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## Article

# The Balance of Power in WTO Decision-Making: Towards Weighted Voting in Legislative Response

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**Artikel--Articles: The Balance of Power in WTO Decision-Making: ...**

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# **Artikel – Articles**

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# The Balance of Power in WTO Decision-Making: Towards Weighted Voting in Legislative Response<sup>#</sup>

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Die Einführung des obligatorischen Streitschlichtungsverfahrens in der Welthandelsorganisation WTO hat ein neues Kapitel auf dem Gebiet der internationalen Rechts- und Handelspolitik eröffnet. Da das Streitschlichtungsverfahren erfolgreich arbeitet und häufig in Anspruch genommen wird, führt es gleichzeitig zu einem Ungleichgewicht zum Verhandlungsprozess, der sowohl während als auch zwischen multilateralen Handelsrunden fort dauert und ausschliesslich auf Beschlussfassung nach dem Konsensprinzip beruht. Dieser Entscheidungsmodus hat bis jetzt rechtsetzende Reaktionen von Seiten der Mitgliedstaaten der WTO verunmöglicht, sowohl in der Form von verbindlicher Vertragsinterpretation als auch von Vertragsabänderung. Diese Konstellation hat im Gegenzug Panels und den Appellate Body zu einer zurückhaltenden Haltung hinsichtlich Interpretation und Anwendung von WTO-Recht gezwungen. Die innerhalb der WTO an sich vorgesehenen Abstimmungsverfahren sind, aus ersichtlichen Gründen, toter Buchstabe geblieben. Das Prinzip, nach dem jedem Land eine Stimme zukommt, führt zu gravierenden Ungleichgewichten und kann nicht ohne das Risiko Anwendung finden, dass sich das «Goldene Dreieck», bestehend aus den Handelsbeziehungen zwischen den USA, der EU und Japan, aus dem Zentrum des multilateralen Welthandelsystems verabschiedet. Der vorliegende Artikel diskutiert das Verhältnis von Streitschlichtung und Entscheidungsfindung. Es wird vorgeschlagen, das Prinzip einer gewichteten Stimmabgabe einzuführen, um rechtsetzende Reaktionen zu ermöglichen, während Entscheidungen in Handelsrunden nach wie vor auf dem Konsensprinzip basieren sollen. Gestützt auf das Beispiel der gewichteten Stimmabgabe innerhalb des Weltwährungsfonds werden verschiedene Modelle und Gewichtungsfaktoren für die WTO entwickelt und berechnet. Diese Abstimmungsmodi werden im Lichte der bekannten Entscheidungstheorie mit Blick darauf beurteilt, ob sie ein grundsätzlich ausgewogenes System der Entscheidungsfindung für die WTO ermöglichen, sowohl zwischen Entwicklungs- und Industrieländern als auch zwischen dem legislativen und dem judikativen Teil der WTO.

*Keywords:* WTO governance, dispute settlement, weighted voting, legislative response

*JEL-Codes:* D72, D74, F13, K33

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# This paper is dedicated to HEINZ HAUSER, with all our best wishes for his 60<sup>th</sup> birthday, and our gratitude for all this work and contributions to fostering linkages of economics and the rule of law in international trade.

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# 1 Powers out of Balance

## 1.1 The Raise of WTO Dispute Settlement

Since the completion of the Uruguay Round and until the launch of the Doha Development Agenda of multilateral trade negotiations, dispute settlement in the WTO has evolved as the organization's main area of activity. It has dominated the inter-round agenda of the WTO from 1995–2002. The diplomatic process was essentially limited to the monitoring of implementation of the Uruguay Round agreements; to important left-over negotiations (financial services, telecommunication); house-keeping (such as the election of a new director-general) and the preparation and launch of the Doha Development Agenda. By August 2002, 262 complaints concerning 180 distinct matters had been filed. Dispute settlement produced a substantial record of 60 panel and Appellate Body reports during its initial phase, from 1995 to mid 2002. Main media attention focused on a few prominent disputes, such as *Bananas*, *Hormones* and *Shrimp – Turtles*, which achieved the status of *causes célèbres*, known well beyond governments and the international trade community. In this period of time, public perception of the performance of the WTO, its success and failure, came to be measured mainly by the functions of adjudication, to a much greater extent than the other, diplomatic branches of WTO work. The reputation and perception of the WTO was coined by highlights – positive and negative – of the dispute settlement mechanism. It became linked to the ability or inability of Members to comply with WTO rulings.

Reactions to the emerging effectiveness and the success of the dispute settlement system diagnose a profound imbalance between dispute settlement and the political process (BARFIELD 2001). Criticism is informed by the view that rulings of panels and the Appellate Body have become increasingly intrusive and put a risk at democracy and legitimacy at home. However, this view and public perceptions tend to ignore the fact that the tensions caused mainly rely upon *substantive* WTO rules and disciplines that are negotiated rights and obligations resulting from the political, rather than the judicial, process. Problems encountered in the *causes célèbres* indicated above were not caused by dispute settlement *per se* but by the very norms and rules that applied to these cases. Apart from fundamental critique addressing the democratic legitimacy of WTO as a whole (e.g. KRAJEWSKI 2001), only a few have so far addressed the need to reform the diplomatic process by which these rules were brought about

(EHLERMANN 2002a; 2002b). Attention has been mainly drawn to the reform of dispute settlement as a main remedy to overcome impasses in settling major, mainly transatlantic, disputes (DAVEY 2003; PETERSMANN 2002).

The alleged imbalance perhaps represents a different concern: what has changed with the 1995 Dispute Settlement Understanding (DSU) and its two-tier system of panels and Appellate Body judicial review is the advent of more effective law-enforcement of existing treaty based obligations by means of suspension and withdrawal of concessions and the imposition of tariffs under a system of cross-retaliation. The traditional weaknesses of international adjudication were overcome by closing existing *exits* at different stages of the process. The right to a panel barred a first exit. The right to seek retaliation in cases of failed implementation or failed compensation barred the second exit. What is new, therefore, is that treaty based obligations and rights are now taken seriously and confront domestic legislators who follow the traditional perception that it is the nature of international law to be used if suitable and discarded at a low cost if not suitable, to narrowly defined short-term national interests.

The perceived intrusion into law making by dispute settlement is thus not caused by excessive and activist law making by panels and the Appellate Body (OESCH 2003). They have by and large remained within their proper province. What may, however, induce such an impression is the fact that rulings of the Appellate Body are final, and only minor amendments to, or changes of, these precedents can be made. It is the inability of the political process to react to rulings that give them such a powerful status. There is, for reasons discussed below, virtually no possibility to change the law or its interpretation adopted by panels or the Appellate Body outside the realm of long-lasting rounds of multilateral trade negotiations. This is perhaps what is meant by imbalance, when comparison is made between the consensus-plagued, slow diplomatic process and swift dispute settlement (cf. EHLERMANN 2002a, p. 40) Indeed, this is, in our view, the only point at which imbalances may truly exist and where remedies should be sought – not in downgrading dispute settlement by returning to more diplomatic modes (BARFIELD 2001), but in reform of the process of treaty-making and the diplomatic legislative process. This brings us to the problem of legislative response.

## 1.2 The Problem of Legislative Response

All legal systems, including the WTO, rely upon a combined and continuous effort of legislation and adjudication in building law. *Lacunae*, inconsistencies and incompleteness of substantive rules inherently require, by way of interpretation, law-making activities of the judge in order to bring about a reasonable and viable result. Many of the WTO agreements and their interrelationship call for such work. WTO law on the whole may gain if panels and the Appellate Body could engage in more extensive law-making within the bounds of established judicial traditions in order to solve the problems put before them with a view to bringing about peaceful settlements. But these activities need to be checked. Ways and means need to exist which allow for reactions either by authentic interpretation or by way of treaty-making by the political branch. What is meant here, of course, is not the immediate reaction to a particular ruling. Parties are bound by a decision and do not have the power to alter it. However, rulings and decisions may eventually induce negotiations and changes in the law. Often, inadequacies of the law are only observed and realised in the course of specific disputes, and thus it is by way of legislative response that they may be addressed *pro futuro*.

Today, the rulings of the Appellate Body are subject to a weak control by the political Dispute Settlement Body (DSB) only, as they cannot be rejected without consensus of all Members present. Criticism by Members may be taken into account informally, influencing the attitude and perceptions of Appellate Body judges. Formally, the Appellate Body depends on critique and dialogue with academia. But there is no effective internal agenda within WTO to this effect. The practical impossibility to formally react in due course to rulings of panels and the Appellate Body by negotiations thus amounts to a problem of insufficient checks and balances. Indeed, given the present system of trade rounds, consensus, and package deals, there is very little room for adequate legislative response within a reasonable period of time. The Marrakesh WTO Agreement allows both for amendment of agreements and for authentic interpretation. Yet, both are virtually impossible to operate for the following reasons.

*Authentic interpretation* according to Art. X(2) WTO Agreement will be difficult to achieve by consensus as a follow up from a ruling by the DSB. The interpretation that deviates from the one adopted by the panel or the Appellate Body will be opposed by the winning party after the report has been adopted by the DSB. It is difficult to conceive that parties that im-

PLICITLY or explicitly approve an interpretation should be willing to reform their opinions in due course. In the absence of consensus, a quorum of  $\frac{3}{4}$  of the Membership is required which is difficult to achieve, would voting ever take place.

*Rule making by treaty-making* following a ruling by a panel or the Appellate Body is available under Art. X WTO Agreement. It is likely to fail for the following reasons: the winning party is likely to block consensus or unanimity, where required, in accordance with Article X(2). For the same reason, it will be difficult to obtain a two-thirds majority of Members who had not opposed by consensus the adoption of the report. Things are only different where negotiations are conducted within a wider context, so that the winning party of a settled dispute may trade the point in issue for other advantages. But this takes time and may only take place within and upon completion of a lengthy trade round.

