arises as *Veto+* concentrates (rather than dilutes) expected voting power in the hands of the (expanded) set of PMs.

A further four structural reforms are weakly dominated by *Present*: these are *PNVM*, *Renew*, *Rotate and Term+*. Each of these four structural reforms have in common that they affect only the probabilities of assignment to the UNSC, leaving voting rights unchanged. It follows that each of these structural reforms leaves the efficiency of the UNSC unchanged, and also leave its regional equity unchanged: only country equity is affected. The worst of these four structural reforms (i.e., the one weakly dominated by the remaining three) is seen to be *PNVM*, under which four NPM seats are converted into PNVM seats. The reform is associated with a marked worsening of CE as it concentrates (when it would ideally dilute) the distribution of expected voting power across countries.

The second-worst of the four structural reforms that are weakly dominated by *Present* is *Rotate*, under which NPM seats are replaced with seats that rotate within region. *Rotate* worsens CE as it as does not shift expected voting power away from the PMs to the remainder of the UN membership (as would be desirable), but instead re-allocates (equalizes) expected voting power within those remaining members. This equalization of expected voting power is counter-productive, however, for under CE more populous countries warrant greater expected voting power than less populous countries.

The next worst structural reform weakly dominated by *Present* – *Renew* – allows re-election as a NPM. Again, *Renew* alters only proximity to the CE concept. The worsening against this concept arises as permitting re-election benefits disproportionately those countries that gain election more often, but Gould and Rablen (2016) show that such countries already receive at least their equitable level of expected voting power. Accordingly, those countries with higher allocation probabilities become over-represented, thereby exacerbating the under-

representation of the remaining countries.

The final structural reform in this group of four is *Term+*, under which some NPM seats would have extended eight-year terms. As may be seen in Figures 1 and 2, although the structural reform worsens CE, the effect is only marginal: to a good first approximation *Term+* has simply no effect at all.

One structural reform does succeed in weakly dominating *Present*: *RR*. Under *RR* the five existing regional groupings would reduce to four. This is the fifth and final structural reform that leaves voting rights unchanged. Accordingly, efficiency and RE are unchanged, but now we observe an improvement in CE. This improvement arises as *RR* disperses some of the excess representation of the WEOG by moving the United States and Canada into the Americas group, and countries such as Australia and New Zealand into the Asia and Pacific group.

RM, under which all EU members act as a single PM, is one of only two structural reforms that dominate *Present*. By reducing the number of actors that wield the right of veto from five at present to four (for the UK and France would no longer exercise separate vetoes) *RM* improves efficiency: it increases the a-priori probability of a resolution being approved from one percent at present to nearly 1.7 percent. Although it marginally worsens proximity to RE (Figure 2b), *RM* leads to an overall improvement in equity, for – by reducing the number of PMs – it substantially dilutes the distribution of expected voting power.

The only other structural reform to dominate *Present* is *Veto–*. Under *Veto–* two PMs would need to vote against a resolution for this to constitute an automatic veto. By reducing the blocking power of each PM, *Veto–* increases the a-priori probability of a resolution being approved to 2.21 per cent. The improvement in equity is attributable to discernible improvements in both CE and RE. The former effect arises as *Veto–* succeeds in diluting the share of expected voting power held by the PMs (through reducing their voting power); the latter arises as the over-representation of EE and the WEOG is eased.

In summary, the types of structural reform under consideration yield always modest, and often negative, improvements in equity and efficiency.

5.2 Expansion

We now consider the effects of expanding the UNSC membership under each structural reform. We say that structural reform i "expansion-dominates" j if it holds that $2PTA_i > 2PTA_j$ and $E_i > E_j$ for all expansions $x = 0,1,\ldots,15$.

The effects of UNSC expansion are seen in Figure 1 to be qualitatively similar under each of the different structural reforms: expansion improves equity, but worsens efficiency. Figure 1

indicates that equity is increasing, but at a decreasing rate, in the size of the UNSC. There are, thus, diminishing equity returns to expansion. Efficiency, however, is decreasing, and at an increasing rate, in the size of the UNSC. *Thus, incremental expansions of the UNSC generate increasingly large efficiency losses, and increasingly small equity gains.* In spite of these qualitative similarities, we do see some important quantitative differences in the way expansion interacts with each structural reform, however, as we shall discuss below.

One structural reform expansion-dominates all the others: *Veto–*. In this sense, this structural reform wins out among those we consider. Alongside *Veto–*, two other structural reforms at least weakly dominate Present at each expansion, *RR* and *RM*.

Of the four structural reforms that are dominated by *Present* in the unexpanded UNSC, three (*PNVM*, *Renew* and *Term+*) are so dominated at every expansion. Note in Figure 1, however, that we observe a crossing in the lines for the *Present* and *Rotate* structural reforms, indicating that the latter structural reform is associated with stronger equity benefits from expansion.