The evidence affirms this view. Up until now, not a single authentic interpretation, let alone an amendment of an agreement, has materialized following dispute settlement. Formal reactions have been limited to the granting of waivers under Article IX:3 WTO Agreement. Unlike legislative response, this however amounts to dispensation from existing agreements and is limited in effect to particular Members. It is at this stage that we recognize one of the main roots of the problem: panels and the Appellate Body are confronted with the interpretation and application of rights and obligations. The scope of law-making and shaping by panels and the Appellate Body is inextricably intertwined with the modes and processes of negotiations applied. Whilst treaty law in many areas calls for support and completion by way of adjudication and case law, the practical impossibility of bringing about legislative response obliges the Appellate Body to exercise strong restraint and refrain from more extensive interpretations, in particular of obligations incurred by the agreements. The emphasis of textual interpretation is an emanation of this constellation. Panels may have somewhat more leeway, as their views can still be tested before the Appellate Body. The same is not true for the review process. It is quasi final until the law changes in a new round of multilateral negotiations. Such restraint, at the same time, bears the risk of limiting forward-looking, purposive interpretations and clarifications that may be used to guide Members, for example in determining the relationship to agreements outside the WTO or to other international organisations. Ideally, the fragmented and often incomplete law of the WTO would rather call for a larger scope of interpretation in order to achieve full coher-



ence with the system. Yet, the lack of possibilities of legislative response and thus a true dialogue between the judicial and the political branches of the WTO renders this politically difficult.

The question therefore arises as to whether conditions for legislative response can be facilitated. To the extent that law-making would become an ongoing process at the WTO, and to the extent that adjudicated rules and their effects may be renegotiated in due course and within a reasonable period of time, the goal of rendering legislative responses may perhaps be achieved. It is here that improvements should be sought and implemented. The issue has not yet received the attention it deserves.<sup>1</sup>

### 1.3 The Inadequacy of Consensus for Legislative Response

Current WTO decision-making, both within and outside rounds of multilateral trade negotiations, exclusively operates on the basis of consensus. Art. IX of the Marrakesh Agreement prescribes that the WTO shall continue the practice of decision-making by consensus that was followed under GATT 1947. Footnote 1 to Art. IX essentially describes consensus as a lack of opposition from the Members present, without requiring the positive assent that characterises unanimity in other fora. It says: "The body concerned shall be deemed to have decided by consensus on a matter submitted for its consideration, if no Member, present at the meeting when the decision is taken, formally objects to the proposed decision". Consensus successfully operates in many instances, as interests of Members are taken into account *ex ante* in the negotiating process. All Members present (not those absent) have the right to oppose, and from this point of view it is a method that inherently reflects the equality of States. At the same time, real power to block consensus is not evenly spread. Some are more equal than others, based upon their stake and interest in the multilateral trading system and the influence they yield. In practical terms, this results in largely divergent powers to effectively use the veto power. While large trading entities are in a position to block consensus

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1 A search on *legislative response* in WTO produced minimal results. SYKES (1999, p.1) discusses the issue in EU law, not WTO law; DILLON (1999, p. 197) states that democratic theory requires constituency input, legislative response, but discusses the matter in the context of the relationship of WTO law and domestic law; JOERGENS (1999, pp. 193, 212) merely observes that legislative response in WTO does not work and that this reflects a major structural deficiency; SHOYER (1998, pp. 75, 77) expresses the hope that the new DSU will trigger more legislative response; COTTIER (1998, pp. 86, 90) argues that the lack of legislative response is an argument against a full *de novo* review of panel reports and thus conducive to judicial restraint *vis-à-vis* panels.

more frequently, smaller nations need to dose the usage of their blocking rights very carefully. In practical terms, the power for them is limited to issues of existential importance.

This model of decision-making which preserves the interests of both small and large partners alike is likely to continue to be successful when dealing with multifarious issues negotiated with a view to achieve an overall and balanced package deal. Past rounds of multilateral negotiations, despite their high complexity, and because of their nature as package deals, were successfully completed by consensus diplomacy. Enlarged membership may further protract results, but does not exclude them. For the purposes of single issues raised in between rounds, in particular authentic interpretation and legislative response, however, results are likely to fail for the reasons already discussed above. A winning party is not likely to concede changes on an issue that may put the successful implementation of a ruling adopted by the DSB at risk. Whether or not voting required in constellations of legislative response will evolve towards a general principle of decision-making in the WTO is a matter the future will decide based upon grown experience. It is in the field of legislative response where a first step towards reforming decision-making practices should be made.

#### **1.4 Towards Voting for Legislative Response**

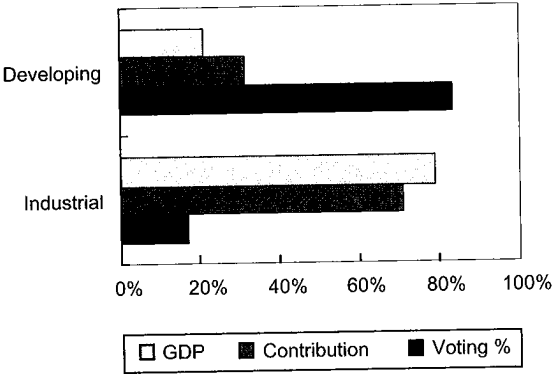
We submit that the achievements of the WTO dispute settlement require a review of political and diplomatic decision-making in order to re-establish the checks and balances of powers. Continued, *de facto* exclusive, reliance upon consensus of the former GATT 1947 cannot be sustained in the long run, since dispute settlement is no longer the same as it was in former times when different *exits* were available. Unless one wishes to return and retrograde to this former stage and give up the remarkable achievements of the past decade, the way has to be forward, with a view to strengthening the multilateral trading system and finding an appropriate balance of political and judicial decision making for coming generations.

Effective decision-making on authentic interpretation and treaty amendment will depend on voting. The WTO provides for a complex set of majority voting rules in Art. IX of the Marrakesh WTO Agreement. Yet, there is virtually no experience of voting procedures in GATT and WTO, and

the rules have remained dead-letter, even in cases where recourse would have been useful in bringing about a clear situation. The election of the director-general is a key case in point of systemic failure. Even here, Members opposed to revert to voting and give up consensus diplomacy. The current rules based upon the 'one state one vote' principle are an extremely long way from customary practice in GATT and the WTO. The reasons are apparent. The voting rules reflect neither the stake individual Members have in the multilateral system nor their real impact on power in shaping the rules of the multilateral system (both of which are recognised by consensus practices).

The imbalance and material inequality of representation in terms of voting rights is significant when we look at the shares of financial contributions to the WTO, gross domestic product (GDP), and voting rates as shown in *Figure 1*. The group of industrial countries, composed of 24 members, occupying 79% of Member's total GDP and supplying 71% of the WTO budget, represent only 16.8% of vote at the WTO. The group of developing countries, comprising 119 members, on the other hand, which contributes 31% to WTO budget and supplies 21% of total Member's GDP, represents 83% of total vote. The ratio of vote representation to budget contribution is 1:4.2 for industrial and 1:0.37 for developing countries, respectively.

**Figure 1** Share of GDP, Contribution and Vote in WTO



*Source:* WDI except for Cyprus, Liechtenstein, Myanmar, and Taiwan (see *Appendix B*);

*Note:* Contribution is the average of 2001–2003; GDP is taken from the average of 1996–2000.

The ratios depict the problem of inequality which is present under the present WTO framework, and which explains why voting procedures under Art. IX WTO Agreement are not used and decision-making remains reserved to consensus. Current voting rules in WTO, in other words, fail to respond to the requirement that majority voting procedures need to be able to assure that major trading partners in the system keep an interest in dealing with each other on the basis of the WTO law. This is a problem of equality to which we return shortly. At this stage, we merely emphasise that loss of control through 'one state one vote' majority voting runs the risk that key stakeholders informally leave the system and turn to unilateral, bilateral or regional trade regulation which they are able to effectively control. This is not in the interest of smaller nations who strongly depend on most-favoured-nation (MFN) and non-discriminatory market access rules. While they clearly have an interest in preserving consensus diplomacy (albeit blocking rights are limited in practice), they also share an interest in making the system fully functional in circumstances, such as legislative response in inter-round constellations, where consensus fails to work.

From this perspective we submit that there is a mutual interest in creating models of *weighted voting* and in constructing majority requirements in such a manner that none of the large partners can individually reject their adoption and that, on the other hand, no agreement should be adopted against the combined will of the major stakeholders. We define major stakeholders as those countries whose relations should essentially and genuinely be based upon WTO law, and not be mediated by way of bilateral or regional preferential agreements. Direct relations of these countries therefore form the backbone of the multilateral system, or the golden triangle. This triangle has essentially entailed the relationship of the United States, the European Communities (hereinafter EU), and Japan. It is in the process of being enlarged to other major countries, depending on their development in international trade. As long as their mutual relations essentially and genuinely rely upon WTO law, the increasing number of regional systems and agreements of the key stakeholders with their neighbours or allies will work as a complement, rather than a threat to, the WTO. Failure to preserve and develop the multilateral backbone, in return, will render the proliferation of unilateralism, bilateralism and regionalism in a manner detrimental to the WTO. It will inevitably lead to the decline of the WTO as the basic constitutional structure of international trade. It is therefore of paramount importance that major stakeholders keep a viable interest in WTO, and incentives to informally de-

part from it are countervailed. At the same time, it is important to do justice to medium and smaller Member States alike. Weighted voting for the purposes of legislative response within the overall system of dispute settlement and law-making may thus assist in avoiding such effects and provide a start for strengthening longer term global integration and governance within the WTO.