The other remarkable feature of the expansion lines in Figure 1 regards *Veto+*, which goes from being the least equitable structural reform in the unexpanded UNSC to being the second most equitable structural reform in the maximally expanded UNSC. This arises as each increase in the number of NPMs incrementally lowers the voting power of the PMs, thereby improving proximity to CE. *Veto+* benefits especially from this effect due to the large number of PMs (i.e., eleven) present under this structural reform.

5.3 Reform proposals

Last, we consider our results for the reform proposals. Recall that these proposals typically combine expansion of the UNSC with one or more structural reforms (as specified in Appendix 2); and that each is represented by an "×" in Figure 1. We say that a reform proposal *i* "dominates" *j* if $2PTA_i > 2PTA_j$ and $E_i > E_j$.[24]

Only two reform proposals dominate *Status quo*: these are *WV* and *EU*. Under *WV* two PMs must vote against a resolution for this to constitute a veto. Figure 1 shows that it is possible to augment *WV* with a significant expansion of the UNSC membership (by as many as 13 members) while remaining in the region that dominates *Status quo* (shaded grey in Figure 1).

[24] Note that, in Figure 1, not all reform proposals lie on the expansion line of a particular structural reform. There are two reasons for this. Most straightforwardly, some reform proposals combine more than one structural reform, and therefore appear somewhere between the relevant expansion lines. Alternatively, a second reason is that some reform proposals imply expansion proportions (in terms of the proportion of new NPM seats that are allocated to each region) that are different from the "optimal" proportions we employ in the simulation (see Appendix 3). Note also that the *EU* reform proposal in Appendix 2 reduces the size of the UNSC to $N = 14$ as France and the UK are no longer separate members. The *RM* structural reform in Appendix 1 adds back this lost member to retain the size of the UNSC at $N = 15$. The *EU* reform proposal therefore appears to the left of the left-most point of the *RM* expansion line in Figure 1.

Under the *EU* proposal the EU would become a single actor in the UNSC. Were this reform implemented, it would be possible to expand the UNSC by up to four members while still dominating *Status quo*. Note, however, that *EU* is itself dominated by *WV*, so, the latter proposal should always be preferred.

Of the remaining reform proposals, each improves upon equity relative to *Status quo*, but – because of the added difficulty of achieving the required level of consensus within an expanded body – worsens efficiency. Helpfully – given the proliferation of reform proposals – it transpires that all but three of the reform proposals we consider can be demonstrated to be dominated (and should, therefore, never be chosen). From Figure 1 we see that *Panama* is dominated by *2+3*, which is itself dominated by *WV*. *Razali* and *Italy* both dominate *G4* and *UfC*, but are themselves dominated by *WV*. HLP_A is weakly dominated by HLP_B, and, as discussed above, *EU* is dominated by *WV*. The three undominated reform proposals are therefore found to be *WV* (as discussed above), High-Level Plan B (HLP_B), and the reform proposal of the African Union (*AU*). From Figure 1 we see that, of the three undominated proposals, *WV* is the most efficient, while the *AU* proposal is the most equitable. The HLP_B proposal, under which the existing regional groupings would be redrawn and eight new renewable seats with four-year terms created, emerges as a "middle" candidate, lying between the *WV* and *AU* proposals on both the equity and efficiency dimensions.

5.4 Extensions

We now briefly consider how our results might change if (i) world leaders willing to reduce Q_N/N – the proportion of the total votes required to be affirmative for a resolution to pass – as part of a reform of the UNSC; or (ii) we were to vary the preference weights in the construction of our composite measure of equity.

Beginning with the level of Q_N/N, were world leaders willing to lower this value below the current level of 0.6, this would make it easier for resolutions to pass, and therefore improve efficiency. As such, all the lines and point estimates in Figure 1 would shift upwards were we to assume a lower value of Q_N/N, but the relative comparisons between structural reforms would be unaffected. We note, however, that there appears little appetite among world leaders to relax Q_N/N.

The effects of altering the preference weights in the construction of our composite measure of equity may be inferred from Figure 2. According to panel (a) *Veto–* and *RM*, and the associated *WV* and *EU* reform proposals, would be the chief beneficiaries from placing greater weight on country equity. The principal losers would be *Veto+*, and the associated *AU* reform proposal. Conversely, *Veto+* and the associated *AU* reform proposal would be the principal beneficiaries if more weight were placed on the regional equity; while *RM* and the

associated *EU* reform proposal, would be the principal losers.

6. Conclusion

The UNSC plays an important role in ensuring global peace – the bedrock of macroeconomic stability. Although reform of the UNSC is one of the most pressing issues facing the international community, as yet no previous analysis has appraised the options for UNSC reform against formal equity and efficiency desiderata.

In this paper we present such an appraisal. Although nearly all countries support expansion of the UNSC membership, so far no expansion has taken place, as some countries worry that an expansion-only reform would be merely a "sticking plaster" that ultimately delayed the implementation of deeper "structural" reforms. On the basis of our analysis we concur that expansion at the levels currently under consideration will provide only modest improvements in equity, and will also come at the expense of efficiency, unless world leaders are also willing to relax the threshold for the proportion of members that must vote in favor of a resolution for it to pass. By segregating the effects of structural reform from those due to expansion, we also find that, in many cases, the types of deeper structural reforms being proposed are in fact counterproductive. As such, in these cases, a reform purely through expansion would actually be preferable to expansion alongside structural reform.