## **2 Weighted Voting for WTO Legislative Responses**

In light of the overall considerations, context and goals discussed above, we thus attempt to examine the potential feasibility of weighted voting as a tool for the provision of more efficient decision-making under WTO for inter-round legislative response and authentic interpretation issues. We firstly make a brief study on the example of the International Monetary Fund (IMF) which adopted weighted voting ever since it was founded in 1944. Lessons may be learnt from this experience. Interestingly, the IMF has recently been subject to a reform process of quota formulation as a basis for defining voting power allocation. Studying the problems faced by the IMF is useful with a view to constructing meaningful and more sophisticated power allocation within the WTO framework. In so doing, tools of economic theory and calculus are used; the effort needs to go beyond the province of law. *Section 2.2* concerns the choice of different variables and formulae for the voting weight calculation and presents the quantified votes. *Section 2.3* assesses voting power allocation based on the results derived from *Section 2.2*. The overall conclusions are drawn in *Part 3*.

### **2.1 The Experience of the IMF**

#### *2.1.1 Voting Weight Allocation*

The Fund operates under a system of weighted voting in which “each member shall have 250 (basic) votes, plus 1 additional vote for each part of its quota equivalent to 100,000 Special Drawing Rights” (IMF Articles of Agreement Art. XII Section 5a). The basic votes are introduced so as to “pay some homage to the traditional principle of the equality of states, to avoid too close an analogy to the private business corporation, and to guard against too great a concentration of voting power in the hands of one or two members” (GOLD 1974, p. 688). In turn, the quota is derived from a member’s economic status relative to other members, taking into account

GDP, current account transactions, and official reserves. The quota allocation is utilised for four different functions:

1. To determine financial contribution to the IMF budget;
2. To provide the basis for each member's access to Fund resources;
3. To determine voting weight;
4. To distribute general allocations of SDRs.<sup>2</sup>

The quota allocation is subject to a review at least every five years, and Members are entitled to request their own quota adjustment at any time. Based on the calculation described above, the allocation of voting rights as of December 2002 (shown in *Table 1*) provides that the biggest contributors occupy a simple majority: 53% of total votes in the IMF is held by the group consisting of the US, the EU, and Japan. Thus 17 countries dominate the majority, out of 184 members. Industrialised countries represent 60.34%. The weight of developing countries by geographical representation amounts to 5.88% for Africa, 10.47% for Asia, 8.32% for Europe, 7.29% for the Middle East, and 7.73% for those in the Western Hemisphere. *Figure 2* compares shares of GDP, contribution, and voting representation for groups of industrial and developing countries. As voting weight is allocated in proportion to the share of contribution, the shares for these two variables are almost the same. The slight difference between them stems from the relationship between the basic votes and the number of countries.

**Table 1** IMF Voting Weight Allocation, 2002

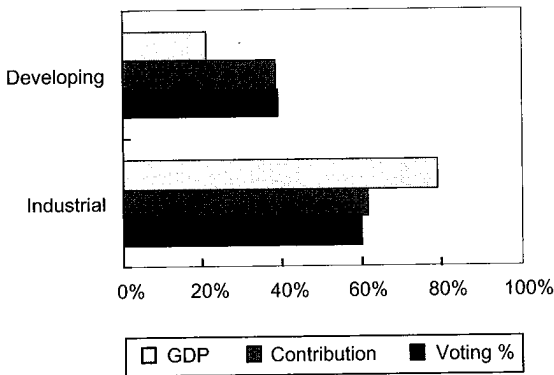
US	17.1%	Asia	10.5%
EU	29.8%	Europe	8.3%
Japan	6.1%	Middle East	7.3%
Other Industrial	7.3%	Western Hemisphere	7.7%
Africa	5.9%		

*Source:* IMF website, Internet: <http://www.imf.org> (downloaded May 1, 2003):

*Note:* The geographical classification for developing countries is according to the Direction of Trade Statistics Yearbook.

<sup>2</sup> The Special Drawing Rights (SDR) was created in 1969 and is valued on the basis of a basket of weighted key national currencies (the key national currencies for the period of 2001–2005 include Euro, Japanese yen, pound sterling, and US dollar) and serves as the IMF's unit of reserve account. The allocation of SDRs is made in proportion to each Member's IMF quotas. However, the decision to allocate SDRs has actually been made only twice in the past in 1970 and 1981.

**Figure 2** Share of GDP, Contribution and Vote in IMF, 2002, (%)



Source: WDI and IMF;

Note: GDP is the average over three year period (1998–2000).

### 2.1.2 Majority Rule

The majority rule adopted by the IMF for decision-making depends on different issues. For instance, with regard to an amendment of the Articles of the Fund (Art. XVII (a) and (b)), it can be adopted by double majority rule: three-fifths of the total membership and four-fifths of the total voting power of Members. However, certain more fundamental types of amending modifications<sup>3</sup> require unanimity. For authentic interpretation of the provisions of the Agreement, a decision made by the Executive Directors can be submitted for further review by the Committee on Interpretation of the Board of Governors; the decision is final, unless the Board of Governors opposes it by an 85% majority of the total votes. Thus, the IMF effectively operates (unlike the WTO) using a panoply of different majorities on different issues when explicitly provided for. However, equal voting power and consensus is mostly utilised in negotiations on important matters (GOLD 1974, p. 708).

3 Three provisions are not modifiable without acceptance by all members – Art. XVII (b):

- (1) the right to withdraw from the Fund;
- (2) the provision that no change in a member's quota shall be made without its consent;
- (3) the provision that no change may be made in the par value of a member's currency except on the proposal of that member.

It is interesting to note that “some major decisions require a very large majority, up to 85% of majority” (IMF 2002, p. 2). This has caused controversy and debate. True, a high level of qualified majority looks democratic and demonstrates the high level of acceptance by States. In the case of weighted voting, however, the effect is not exactly so. The majority rule, set at 85% in the IMF, provides independent veto powers to the US and EU. The United States is allocated 17% of voting power, meaning that the United States alone can block a motion, as the remainder of the membership only reaches 83%. The EU, in a combination of 15 countries, has 29.77% of total vote, provided that they cast their vote uniformly. The constellation leads to the conclusion that on matters subject to 85% qualified majority, powerful countries alone have complete negative control<sup>4</sup> in the institution.

### 2.1.3 *The Reform of Quota Allocation*

The distribution of quotas and, hence, of the voting weight is currently under review with a view to meeting concerns that the model no longer reflects a changing international climate. It is not the first effort aimed at reform.

During the course of its history since 1944, the quota formula was revised twice – in 1962/63 and 1981/82. Starting from a single equation with the 1944 Bretton Woods formula, it evolved towards the usage of multiple formulae (see *Appendix A*). Under the current reform, the quota formula is required to achieve certain functional properties: simplicity, transparency and robustness to changes in the international economy and to the relative change in the position of a country. The former implies that the formula should be “parsimonious in the number of variables and have intuitive appeal in its interpretation”. And the latter implies that if a country experiences an increasing variable with other variables being unchanged, the country’s quota share should increase (IMF 2001, pp. 21–22). As the quota is utilised for allocations of financial contributions and votes alike, it is constrained by the opposing concerns of the financial ability of smaller countries to increase their contribution versus the increase in their voting representation. Ultimately, it is suggested that the number of basic votes need to be modified in order to change voting weight allocation.

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4 There are two types of controls – positive and negative ones. A complete positive control refers to a situation when a specific country votes for yes, the yes decision is made. A complete negative control, on the other hand, refers to a situation when a specific country says no, the decision will not be taken.



These are important lessons to be retained for the purpose of the WTO. Whichever model is applied, it is bound to rely upon a number of factors, and cannot be directly linked to a single indicator, such as contribution, or, in the case of WTO, such as the percentage of world trade in goods and services.

## **2.2 The Models of Weighted Voting for the WTO**

### *2.2.1 Basic Requirements*

Basic requirements discussed at the IMF relating to simplicity, transparency and robustness to changing economic climate, as well as to a member's relative power, offer guidance that could also be applied for designing a weighted voting system in the context of the WTO. These criteria are fundamental for the legitimacy of an international organisation where a wide range of (often opposing) interests and obligations are processed, as they ensure that certain groups of countries are not particularly favoured. Further, we suggest the introduction of the concern of fairness between industrial and developing countries, as the gap in trade interests for these two groups of countries has become increasingly persistent. Thus we also seek for the balance of representation between the two groups to be taken into account.

Bearing this in mind, we attempt to calculate the weighted voting allocation for 2003. Based upon current power relations discussed above, we firstly discuss considerations on the choice of variables (*Subsections 2.2.2 and 2.2.3*), on the construction of formulae (*Subsection 2.2.4*) and on the quantification of formulae (*Subsection 2.2.5*).

### *2.2.2 The Choice of Variables*

The WTO is an international organisation that primarily deals with trade and trade-related rules among Member countries. Hence, it is natural to assume that variables for voting weight allocation should reflect each Member's power in terms of trade. There are four possible variables to be considered here: the size of trade in goods and services, the size of GDP, the openness of the market, and population.

### 2.2.2.1 *The Size of Trade – The Contribution to the WTO*

The size of the international trade of a Member in relation to other Members will be the most powerful indicator in assessing their influence within the context of the WTO, and it is in fact used for assessing the share of contribution to WTO. The share of a Member's contribution is determined in proportion to each Member's share of international trade (in per cent), based on trade in goods, services and intellectual property rights for the most recent three years for which data is available<sup>5</sup>. There is a minimum contribution of 0.015 per cent for Members whose share in the total trade of all Members is less than 0.015 per cent.

One possibility for the inclusion of the size of trade as a variable is to utilise existing contributions to the WTO. By so doing, this creates consistency and efficiency within the statistics utilised by the WTO. It also allows power assessments in two ways – the influential role in terms of international trade and in terms of budgetary contribution to the organisation. For this reason, the WTO contribution is utilised to assess the size of trade.