The most promising reform proposal among those we consider is one in which two PMs would have to cast a vote against a resolution for this to constitute a veto (*WV*). Its success owes to the fact that, by reducing the voting power of the PMs, it dilutes the distribution of expected voting power away from these countries. Regrettably, however, this reform proposal appears stymied in the short- and even medium term, for no PM is willing to relinquish its right of veto, and the constitutional ability of the PMs to retain these powers seems impregnable.[25] The only other reform proposal to dominate the present arrangements is the EU becoming a single actor. This is also politically infeasible in the short- and medium-term, for neither France nor the UK will consent to losing the right to an individual veto. Accordingly, those hoping for a step-change in the efficiency and equity of the UNSC in the short-run are likely to be disappointed.

An (albeit ambitious) direction for future research would be to characterize the optimal "second-best" reform that is as proximate as possible to the equity concepts adopted in this paper, but which satisfies a "functionality" or realpolitik constraint. While this idea must

[25] The San Francisco Declaration of 1945 ensures that a PM can veto questions of veto rights, for a PM exercises a veto on all non-procedural matters and also on whether a matter is to be deemed procedural or non-procedural (see, e.g., Köchler, 1995).

await a proper treatment, we believe that the present contribution at least clarifies what (little) can be achieved with the reform proposals presently on the table.

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Appendix 1: Structural Reforms

Reform	Details
PNVM	Four new PNVM seats (replacing one NPM seat for each of Africa, Asia, the GRULAC and the WEOG).[1]
Present	Implement no structural reform.
Renew	All NPM seats made renewable.
RM	All EU members act jointly as a single PM with the right of veto within the WEOG. One new NPM seat (to restore the UNSC to 15 members) allocated to regions according to the relevant expansion path (see Section 4.2).
Rotate	Ten seats that rotate among the region members (replacing existing NPM seats).
RR	New regional groupings: Africa, Asia and Pacific, Europe, and the Americas (three NPMs for Africa; 2.5 for each of the Asia and Pacific and the Americas; two for Europe).[2]
Term+	Eight seats with a four-year term (replacing two NPM seats for each of Africa, Asia and the GRULAC; one NPM seat for each of EE and the WEOG).
Veto+	Six new PM seats with the right of veto (replacing two NPM seats for each of Africa and Asia; one NPM seat for each of the GRULAC and the WEOG).[3]
Veto–	Two PM votes against a resolution required to form a veto.

[1] We assume that the PNVM seats are given to Nigeria in Africa, India in Asia, Brazil in the GRULAC, and Germany in the WEOG.

[2] These proportions are chosen to maintain, insofar as possible, the regional allocation of NPM seats between the existing five regional groups. The two NPM seats currently allocated to the WEOG are split one to Europe, and the other shared (rotated) between the Americas and Asia and Pacific (hence the fractional number of NPMs for these two regions). The new regional groupings are based on the report of the UN's High-level Panel on Threats, Challenges and Change (HLP, 2004). The report does not detail the precise membership of each group, but does indicate the number of countries belonging in each (allowing some inference to be made over the intended membership). We assume the Africa group to correspond to the existing Africa group; the Europe group to correspond to the existing EE group and the European countries in the WEOG; Asia and the Pacific to correspond to the existing Asia group with the addition of New Zealand and Australia; and the Americas group to correspond to the existing GRULAC plus Canada and the United States.

[3] As this structural reform is associated with the *AU* reform proposal we follow Appendix 2 (note 2) in assuming that the new PM seats are given to Nigeria and Egypt in Africa, India and Japan in Asia, Brazil in the GRULAC and Germany in the WEOG.

Appendix 2: Reform Proposals

Proposal	Details
2+3	Two new PNVM seats and three new NPM seats (one each for Africa, Asia and the GRULAC).[1]
AU	Six new PM seats with the right of veto (two each for Africa and Asia; one each for the GRULAC and the WEOG) and five new NPM seats (two for Africa; one each for Asia, EE and the GRULAC).[2]
EU	All EU members act jointly as a single PM with the right of veto.
G4	Six new PNVM seats (two each for Africa and Asia; one each for the GRULAC and the WEOG) and four NPM seats (one each for Africa, Asia, EE and the GRULAC).[3]
HLP$_A$	New regional groupings: Africa, Asia and Pacific, Europe, and the Americas. Six new PNVM seats (two each for Africa and Asia and Pacific; one each for Europe and the Americas). A total of 13 NPM seats (four for Africa and Americas; three for Asia and Pacific; two for Europe).[4]
HLP$_B$	New regional groupings: Africa, Asia and Pacific, Europe, and the Americas. Eight new renewable seats with four-year terms (two for each region). A total of 11 NPM seats (four for Africa; three each for Asia and Pacific and the Americas; one for Europe).
Italy	Ten new regional rotating seats (three each for Africa and Asia; two for the GRULAC; one each for EE and the WEOG).[5]
Panama	Six new renewable seats with five-year terms (two each for Africa and Asia; one each for the GRULAC and the WEOG). Any country elected for four consecutive terms to these new seats to become a PNVM.
Status quo	Do nothing.
Razali	Five new PNVM seats (two for Asia; one each for Africa, the GRULAC and the WEOG). Four new NPM seats (one each for Africa, Asia, EE, the GRULAC).[6]
UfC	All NPM seats to be renewable. Ten new renewable NPM seats (three each to Africa and Asia; two for the GRULAC; one each for EE and the WEOG).[7]
WV	Two PM votes against a resolution required to form a veto.