### 2.2.2.2 *Gross Domestic Product*

GDP is one of the most comprehensive indicators for measuring a Member's economic size relative to other members. Further, the availability of data is relatively well established for almost all countries. Hence it permits the assessment of their relative economic size in a constant manner. As to the measure of GDP, it may be more appropriate to use purchasing power parity (PPP) measures in relation to WTO. However, due to the fact that availability of such measures is to certain extent limited, GDP in current US dollars (\$US) is utilised for this assessment.

The average GDP in current \$US over a three-year period is applied to the calculation to smooth out the effects of cyclical fluctuation or sudden external shocks such as exchange rate movements, while limiting the effect of not capturing the update condition of a Member state (e.g. in contrast to a 5 or 10-year average).

### 2.2.2.3 *Market Openness*

Market openness is defined as the proportion of imports to GDP. This factor enables the assessment of a member's relative contribution to world trade by offering open markets, regardless of the size of the Mem-

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<sup>5</sup> The years used for the calculation of WTO contribution assessment are 1996–1998, 1997–1999 and 1998–2000 for the years 2001, 2002 and 2003, respectively. However, for the following ten years from 2004, it will be based on a four-year period (e.g. 1997–2001 for 2004 and 1998–2002 for 2005, and so on).

ber's GDP. In addition, the interesting impact of including openness is that it provides a criterion to offset a bias against smaller countries whose share tends to be very small in trade and GDP, yet whose markets tend to be relatively more open. Accordingly, it enhances their influence in decision-making, in accordance with their relative interest as stakeholders dependent on the international trading system.

#### 2.2.2.4 *Population*

The purpose of the inclusion of population as a variable is to take the size of the population into account that is affected by a decision. This factor is justified as the size of countries, independent of market opening or level of GDP, needs to be taken into account in order to achieve weighted voting in accordance with demographic constellations and, thus, the needs of peoples in different stages of social and economic development.

#### 2.2.3 *The Distribution of Variables*

The distribution of variables amongst WTO Members is shown in *Table 2*. One notable feature of the pattern of distribution of different variables is that there is a clear contrast between industrial and developing countries. Industrial countries dominate the variables of contribution and GDP whereas developing countries dominate the population variable. As for countries' market openness to trade, it is also clear that developing countries are usually much more open than industrial countries. Thus the inclusion of openness and population as variables will help to soften the concentration of voting weight at economically strong countries.

**Table 2** Regional Distribution<sup>1</sup>

	<b>Contribution WTO 2003</b>	<b>GDP Average 1998–2000</b>	<b>Openness Average 1998–2000</b>	<b>Population 2001</b>
<b>Industrial countries (24)</b>	<b>69,5</b>	<b>79,3</b>	<b>0,25<sup>2</sup></b>	<b>16,0</b>
• USA (1)	15,9	31,3	0,14	5,3
• EU (15)	39,6	28,0	0,25 <sup>3</sup>	7,1
• Japan (1)	6,4	15,0	0,09	2,4
<b>Developing countries (119)</b>	<b>30,5</b>	<b>20,6</b>	<b>0,49</b>	<b>84,3</b>
• Africa (40)	1,8	1,3	0,43	11,2
• Asia (21)	17,7	9,9	0,55	58,2
• Europe (18)	3,5	1,9	0,54	3,6
• Middle East (8)	1,9	1,1	0,46	1,6
• Western Hemisphere (32)	5,7	6,5	0,49	9,7

*Source:* Calculations by the authors from various sources; WTO, WDI, National statistics, UN Statistics Division, DOTS and IFS (see *Appendix B* and *C* for details).

*Note:*

- <sup>1</sup> Numbers in parentheses indicate the number of Members for each region. Country composition of regional area adopts classification of IFS except for Liechtenstein, Taiwan, and Cuba, which are put into category of Industrial, Asia, and Western Hemisphere, respectively;
- <sup>2</sup> Excluding Liechtenstein (inclusion of the country yields 0.37 for average openness for industrial countries as its openness is exceptionally high at 2.75);
- <sup>3</sup> Excluding intra-EU trade. The openness for EU is 0.473 when intra-EU trade is included. Further, when 15 members are treated as 1 (EU), the openness is 0.176.

### 2.2.4 *The Construction of the Formula*

In constructing the formula, two major concerns arise. The first relates to the question of the form that it should take – linear, multiplicative, etc. The second concern relates to the issue of whether there is a need to introduce the basic votes so as to provide for the equality principle among Members, as is the case for the IMF. Although the openness and population variables are inserted in order to strengthen the interest representation of the developing countries, the distribution of benefits from such variables within the group is disproportionate, and a number of Members may be left with a very small number of votes and may not benefit from them. In such a case the introduction of basic votes can provide the basis for a more equal distribution of votes among Members. As regards the

former concern, the following two formulae have been chosen after testing several models<sup>6</sup>, since their results closely suit the set of criteria and provide reasonable distribution of shares among different regions. The two formulae that have been selected are:

*Formula-1:* linear in share of vote and individual country variables:

$$V = a + bC_s + cY_s + dP + eL_s$$

*Formula-2:* non-linear model with the vote given by the sum of terms in which the share or individual variables are elevated to the exponent 3/4. In this way, the dynamic range of each individual variable is reduced:

$$V = a + bC_s^{0.75} + cY_s^{0.75} + dP^{0.75} + eL_s^{0.75}$$

where  $V$  = number of votes

$a$  = basic votes ( $a=0$  in case of no basic votes)

$C$  = contribution

$Y$  = GDP over three year average

$P$  = openness

$L$  = population

The subscript  $s$  denotes "share".

In order to reflect the second concern on basic vote, each model is tested in three modes. One without basic vote where  $a = 0$ . The remaining two modes are with basic vote where  $a > 0$ , either including or excluding the population variable. The weight of basic vote as a variable is given by 250 and it is divided by the number of Members. Each Member will thus receive 250/143 or 1.748 basic votes.

## 2.2.5 Quantification of Formulae

### 2.2.5.1 Data Selection

In calculating the voting weight for 2003, the periods of data utilised are as follows:

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6 Other formulae concerned were:

1. linear model in value:  $V = a + bC + cY + dP + eL$

2. square root model:  $V = a + b(C_s)^{1/2} + c(Y_s)^{1/2} + d(P)^{1/2} + e(L_s)^{1/2}$

3. log-log model:  $\log(V) = \log(a) + b \log(C) + c \log(Y) + d \log(P) + e \log(L)$

which is equivalent to:  $V = \alpha C^b Y^c P^d L^e$ ; where  $\alpha$  is a normalization factor.

4. lin-log model:  $V = a + b \log(C) + c \log(Y) + d \log(P) + e \log(L)$

They are dismissed either because the distribution of vote is heavily biased towards a particular country or region, and/or the attribution of weight of each variable is unclear and, hence, lacks transparency.

*Contribution 2003* whose calculation is based on international trade statistics for the years 1998–2000;  
*GDP* average over the period of 1998–2000;  
*Openness* average over the period of 1998–2000;  
*Population* statistics of 2001.

Since the voting weight for a specific year (in this case 2003) will be calculated in the previous year (in this case 2002), the latest data comprehensively available at the time of calculation will be 2000<sup>7</sup>. Hence, the variables are averaged over the period of 1998–2000, except for population. *Appendix B* provides the detailed sources of data.<sup>8</sup>

### 2.2.5.2 Illustrative Calculations

Using the chosen formulae and data described above, the regional representation of voting weights for each formula is shown in *Table 3*. For results concerning individual countries see *Appendix C* (cf. *Note 8* above). Each formula is tested for three variations:

- a. model without basic votes;
- b. model with basic votes;
- c. model with basic votes and exclusion of population variable.

The population variable is excluded in model (c), as it is only one social factor amongst three others and in order to see its impact separately. For all the models, the total number of votes is set at 1500 for model (a) and model (c), and at 1750 for model (b). Given the total maximum of votes, both contribution and GDP variables are given 500 votes each whereas basic votes, openness and population are given 250 votes each. Thus the former two variables are provided with larger voting weights compared to the latter ones. This is to put emphasis on reflecting the power in economics and trade, which can be considered as the most powerful variables, in assessing the power relation inside the WTO. The latter variables, on the other hand, are given lower weights which is in order to avoid too strong a concentration of vote distribution to economically strong Members as well as to balance the interest representation between the industrial and developing groups. The coefficients are sought so as to achieve as closely as possible the set number of each variable vote. The sum of all variables is

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7 The availability of the previous year (2001) to the calculation year (2002) is widely fragmented depending on the individual country's accounting practice.

8 *Appendix C* presents the list of actual figures for individual countries and is downloadable from this journal's website. Internet: <http://www.journal-aussenwirtschaft.ch>.

finally rounded for each country. That is why the calculated total number of votes is not exactly 1500 or 1750.

The current 15 EU members are treated individually at this stage. The share of EU presented in *Table 3* is the sum of each member country. They will, however, be treated as one when assessing the voting power. This procedure is taken from EU practice in the WTO, with Member States and the EU as separate members. Each member is thus treated individually under the WTO (e.g. allocation of contribution) rather than the EU as a whole. Their voting behaviour, on the other hand, is completely homogeneous and controversial votes cannot be made amongst members.