[1] According to Davis (2010), Germany and Japan were widely seen as deserving the two NPVM seats. We therefore allocate these seats on this basis.

[2] As the identities of the new PMs is not specified, we assume that the new PM seats are allocated to Nigeria and Egypt in Africa, India and Japan in Asia, Brazil in the GRULAC and Germany in the WEOG.

[3] We assume the six new PNVMs to be the same six countries assumed to be PMs in the *AU* reform proposal.

[4] We assume that the six new PNVMs are identical those in the *G4* reform proposal.

[5] Italy (2005) terms the ten new seats as "Regional" seats. Rotation is not proposed explicitly, but, according to Martini (2009: 7), is implicit in the Italian position.

[6] Specifically, the reform proposal allocates two new PNVM seats to the "industrialized states". According to Macqueen (2010), these two seats were intended for Germany and Japan. The reform proposal then allocates one PNVM seat to "developing states" in Africa, Asia and the GRULAC respectively. We allocate these seats to Nigeria, India and Brazil respectively.

[7] The *UfC* reform proposal we examine here superseded two earlier reform proposals made by the UfC (the "Blue" and "Green" Models). For a discussion of these reform proposals see Hoffmann and Ariyoruk (2005).

Appendix 3: Simulation Model

Election of UNSC Members

We begin by specifying, for each region, the number of seats of each membership category that are to be assigned in a given year. We are obliged to do this as only a subset of UNSC members complete their terms in a given year, so the timing of seats becoming vacant is not unique. For instance, in the present UNSC the GRULAC and the WEOG both receive two NPM seats: the GRULAC elect one of their seats each year – the sequence {1,1} – whereas the WEOG elect both their seats in odd years, and hold no elections in even years – the sequence {2,0}. As, the WEOG aside, the remaining regions display a preference for temporal smoothing of seats becoming vacant, we choose the timing of seat assignments to be that which is maximally smooth through time. Specifically, we look (under each structural reform) for the set of sequences that (i) makes maximally smooth the number of vacant seats per year within each region, and which (ii) also makes maximally smooth the total number of seats becoming vacant per year across regions.[26]

Under current UNSC rules, the UNGA simultaneously elects new NPMs to the UNSC in an annual ballot. In order to obtain a tractable electoral model for purposes of simulation, however, we suppose that elections are conducted sequentially, with countries elected one-by-one to each membership category in turn. As countries that win UNSC membership in the category elected first become ineligible for election to the membership category elected second, and so on, we assume that the elections for each membership category are held in order of desirability, with seats belonging to the most desirable membership category elected first. This assumption rules out the possibility a country might not participate in the elections for the membership category contested first so as to ensure eligibility for a more desirable membership category to be contested later. Of the elected membership categories, PNVM membership is deemed the most desirable, with further membership categories ranked by term length (longer preferred to shorter), followed by renewable status (renewable preferred to non-renewable). The least desirable membership category – two years non-renewable – is therefore elected last.[27]

[26] Specifically, we employ a lexicographic procedure in which, first, we identify the sets of sequences that makes maximally smooth the number of vacant seats per year within each region. Second, among these sets of sequences, we identify those that maximally smooth the total number of vacant seats across regions. Last, if a unique set of sequences is not yet determined, a final choice is made according to a random draw from the remaining sequence sets.

[27] The *Rotate* structural reform is the introduction of ten regional rotating seats to replace the ten existing NPM seats. To analyze this structural reform, we draw, for each region, the countries one-by-one without replacement under a uniform distribution to determine the order of rotation. In some instances, a country may be elected to a more desirable membership category when its "turn" for a rotating seat comes, in which case its turn as a rotating member is delayed until its UNSC term has ended. Similarly, a country may be ineligible to serve on

If, in year t, there are n_{jkt} seats of membership category k to be filled by new members from region j, then, in each of n_{jkt} rounds, there is a new realization of a random variable that elects country a_{ij} with probability ρ_{ijk}. A complication is that countries cannot have dual membership of the UNSC, so, if the same country is elected in more than one round, the process is repeated again in full until distinct countries are elected.