**Table 3** Regional Representation from Calculated Voting Weight

	Formula-1		Formula-2			
	a = 0	a = 1.74825	a = 0	a = 1.74825		
	Variable coefficients		Variable coefficients			
Contribution	5,0000		6,2007			
GDP	5,0000		7,0390			
Openness	3,7605		3,2065			
Population	2,5000	0,0000	3,1804	0,0000		
Calculated vote shares (as percentage)						
Models	1a	1b	1c	2a	2b	2c
<b>Industrial countries</b>	<b>54,53</b>	<b>49,17</b>	<b>54,74</b>	<b>46,98</b>	<b>42,78</b>	<b>46,86</b>
USA	16,67	14,41	15,89	10,23	8,90	9,69
EU	24,67	22,64	25,23	24,65	22,70	24,93
Japan	7,53	6,58	7,28	5,65	4,96	5,41
<b>Developing countries</b>	<b>45,47</b>	<b>50,83</b>	<b>45,26</b>	<b>53,02</b>	<b>57,22</b>	<b>53,14</b>
Africa	7,20	10,18	9,95	10,03	12,38	11,70
Asia	21,73	20,75	14,49	20,80	20,08	16,18
Europe	4,80	5,95	6,34	6,51	7,59	7,69
Middle East	2,13	2,69	2,87	3,26	3,54	3,61
Western Hemisphere	9,60	11,26	11,62	12,43	13,63	13,97
<b>Total</b>	<b>1500</b>	<b>1749</b>	<b>1500</b>	<b>1505</b>	<b>1753</b>	<b>1496</b>
maximum vote	250	252	238	154	156	145
minimum vote	1	3	3	2	3	3
Difference in the share between industrial and developing groups	9,1	1,7	9,5	6,0	14,4	6,3

Source: Calculations by the authors.

As *Table 3* shows, the difference in shares of calculated voting representation between the group of industrial countries and developing countries is

within the range of  $\pm 1.7\%$  (for model 1b, the difference is derived from 49.17% for the industrial group *versus* 50.83% for the developing group) to 14.4% (for model 2b, 42.78% *versus* 57.22%, respectively).

Several points need to be observed: it seems to be that the larger the amount of difference between maximum and minimum votes, the more likely it is that the share of industrial countries is higher. This is because variables such as contribution and GDP are given more weight than other variables. Regarding the distribution of votes amongst industrial countries, the difference between the US and the EU is much wider for *Formula-2*, by a magnitude of about 2.5 (as opposed to being around 1.5 times greater for *Formula-1*). This is because the share of the US is much lower in *Formula-2* than in *Formula-1*, whereas the share of the EU remains roughly the same between the two models. The reason for this stems from the fact that the EU is treated as 15 individual countries, leading to the compressed level being much lower than if it were treated as one.

Asia is given by far the highest voting representation within the group of developing countries. This is not surprising, given the high proportion that Asia represents for contribution, GDP and population. As Asian countries largely dominate the world's population, the inclusion or exclusion of a population variable makes a considerable difference in the share of votes for this region. Although in any case, Asia is provided with the largest allocation of votes, the other two developing continental regions of Africa and Western Hemisphere are given a reasonable share; here, the low share in GDP and financial contribution to the WTO is offset by openness and the human factor of population.

The effect of the population variable (model (b) versus (c)) favours the group of developing countries as a whole. Yet, the effect is not equally distributed amongst regions. It strongly favours Asia and slightly favours Africa. However, the population variable negatively affects the number of votes for the regions of Europe, the Middle East, and the Western Hemisphere. For each model, the introduction of basic votes (model (a) versus (b)) can increase the share of developing countries by about 4 to 5%. With the exception of Asia, all regions of developing countries are better off with basic votes.

*Table 4* provides the list of the top ten countries ranked according to the number of votes for each model. The top three countries are the EU, the US and Japan for all cases. In all cases they are then followed by China,



whereas India is ranked at the fifth position except for model (c) which does not take the population size into account. For the rest of the ranking, the order is made among Brazil, Canada, Hong Kong, Korea, Mexico, Singapore, and Taiwan.

**Table 4** Ranking of Ten Highest Vote Countries from Calculation

Formula 1	a		b		c	
	countries	# of vote	countries	# of vote	countries	# of vote
	EU	370	EU	397	EU	378
	US	250	US	252	US	238
	Japan	113	Japan	115	Japan	109
	China	93	China	95	China	35
	India	60	India	62	Canada	34
	Canada	34	Canada	35	H.K.	25
	Mexico	26	Mexico	27	Mexico	23
	H.K.	24	H.K.	26	Korea	22
	Brazil	24	Brazil	26	Taiwan	19
	Korea	22	Korea	24	Singapore	19
Formula 2	a		b		c	
	countries	# of vote	countries	# of vote	countries	# of vote
	EU	372	EU	398	EU	373
	US	155	US	156	US	145
	Japan	85	Japan	87	Japan	81
	China	68	China	69	China	35
	India	45	India	47	Canada	33
	Canada	34	Canada	35	H.K.	25
	Mexico	28	Mexico	30	Mexico	25
	Brazil	27	Brazil	28	Korea	24
	Korea	25	Korea	27	Taiwan	21
	H.K.	24	H.K.	26	Brazil	21

Source: Calculations by the authors.

### 2.2.6 Comments

Although there are many other possible combinations of distributions, the final choice of the optimum vote allocation will depend entirely on the political acceptance of Member countries. The purpose of this exercise is to demonstrate that a rational basis for defining voting right exists, leading to legitimate results. In particular, the voting weight allocated here was calculated with the aim of meeting three essential criteria: they are *simple*, in that they are based on a single formula in which the number of votes just amounts to the summation of shares (or compressed shares) of variables. They are *transparent*, as the formulae are simple and comprised

of very basic economic and social variables, which are easily obtainable. And finally, their *robustness to changing economic climate and Member's relative power* is firstly achieved by utilising multiple variables, none of which has particularly strong dominance in determining the number of votes. Secondly, the fact that the economic variables consist of an average of the most recent three-year period evades wide fluctuations due to short-run cyclical effects. The third concern is the openness, which would be the most volatile variable. For example, a country which is experiencing lower import growth than GDP growth will see a decline in its number of votes from the variable. This could well be the case for countries with export-led economic growth. However, such effects can be anchored by the contribution variable, as this factor is derived from the size of both imports and exports.

In addition to these three criteria, the element of *fairness* between industrialised and developing countries is emphasised by our models, as it takes into account two groups of variables; one (namely, contribution and GDP) favouring industrial countries, whilst the other (openness and population) favours developing countries.

### 2.3 Assessment of Voting Power

So far, we have concentrated our attention on voting weight allocation among different countries and regions. This section will turn the attention to their voting power. In assessing voting power, co-operative game theory provides a range of analytical tools. The most frequently utilised power indices are the Shapley-Shubik and Banzaf Power Indices (hereinafter SSI and BI, respectively) which calculate, based on different assumptions, the probability that a country will act as a pivot in the passing of legislation. In addition, the inclusiveness index and the decision probability index are utilised in the analysis of power. While the former provides the probability that a country will be part of the winning coalition, the latter assesses the probability that a decision will be taken out of all possible coalitions. The “vpower programme”<sup>9</sup> is utilised in the calculation of SSI and BI. The inclusiveness index and decision probability can be easily calculated using a Monte Carlo technique. Here, we have adopted this technique, assuming a very large number of trial combinations (a few million),

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9 The “vpower programme” is obtained by private communication from TOMOMI MATSUI, Department of Mathematical Informatics at Tokyo University, Japan. See Internet: <http://www.simplex.t.u-tokyo.ac.jp/~tomomi/welcomeE.html> (downloaded May 1, 2003).

and simply counting the number of inclusions into a given winning coalition set. The method has been successfully tested by comparing the result with one obtained with an analytical method (see the IOP programme<sup>10</sup>) for a calculation with a reduced number of players.

### 2.3.1 *The Definition of Power*

SHAPLEY and SHUBIK (1954) define the power of an individual country as “the chance [it] has of being critical to the success of a winning coalition”. In other words, the power is the probability that a country will be pivotal to the taking of a decision, whose vote turns a losing coalition<sup>11</sup> into a winning one. BALDWIN (1994, p. 181) provides a more political interpretation: “this constitutes power, since a country that finds itself in such a pivotal situation can ask for many sweeteners as the price for its vote”.

In assessing the power allocation under a weighted voting system, it is inappropriate if one simply compares the assigned weights of different countries. In weighted voting, the power is made up of “a complex interaction of the majority rule and the number of votes that other countries have” (BALDWIN 1994, p. 75). WIDGREN (1995, p. 114) provides three determinants to the voting power outcome:

- (a) Majority rule (e.g. simple majority or qualified majority);
- (b) Assigned weights of the various countries;
- (c) Voting behaviour of the countries.

Although more votes represent more power in general, the two are not directly proportional (SHAPLEY and SHUBIK 1954). Thus, weight assignment is an important component in constructing power, but the weight does not by itself indicate the real power that a country possesses.

### 2.3.2 *Shapley-Shubik, Banzhaf Power and Inclusiveness Indices*

#### 2.3.2.1 *Shapley-Shubik Index*

The Shapley-Shubik Index was introduced by a method adopting the theory of games in 1954 and it has remained one of the most influential

<sup>10</sup> The Indices of Power IOP Programme is developed by BRÄUNINGER and KÖNIG, Department of Politics and Management at University of Konstanz, Germany. See Internet: <http://www.uni-konstanz.de/FuF/Verwiss/koenig/IOP.html> (downloaded May 1, 2003).