UNSC Expansion

Under each structural reform we denote the total number of UNSC seats (of all categories) belonging to region j with a vector $\mathbf{n}^0 = (n^0_{Africa}, n^0_{Asia}, \ldots, n^0_{WEOG})^{\mathrm{T}}$. We allow each new NPM seat to be allocated to region j with probability ψ_j, subject to the condition that, when allocating x new NPM seats, the realized allocation must satisfy $\gamma_{jx} \geq \lfloor \psi_j x \rfloor$ for all j.[28] We divide the performed 100,000 realizations equally between each valid allocation.

How to choose the ψ_j? We note that one of our equity concepts – CE – is prescriptive regarding the assignment of UNSC seats to regions. Gould and Rablen (2016) prove (Proposition 4) that, under CE, the number of seats assigned to region j, n_j, satisfies

$$n_j \propto \sum_{a_{ij} \in R_j} \frac{\sqrt{q_{ij}}}{\beta_{ij}} \text{ for all } j.^{29}$$

(A.1)

We choose the ψ_j separately for each structural reform. We do this as, to be scrupulously fair in evaluating each reform proposal, it is appropriate to give regions that benefit disproportionately from a given structural reform less weight in the subsequent expansion of the UNSC. Accordingly, for each structural reform, s, we compute the ψ_j such that the UNSC attains the CE concept at the maximal expansion $x = 193 - 15 = 178$. To do this, for each s, we (*i*) add 178 new NPM seats to $\mathbf{n}^0$ to give $\mathbf{n}^{178}$; (*ii*) compute the β_{ij} for $\mathbf{n}^{178}$; (*iii*) use (A.1) to determine the n_j that implement CE for $\mathbf{n}^{178}$, (*iv*) compute the vector of implied x_j: $\mathbf{x} = \mathbf{n}^{178} - \mathbf{n}^0$; and (*v*) set $\psi_j = (1/178)x_j$. Although there is some modest variation across structural reforms, the typical values of the ψ_j yielded by this procedure are: $\psi_{Africa} = 0.29$, $\psi_{Asia} = 0.36$, $\psi_{EE} = 0.09$, $\psi_{GRULAC} = 0.14$, and $\psi_{WEOG} = 0.12$. Under these proportions the first ten additional NPM seats would be allocated three to Africa, four to Asia, and one to each of EE, the GRULAC and the WEOG.

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the UNSC when its "turn" for a regional seat comes, in which case its turn is delayed until it next becomes eligible.

[28] Hence, we do not consider extreme divisions of seats to regions in which the number of new NPM seats given to one or more region deviates significantly from its expected value $\psi_j x$.

[29] Strictly, speaking, Gould and Rablen's Proposition 4 proves this result under "strong" CE, whereas here we employ what these authors term "weak" CE. It is straightforward to verify, however, that the proof of their Proposition 4 extends to the weak case.

Appendix 4: Estimated (ρ_{ij}, $\bar{p}_{ij}$)

Africa	ρ_{ij}	$\bar{p}_{ij}$
Algeria	0.0860	0.21008
Morocco	0.0501	0.14208
Nigeria	0.0497	0.13907
Egypt	0.0424	0.12154
Ghana	0.0384	0.11102
Tunisia	0.0377	0.11090
Tanzania	0.0376	0.10926
South Africa	0.0336	0.10050
Zimbabwe	0.0329	0.09992
Zambia	0.0322	0.09598
Mozambique	0.0319	0.09548
Kenya	0.0319	0.09436
Senegal	0.0309	0.09200
Mali	0.0245	0.07654
Niger	0.0226	0.06948
Cote d'Ivoire	0.0220	0.06816
Guinea	0.0218	0.06788
Congo	0.0218	0.06742
Ethiopia	0.0213	0.06704
Angola	0.0198	0.06180
Libya	0.0189	0.06026
Uganda	0.0184	0.05822
Burkina Faso	0.0173	0.05374
Malawi	0.0172	0.05372
Madagascar	0.0170	0.05324
Mauritania	0.0163	0.05316
Sudan	0.0159	0.05080
Togo	0.0150	0.04828
Gabon	0.0147	0.04704
Benin	0.0136	0.04424
Namibia	0.0124	0.04001
Mauritius	0.0121	0.03802
Cameroon	0.0104	0.03312
South Sudan	0.0098	0.03206
Botswana	0.0097	0.02964
Sierra Leone	0.0087	0.02920
Lesotho	0.0087	0.02830
DR Congo	0.0082	0.02516
Eritrea	0.0072	0.02394
Djibouti	0.0071	0.02308
Gambia	0.0062	0.02110
Central African Republic	0.0061	0.02070
Burundi	0.0059	0.01860
Rwanda	0.0055	0.01756
Swaziland	0.0050	0.01590
Somalia	0.0048	0.01560
Cape Verde	0.0045	0.01454
Comoros	0.0030	0.01058
Chad	0.0029	0.01038
Guinea-Bissau	0.0024	0.00886
Liberia	0.0023	0.00744
Sao Tome and Principe	0.0019	0.00694
Equatorial Guinea	0.0012	0.00458
Seychelles	0.0005	0.00148