<sup>11</sup> In cooperative game theory terminology, a group of players (voters) that vote for the same outcome is considered to be a coalition.

power indices ever since. It “measures the number of times that the action of the individual actually changes the state of affairs” (SHAPLEY and SHUBIK 1954, p. 788). The random ordering of voters is important in this model, assuming that as soon as a majority is achieved, the remaining unexercised votes are no longer relevant to the outcome. For example, for the passing of a piece of legislation, only a minimal winning coalition is required. The logic of the Shapley-Shubik Index can be explained by a weighted majority game defined by a simple majority decision-making rule (i.e., 50 percent plus 1 vote) having three players (A, B and C) with different voting weights –  $w_A = 1$ ,  $w_B = 49$  and  $w_C = 50$ . Since the number of possible orderings is  $3! = 6$ , there are 6 pivots in this game. Such grand coalitions are:

- |                        |                        |                        |
|------------------------|------------------------|------------------------|
| 1. (A, B, $\square$ C) | 2. (A, $\square$ C, B) | 3. (B, A, $\square$ C) |
| 4. (B, $\square$ C, A) | 5. (C, $\square$ A, B) | 6. (C, $\square$ B, A) |

The player with a pivotal position in each ordering is marked by square. Player A and player B are both in pivotal positions once out of six pivots, whereas player C is pivotal on four occasions. Hence the SSI for each player is:

$\phi_A = 1/6$ (0.167)	$\phi_B = 1/6$ (0.167)	$\phi_C = 2/3$ (0.667)
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This is the proportion of incidence that a player can be pivotal in decision making. The higher the proportion, the higher the player’s expected payoff or voting power. An interesting remark is the fact that players A and B possess exactly the same voting power regardless of the difference in voting weights – 1 and 49, respectively. On the other hand, player C enjoys power four times higher than either of the other players. Thus, there is a non-linear relationship between a player’s proportion of vote and the SSI<sup>12</sup>.

### 2.3.2.2 Banzhaf Index

As opposed to the SSI, BANZHAF argues that the order in which voters join a coalition should not be an important factor. Instead he proposed a voting situation in which each voter is independent and each can influence the outcome only through his vote. He then provided for the measurement of voting power by the number of probabilities that he is able to alter the outcome by changing his vote.

12 The formal definition of SSI is expressed as:  $\phi_i = \sum_{S \in Mi} \frac{(s-1)!(n-s)!}{n!}$ ,

where  $S$  denotes the randomly chosen coalition,  $M_i$  is the class of minimum winning coalitions with respect to country  $i$ , and  $n$  is the number of countries.

Using the simple example above, BI can be derived by counting the probability of altering the coalition for each voter. The winning coalitions<sup>13</sup> are shown below and swing voters who can change the winning coalition to a losing one by changing his vote are boxed.

1. (A,  $\boxed{B}$ ,  $\boxed{C}$ )                      2. ( $\boxed{A}$ ,  $\boxed{C}$ )                      3. ( $\boxed{B}$ ,  $\boxed{C}$ )

Hence the Banzhaf index<sup>14</sup> for A, B, C is the ratio 1:2:3. The normalised Banzhaf index is:

$$\beta_A = \frac{1}{6} \quad \beta_B = \frac{2}{6} \quad \beta_C = \frac{3}{6}$$

(0.167)                      (0.333)                      (0.5)

There is a difference that should be noted before any comparison of the two power indices is being made. For SSI, voters A and B have the same voting power, whereas in the BI voter B has twice as much power as A. The difference between SSI and BI lies in their different assumptions which are often referred to as permutation versus combination. The SSI assumes that homogeneity and winning coalitions are formed in some order. The BI, on the other hand, assumes independence, and instead focuses on the final winning coalition.

In this regard, STRAFFIN (1988) stresses the importance of choosing an index that is appropriate for a given situation. To this effect, he suggests that the SSI is more applicable to legislative action when there is considerable communication amongst members and when there is a strong coalition building activity, whereas the BI is more appropriate where there is no communication, and thus coalition building is absent and only final votes are observable. For the purpose of our analysis on WTO weighted voting, SSI may be the more relevant index in most cases.

### 2.3.2.3 Inclusiveness Index

Another power assessment calculated here is the inclusiveness index, suggested by KÖNIG and BRÄUNINGER (1998). The inclusiveness index assesses the absolute chance that a particular Member will be incorporated in potential collective decision-making. Thus it provides a quantified expectation for an individual player in the potential legislation system by

13 There are 8 possible yes vote coalition:  $\{\underline{A}, \underline{B}, \underline{C}\}$ ;  $\{A, B\}$ ;  $\{\underline{A}, C\}$ ;  $\{A\}$ ;  $\{B, C\}$ ;  $\{B\}$ ;  $\{C\}$ ;  $\emptyset$ . The underlined coalitions are the winning coalitions, the ones that lead the decision to yes.

14 The formal definition of BI is expressed as  $\beta_i = \sum_{S \in Mi} \left(\frac{1}{2}\right)^{n-1}$ .

choosing a decision-making rule from various alternatives. The expectation of Member States, in turn, is assumed to be the legislative gain from potential legislation. Using the example shown above for SSI and BI, players A and B appear twice, whereas player C appears three times out of three possible winning coalitions. Hence the inclusiveness index for player A and B is  $2/3$  or 0.67, while it is 1.00 for the player C<sup>15</sup>.

### 2.3.3 Calculated Power Indices

The SSI, BI<sup>16</sup> and inclusiveness index are calculated here for voting weights provided by the six models presented in *Section 2.2*. Each model is subject to tests for simple majority (50% plus 1 vote) and 70% majority rule. The 70% majority rule is chosen so as not to provide any country with veto power. In our case, the voting share of EU which yields the highest vote for all models at around 25% is the critical factor in choosing the 70% majority rule.

#### 2.3.3.1 Shapley-Shubik Index

*Table 5* shows the regional share of voting power for consensus and for simple and 70% majority rule, respectively.<sup>17</sup> It reveals that the introduction of a weighted voting system will inevitably change the current balance of power under consensus. Consensus diplomacy and the ‘one state one vote’ principle ensure that all countries are given one vote, each one being pivotal in every voting, and the SSI and BI power indices assume the value of  $1/129 = 0.00775$ <sup>18</sup>. The gains in power from weighted voting for industrial countries are offset by a significantly large loss in power for developing countries. Asia provides an exception as it gains power when the model includes a population variable. For all of the models, more than 100 countries would have less voting power with weighted voting than under the consensus decision-making rule.

The power of industrial countries is 3% to 5% higher than their voting weight (see *Table 3*). The higher share of power compared to voting

15 The formal definition of the inclusiveness index is expressed as:  $\omega_i(v) = \frac{\sum_{S \in N, i \in S} v(S)}{\sum_{S \in N} v(S)}$ .

16 Both SSI and BI are presented here. However, as SSI is the most relevant index for our analysis, the BI is shown for reference. The power analysis is focused on SSI here.

17 *Appendix D* presents the list of actual figures for individual countries and is downloadable from this journal’s website. Internet: <http://www.journal-aussenwirtschaft.ch>.

18 This is, of course, the value of the normalised indices. Non-normalised SSI and BI would be 1.0 for each country.

weight is offset by the lower power for developing countries, at around 1% for each region. The difference in voting power between simple and 70% majority rules favours industrial countries slightly under *Formula-1* and minimally under *Formula-2*.

As for the difference between maximum and minimum voting power, *Table 6* shows the respective numbers, indicating the maximum vote over minimum vote for each model. The difference is magnified when one looks at power in comparison to vote share. Especially for the model (1a), the difference in power is twice as much as in the share of vote. These phenomena could be well explained by looking at the power held by the top ten countries with the highest votes shown in *Table 7*. The SSI power distribution is roughly proportional to the voting share in almost all cases except for the EU, which has more than 5% power to its voting share (excluding model (2b) at +4.7 %). For model (2c), for example, EU voting power is 7% higher. For the rest of countries, the power is slightly less than the actual voting share. The higher voting power than voting share for industrial countries is explained by the higher rate for the EU, and for other countries in the group it is actually lower, except for the US in some cases. So, the gain of the share in power is mostly absorbed by the EU, with other industrial countries' power actually being lower than their voting weight. The minimum and maximum vote share difference is also explained by much higher EU power than voting share.

As to the power relationship between the EU and the US, *Formula-2* shows three times as much difference between the two in favour of the EU for each of the models. This is because of disproportionate voting weight allocation and the power being given much more to the EU than to the US. Such a large difference will be economically and politically unacceptable. Also for the model (1c), the EU has twice as much power compared to the US regarding both the simple and 70% majority rule, even though its vote share is limited to be 1.5 times higher. A more acceptable distribution of power between the two would be provided by model (1a) or model (1b).