Asia		
India	0.47728	0.51706
Japan	0.12114	0.28257
Pakistan	0.09212	0.23894
Malaysia	0.04707	0.13667
Republic of Korea	0.04376	0.12900
Indonesia	0.03583	0.10664
Bangladesh	0.02381	0.07358
Singapore	0.01899	0.05942
Thailand	0.01732	0.05458
Jordan	0.01521	0.05002
Philippines	0.01487	0.04852
United Arab Emirates	0.01314	0.04120
Sri Lanka	0.01113	0.03650
Iran	0.00657	0.02182
Saudi Arabia	0.00630	0.02040
Kuwait	0.00579	0.01916
Myanmar	0.00518	0.01714
Nepal	0.00516	0.01670
Qatar	0.00462	0.01560
Yemen	0.00414	0.01296
Iraq	0.00332	0.01102
Vietnam	0.00324	0.01102
Oman	0.00323	0.01024
Kazakhstan	0.00257	0.00884
Fiji	0.00203	0.00712
Cyprus	0.00200	0.00696
Papua New Guinea	0.00196	0.00666
Syrian Arab Republic	0.00168	0.00544
Bahrain	0.00149	0.00510
Uzbekistan	0.00148	0.00420
Brunei	0.00092	0.00310
Lebanon	0.00082	0.00262
DPR Korea	0.00076	0.00248
Afghanistan	0.00075	0.00240
Cambodia	0.00062	0.00236
Turkmenistan	0.00060	0.00200
Mongolia	0.00048	0.00172
Tajikistan	0.00044	0.00138
Kyrgyzstan	0.00042	0.00122
Laos	0.00040	0.00118
Bhutan	0.00033	0.00106
Maldives	0.00022	0.00076
Solomon Islands	0.00022	0.00076
Timor Leste	0.00018	0.00046
Tonga	0.00008	0.00028
Kiribati	0.00007	0.00024
Vanuatu	0.00007	0.00022
Samoa	0.00005	0.00018
Micronesia	0.00003	0.00016
Nauru	0.00002	0.00012
Marshall Islands	0.00002	0.00010
Tuvalu	0.00002	0.00006
Palau	0.00002	0.00006

EE		
Poland	0.3681	0.29800
Ukraine	0.247	0.23984
Romania	0.1122	0.12666
Hungary	0.0591	0.06883
Czech Republic	0.0525	0.06436
Belarus	0.0256	0.03156
Serbia	0.0227	0.02902
Bulgaria	0.0191	0.02282
Azerbaijan	0.0178	0.02243
Slovakia	0.0145	0.01816
Croatia	0.0112	0.01412
Republic of Moldova	0.0078	0.00980
Georgia	0.0074	0.00940
Albania	0.0062	0.00804
Lithuania	0.0060	0.00772
Slovenia	0.0052	0.00664
Bosnia & Herzegovina	0.0047	0.00594
Latvia	0.0037	0.00462
TFYR Macedonia	0.0034	0.00434
Armenia	0.0034	0.00420
Estonia	0.0019	0.00262
Montenegro	0.0005	0.00088

GRULAC		
Brazil	0.34235	0.46438
Mexico	0.19389	0.36558
Venezuela	0.16637	0.33693
Argentina	0.08081	0.20360
Colombia	0.04673	0.12944
Chile	0.04251	0.11812
Peru	0.02556	0.07396
Ecuador	0.01801	0.05282
Uruguay	0.01334	0.03926
Cuba	0.01019	0.03174
Dominican Republic	0.00765	0.02328
Honduras	0.00712	0.02162
Costa Rica	0.00605	0.01864
Guatemala	0.00538	0.01729
Panama	0.00484	0.01478
Trinidad and Tobago	0.00458	0.01440
Guyana	0.00415	0.01280
Paraguay	0.00409	0.01192
Jamaica	0.00381	0.01142
Nicaragua	0.00371	0.01098
Bolivia	0.00340	0.01024
El Salvador	0.00165	0.00510
Bahamas	0.00149	0.00484
Belize	0.00070	0.00206
Suriname	0.00061	0.00160
Barbados	0.00046	0.00108
Haiti	0.00020	0.00082
Antigua and Barbuda	0.00015	0.00058
Saint Lucia	0.00013	0.00048
Saint Kitts and Nevis	0.00002	0.00012
St Vincent & Grenadines	0.00002	0.00006
Grenada	0.00001	0.00004
Dominica	0.00001	0.00002

WEOG		
Germany	0.28949	0.40439
Turkey	0.16346	0.30002
Italy	0.11347	0.23468
Spain	0.07454	0.16795
Austria	0.07041	0.16302
Netherlands	0.04505	0.10772
Canada	0.03614	0.09062
Sweden	0.03072	0.07792
Switzerland	0.02616	0.06536
Ireland	0.02483	0.06198
Denmark	0.02285	0.05798
Belgium	0.02184	0.05574
Finland	0.01849	0.04794
Portugal	0.01692	0.04348
Norway	0.01666	0.04302
Australia	0.01228	0.03320
New Zealand	0.01027	0.02716
Greece	0.00497	0.01398
Israel	0.00054	0.00166
Malta	0.00039	0.00100
Luxembourg	0.00025	0.00070
Iceland	0.00007	0.00012
Monaco	0.00007	0.00012
Andorra	0.00005	0.00012
San Marino	0.00004	0.00008
Liechtenstein	0.00003	0.00004

Estimates computed from Table 3a of Dreher et al. (2014). Countries are listed in descending order of ρ_{ij} within each region.