**Table 5** Regional Distribution of Voting Power; Consensus, Simple, and 70% Majority Rule

<b>Consensus</b>		<i>SSI</i>		<i>BI</i>			
	<b>Industrial (10)*</b>	<b>0,078</b>	<b>0,078</b>	* EU is treated as one			
	<b>Developing (119)</b>	<b>0,922</b>	<b>0,922</b>				
	Africa (40)	0,310	0,310				
	Asia (21)	0,163	0,163				
	Europe (18)	0,140	0,140				
	M. East (8)	0,062	0,062				
	W. Hemisph. (32)	0,248	0,248				
<b>Formula-1</b>		<i>model (1a)</i>		<i>model (1b)</i>		<i>model (1c)</i>	
		<i>SM</i>	<i>70%</i>	<i>SM</i>	<i>70%</i>	<i>SM</i>	<i>70%</i>
	<b>SSI</b>						
	<b>Industrial</b>	<b>0,589</b>	<b>0,596</b>	<b>0,535</b>	<b>0,537</b>	<b>0,595</b>	<b>0,605</b>
	<b>Developing</b>	<b>0,411</b>	<b>0,404</b>	<b>0,465</b>	<b>0,493</b>	<b>0,405</b>	<b>0,395</b>
	Africa	0,064	0,064	0,092	0,092	0,089	0,087
	Asia	0,199	0,193	0,192	0,190	0,130	0,127
	Europe	0,043	0,043	0,054	0,054	0,057	0,055
	M. East	0,019	0,019	0,024	0,054	0,026	0,025
	W. Hemisphere	0,086	0,085	0,103	0,103	0,104	0,101
	<b>BI</b>						
	<b>Industrial</b>	<b>0,533</b>	<b>0,515</b>	<b>0,490</b>	<b>0,416</b>	<b>0,496</b>	<b>0,526</b>
	<b>Developing</b>	<b>0,467</b>	<b>0,486</b>	<b>0,510</b>	<b>0,621</b>	<b>0,504</b>	<b>0,474</b>
	Africa	0,073	0,076	0,101	0,116	0,110	0,104
	Asia	0,225	0,235	0,210	0,241	0,162	0,151
	Europe	0,049	0,051	0,059	0,068	0,070	0,067
	M. East	0,022	0,023	0,027	0,068	0,032	0,030
	W. Hemisphere	0,098	0,101	0,113	0,129	0,129	0,122
<b>Formula-2</b>		<i>model (2a)</i>		<i>model (2b)</i>		<i>model (2c)</i>	
		<i>SM</i>	<i>70%</i>	<i>SM</i>	<i>70%</i>	<i>SM</i>	<i>70%</i>
	<b>SSI</b>						
	<b>Industrial</b>	<b>0,523</b>	<b>0,524</b>	<b>0,476</b>	<b>0,475</b>	<b>0,524</b>	<b>0,525</b>
	<b>Developing</b>	<b>0,477</b>	<b>0,477</b>	<b>0,522</b>	<b>0,525</b>	<b>0,475</b>	<b>0,475</b>
	Africa	0,090	0,090	0,113	0,113	0,104	0,104
	Asia	0,189	0,188	0,185	0,185	0,145	0,145
	Europe	0,058	0,058	0,067	0,069	0,069	0,069
	M. East	0,029	0,029	0,032	0,032	0,032	0,032
	W. Hemisphere	0,112	0,112	0,125	0,125	0,125	0,125
	<b>BI</b>						
	<b>Industrial</b>	<b>0,589</b>	<b>0,363</b>	<b>0,570</b>	<b>0,296</b>	<b>0,658</b>	<b>0,341</b>
	<b>Developing</b>	<b>0,411</b>	<b>0,637</b>	<b>0,429</b>	<b>0,703</b>	<b>0,342</b>	<b>0,659</b>
	Africa	0,078	0,120	0,094	0,152	0,076	0,145
	Asia	0,159	0,252	0,149	0,247	0,103	0,201
	Europe	0,051	0,078	0,056	0,093	0,050	0,095
	M. East	0,025	0,039	0,027	0,043	0,023	0,045
	W. Hemisphere	0,097	0,149	0,103	0,167	0,090	0,173

Source: Calculations by the authors.



### 2.3.3.2 *Inclusiveness Index*

As for the inclusiveness probability, consensus rule ensures absolute inclusiveness to the decision-making for all countries. However, the weighted voting system lowers the probability at different magnitudes amongst countries. Under the 70% majority rule, the EU enjoys absolute inclusiveness in the decision-making process and so does the US at almost absolute level. This will assure that the interests of these two large economic blocks will be fully reflected in the process of decision-making. Japan, on the other hand, will have a very high chance of inclusiveness but not at absolute levels. The top ten countries listed will also have relatively high levels of inclusiveness, while the rest of countries will have at least 50% inclusiveness under any of the models.

The picture changes when one looks at simple majority. Although EU has the highest inclusiveness probability, it is not at an absolute level. The US and Japan will have much lower inclusiveness with simple majority. The same holds true for countries with high levels of inclusiveness. For the majority of countries the change in inclusiveness will be minimal, as the minimum level remains at 50 percent.

**Table 6** Difference between Max. and Min. Votes under Simple and 70% Majority Rule

	v-share	SSI		BI	
		SM	70	SM	70
model (1a)	247	505	516	422	259
model (1b)	114	177	178	164	68
model (1c)	126	174	184	131	81
model (2a)	247	266	267	444	68
model (2b)	114	183	182	351	38
model (2c)	125	179	180	438	37

*Source:* Calculations by the authors;

*Note:* Figures show maximum over minimum number of votes.

**Table 7a** Voting Power Indices for Top Ten Countries with Highest Votes for Simple and 70% Majority Rule (*Formula-1*)

Formula-1	model (1a)							
	countries	v-share	SSI		BI		Inclusiveness	
			SM	70	SM	70	SM	70
	EU	0,247	0,298	0,304	0,287	0,181	0,869	1,000
	US	0,167	0,167	0,175	0,102	0,181	0,632	0,999
	Japan	0,075	0,072	0,065	0,085	0,092	0,612	0,756
	China	0,062	0,058	0,055	0,069	0,068	0,589	0,688
	India	0,040	0,037	0,036	0,039	0,046	0,550	0,625
	Canada	0,023	0,021	0,020	0,023	0,024	0,528	0,562
	Mexico	0,017	0,016	0,016	0,018	0,018	0,523	0,551
H.K.	0,016	0,014	0,014	0,016	0,017	0,519	0,546	
Brazil	0,016	0,014	0,014	0,016	0,017	0,519	0,546	
Korea	0,015	0,013	0,013	0,015	0,015	0,521	0,546	
	model (1b)							
	countries	v-share	SSI		BI		Inclusiveness	
			SM	70	SM	70	SM	70
	EU	0,227	0,274	0,276	0,280	0,133	0,885	1,000
	US	0,144	0,147	0,149	0,085	0,133	0,616	0,999
	Japan	0,066	0,063	0,061	0,070	0,086	0,597	0,823
	China	0,054	0,052	0,051	0,058	0,065	0,581	0,748
	India	0,035	0,033	0,033	0,035	0,042	0,548	0,653
	Canada	0,020	0,018	0,018	0,020	0,023	0,527	0,582
	Mexico	0,015	0,014	0,014	0,015	0,018	0,520	0,568
H.K.	0,015	0,014	0,014	0,015	0,017	0,521	0,562	
Brazil	0,015	0,014	0,014	0,015	0,017	0,521	0,562	
Korea	0,014	0,013	0,013	0,014	0,016	0,519	0,564	
	model (1c)							
	countries	v-share	SSI		BI		Inclusiveness	
			SM	70	SM	70	SM	70
	EU	0,252	0,311	0,321	0,292	0,171	0,907	1,000
	US	0,159	0,157	0,167	0,067	0,171	0,594	1,000
	Japan	0,073	0,070	0,062	0,066	0,119	0,592	0,849
	China	0,023	0,021	0,020	0,027	0,024	0,538	0,572
	Canada	0,023	0,021	0,020	0,026	0,023	0,536	0,569
	H.K.	0,017	0,015	0,015	0,019	0,017	0,526	0,546
	Mexico	0,015	0,014	0,013	0,017	0,016	0,523	0,549
Korea	0,015	0,013	0,013	0,016	0,015	0,523	0,542	
Taiwan	0,013	0,011	0,011	0,014	0,013	0,520	0,541	
Singapore	0,013	0,011	0,011	0,014	0,013	0,520	0,541	

Source: Calculations by the authors;

Note: The table shows the list of ten countries with highest voting weight, denoted as *v-share*, for each model. Then the calculated results for the three indices (SSI, BI, and Inclusiveness), tested for two majority rules (simple majority [*SM*] and 70% majority [*70*]) are shown for each listed Member.

**Table 7b** Voting Power Indices for Top Ten Countries with Highest Votes for Simple and 70% Majority Rule (*Formula-2*)

Formula-2	model (2a)							
	countries	v-share	SSI		BI		Inclusiveness	
			SM	70	SM	70	SM	70
	EU	0,247	0,314	0,315	0,462	0,108	0,961	1,000
	US	0,103	0,099	0,099	0,040	0,105	0,540	0,989
	Japan	0,056	0,053	0,052	0,037	0,073	0,537	0,837
	China	0,045	0,042	0,041	0,033	0,056	0,533	0,760
	India	0,030	0,027	0,027	0,023	0,036	0,523	0,666
	Canada	0,023	0,020	0,020	0,017	0,027	0,517	0,626
	Mexico	0,019	0,017	0,017	0,014	0,022	0,514	0,602
Brazil	0,018	0,016	0,016	0,014	0,021	0,514	0,601	
Korea	0,017	0,015	0,015	0,013	0,020	0,513	0,592	
H.K.	0,016	0,014	0,014	0,012	0,019	0,512	0,590	
model (2b)								
countries	v-share	SSI		BI		Inclusiveness		
		SM	70	SM	70	SM	70	
EU	0,227	0,285	0,285	0,456	0,080	0,965	1,000	
US	0,089	0,087	0,087	0,035	0,079	0,536	0,993	
Japan	0,050	0,047	0,047	0,032	0,061	0,532	0,882	
China	0,039	0,037	0,037	0,028	0,049	0,529	0,805	
India	0,027	0,025	0,025	0,020	0,033	0,520	0,707	
Canada	0,020	0,018	0,018	0,015	0,025	0,515	0,654	
Mexico	0,017	0,016	0,016	0,013	0,021	0,512	0,630	
Brazil	0,016	0,015	0,015	0,012	0,020	0,512	0,624	
Korea	0,015	0,014	0,014	0,012	0,019	0,512	0,617	
H.K.	0,015	0,014	0,014	0,011	0,018	0,511	0,614	
model (2c)								
countries	v-share	SSI		BI		Inclusiveness		
		SM	70	SM	70	SM	70	
EU	0,249	0,321	0,322	0,569	0,092	0,981	1,000	
US	0,097	0,092	0,093	0,023	0,091	0,520	0,997	
Japan	0,054	0,050	0,049	0,023	0,073	0,519	0,897	
China	0,023	0,021	0,021	0,014	0,029	0,513	0,659	
Canada	0,022	0,020	0,020	0,014	0,028	0,511	0,650	
H.K.	0,017	0,015	0,015	0,011	0,021	0,509	0,613	
Mexico	0,017	0,015	0,015	0,011	0,021	0,509	0,613	
Korea	0,016	0,014	0,014	0,010	0,020	0,509	0,609	
Brazil	0,014	0,013	0,013	0,009	0,017	0,507	0,595	
Taiwan	0,014	0,013	0,013	0,009	0,017	0,507	0,595	

Source: Calculations by the authors;

Note: The table shows the list of ten countries with highest voting weight, denoted as *v-share*, for each model. Then the calculated results for the three indices (SSI, BI, and Inclusiveness), tested for two majority rules (simple majority [SM] and 70% majority [70]) are shown for each listed Member.