Figures

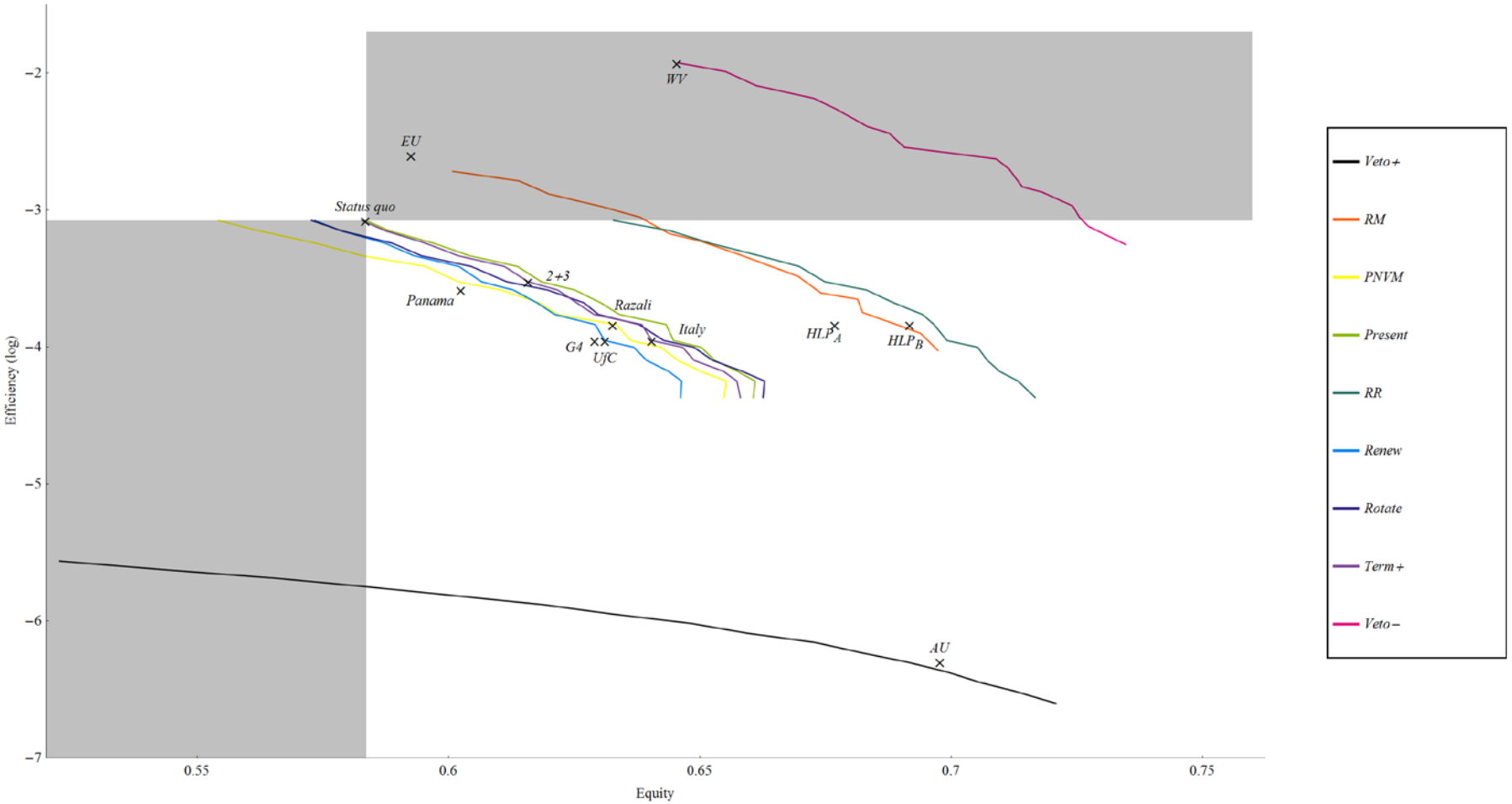

Figure 1: Equity and efficiency

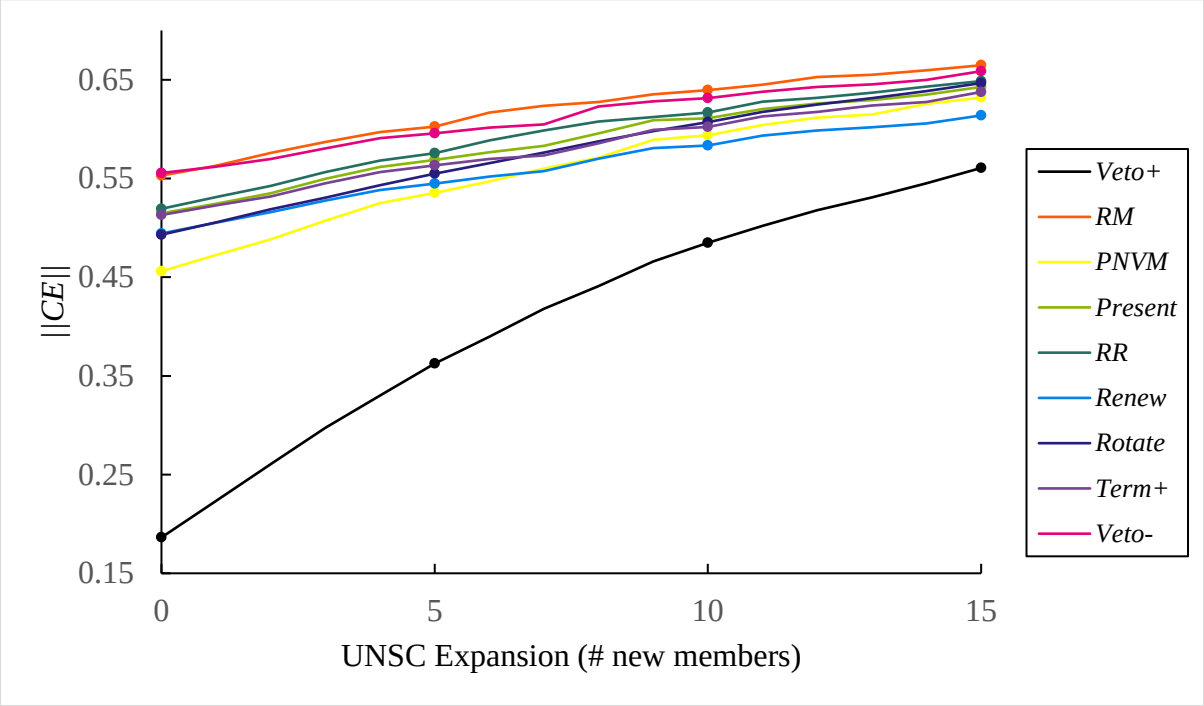

Figure 2(a): Proximity to CE at each expansion

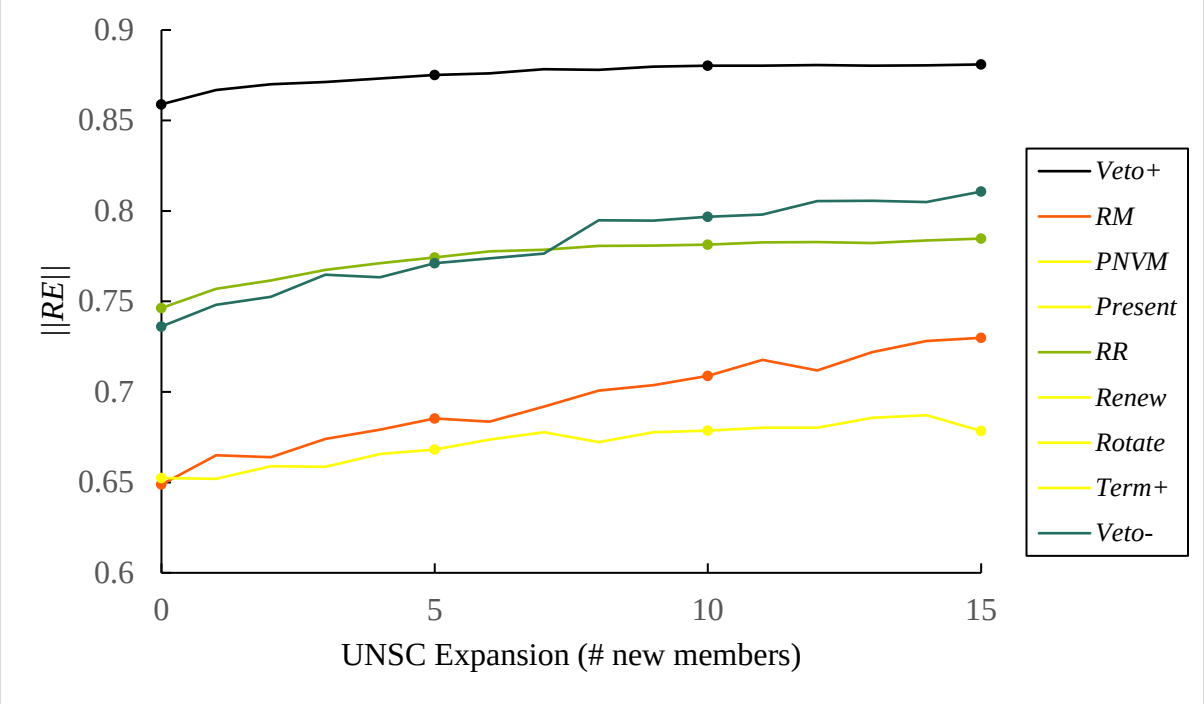

Figure 2(b): Proximity to RE at each expansion