Having seen the SSI, BI and Inclusiveness indices in relation to tested voting weight allocation, the final remark on power assessment is made by reference to the Coleman Collectivity Index which provides the power of the collectivity to act for a voting body (COLEMAN 1971). In contrast to previous indices which assess voting powers of individual Members, this index provides the ability of the voting body to reach a successful passage of legislation. Hence, this index enables the efficiency level of a given decision-making rule to be assessed.

This index is derived from the number of all winning coalitions, divided by the number of all possible coalitions. The index value can simply be interpreted as the percentage of winning coalitions amongst all possible coalitions<sup>19</sup>. Using our example of weighted majority game [51; 1, 49, 50], there are three winning coalitions out of all  $2^3 = 8$  possible coalitions. Hence, the decision probability index is  $3/8$  or 38%.

Table 8 shows the decision probability index for the current WTO consensus based decision-making rule and the six weighted voting models, each under simple majority and 70% majority rule. Starting from the infinitely close to zero decision probability under consensus ( $P(v) = 1/(2^{129})$ ), all models show a much higher probability that a decision will be taken. For simple majority, the decision probability is about 50% for all models, with minimal deviation. However, there are many differences among different models for the 70% majority rule. Firstly, *Formula-1* obtains almost twice as much probability as *Formula-2* for each of the corresponding models. Secondly, model (1a) exhibits the highest probability of decision-making at 13.6%. Model (1c) is nearly the same as model (1a) at 13.4%, whereas model (1b) is significantly lower at 10%. Somehow, any shift from the consensus based decision-making rule will improve the efficiency of the voting body as a whole.

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19 The formal definition of decision probability index is:  $P(v) = \frac{\sum_{S \in \mathcal{N}} v(S)}{2^n}$ .

where  $v(S) = 1$  if  $S$  is winning (for inclusiveness) and  $v(S) = 0$  if  $S$  is loosing (for exclusiveness).

**Table 8** Decision Probability Indices

Consensus	0.000	Simple Majority	70.0%
		0,497	0,136
		0,498	0,100
		0,499	0,134
		0,499	0,079
		0,499	0,048
		0,500	0,070

Source: Calculations by the authors.

### 2.3.5 Comment on Power Analysis

Although the indices utilised above provide a useful tool for estimating the voting power, special attention should be paid to their common assumption of equiprobable Yes- and No-alternatives. This assumption suggests that these indices are suitable to circumstances where voting practices are at very large number, covering a broad range of issues. As BALDWIN (1994) points out, by way of criticism, some real world considerations have been omitted, such as the question of who sets the voting agenda, how coalitions are formed, or how intensively each country holds its various position. Nevertheless, these may still be the most appropriate tools for the analysis of intrinsic power relations from given voting settings<sup>20</sup>.

From the power assessment conducted in this section, the introduction of a weighted voting system will have different impacts on power relations amongst Members. The shift away from current consensus rule leaves a large number of Members with decreased voting power. However, the distribution of voting power is not only concentrated in favour of industrial countries. In fact, among the top ten countries with the highest number of votes, six Members are developing countries, mainly from the regions of Asia and the Western Hemisphere.

Regarding the balance of power among industrial countries, *Formula-1* is preferable to *Formula-2* because the balance of power within the group of industrialised countries provides much more power to the EU than to the US, by a factor of more than three times. Further, model (1c) showed

20 If the data of voting history were to be obtainable, a modification of BI would be possible to make for a more realistic assessment of power. In fact, correlations amongst Members (or groups) based on different probabilities over Yes and No according to each Member voting history can be introduced. The Monte Carlo technique allows for taking into account such correlations.

more than twice as much power for the EU in relation to the US. Hence, model (1a) or model (1b) would be optimal for industrial countries. In addition, the inclusiveness index demonstrated that the combined interests of the EU and US would almost entirely be reflected in decision-making. Among the models from *Formula-1*, there are conflicting results within developing countries between basic votes and the population variable, although inclusion of these variables generally favours the group as a whole. While the former variable favours all developing regions except for Asia, the latter favours Asia almost exclusively and Africa slightly. If the choice of representation should reflect the interests of more countries, then model (1c) (without population) would be more suitable. Even though the population variable drops, Asia will still retain the highest representation amongst developing countries.

Finally, the decision probability index showed similar results for model (1a) and model (1c), leaving model (1b) with the lowest probability (but not dramatically lower than the others). The optimal voting weight allocation of the models tested is those of *Formula-1*. The final optimal choice amongst these, however, may be left to political acceptance by Member states as each model exhibits favours towards different groups and regions of countries in different combination.

### 3 Conclusion

In this paper we present some possible avenues for the introduction of a weighted voting system to the WTO for the purposes of legislative response in between rounds of multilateral trade negotiations where consensus and package deal approaches are not suitable. The avenues are based upon realistic calculation of voting weights and related power assessments, all with a view to bringing greater efficiency and reflecting the balance of power consideration for the inter-round decision-making processes.

We propose a weighted voting model using contribution, GDP, market openness, population variables, and/or basic votes. In so doing, particular attention has been paid to the achievement of simplicity, transparency and robustness to a changing economic climate and a Member's relative power, as well as fairness regarding the representation of interests between the groups of industrial and developing countries. In particular, we suggested that *Formula-1*, the simplest one which is linear in the share of vote and of individual country variables would be the optimal choice for

actual calculation of weighted voting as it best suits the set of criteria and provides the most reasonable distribution of voting weight and power amongst different groups of countries. The exact choice of models belonging to *Formula-1*, however, is left to the political preferences of Member states and leaves room for the negotiating process. In the same vein, Members may examine the impact of existing rules on voting in Articles IX and X of the WTO Agreement. According to these Articles, authentic interpretation needs to be adopted by 3/4 of the vote, amendments by 2/3 and major fundamental provisions, such as MFN, even by unanimity. The current models calculated on the basis of simple majority and the average 70% majority rule used in this study will need to be further refined and the impact for the inclusiveness of major trading partners extensively studied. The same is true for assessing rules relating to qualified majorities. Whether or not current rules need to be changed will largely depend on the political assessment whether major trading partners will seek to retain a veto power in key areas.

Although gains from introduction of weighted voting may differ widely between different countries, the examined cases show that the voting weight and power will be distributed amongst countries from both the industrial and developing group, whilst fully preserving the interest of economically powerful countries in the process of decision-making. Finally, we would like to emphasise an important implication of our findings: there is a trade-off between the absolute influence that a Member may enjoy in making a decision and the efficiency of the voting body as a whole. The inclusiveness index shows that all countries will have to give up parts of their discretion over decision-making under a weighted voting system, except for the EU and the US under a 70% majority rule. Under consensus rule, in contrast, the protection of all members' vital interests is theoretically assured. The decision probability index, on the other hand, demonstrates the strong inefficiencies of the consensus rule in decision-making at a probability of infinitely close to zero. Under such conditions, Members no longer benefit from an organization whose decision-making is blocked and which is unable to provide legislative response with a view to balance the judicial and political branches of the WTO. The necessity, under consensus, to accommodate all members' interests alike may ultimately undermine the very existence of the organisation. Adopting weighted voting for inter-round negotiations and decision-making will contribute to prevent this taking place in coming years. It allows the asset of effective dispute settlement to be developed and strengthened, while

reinforcing political power with a view to re-establishing the balance of power within the different branches of WTO governance.

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## Appendix A: Evolution of the IMF Quota Formulas

(Source: IMF [2001])

### The Original Bretton Woods Formula

$$Q^C = (0.02Y + 0.05R + 0.010M + 0.10V)(1 + X/Y)$$

where:  $Q^C$  = Calculated Quota

$Y$  = National income

$R$  = Gold and foreign exchange reserves

$X, M$  = Average annual exports or imports over five-year period

$V$  = Maximum fluctuation in exports defined as the difference between the highest and lowest value of exports during five-year period

### 1962/63 Revision of the Formula and Multi-Formula System

The change in quota calculation was made by utilising a dual structure of ten formulae, with different sets of data for each structure, each consisting of revised Bretton Woods Formula and four derived formulae. The use of a different set of data mirrors the improvements in the reporting of invisible transactions and transfers. For example,  $P$ , the current payments in Set II Data, replaced  $M$ , merchandise imports in the Set I Data. Further, the original coefficients were reduced by half for Revised Bretton Woods.

*Revised Bretton Woods:*

$$Q_1 = (0.01Y + 0.025R + 0.05M + 0.2276V)(1 + X/Y)$$

$$Q^*_1 = (0.01Y + 0.025R + 0.05P + 0.2276VC)(1 + C/Y)$$

where:  $Y, R, X, M$  = as defined in original Bretton Woods formula

$Q_1$  = Quota calculated with Set I data

$Q^*_1$  = Quota calculated with Set II data

$C, P$  = Average annual current receipts or payments over a recent five-year period

$V, VC$  = Variability of annual exports or current receipts, defined as one standard deviation from the centered five-year moving average, for a recent 13-year period

Modified Formulae on Set I Data (that use trade data):

Scheme III:  $Q_2 = (0.0065Y + 0.078M + 0.5065V)(1 + X/Y)$

Scheme IV:  $Q_3 = (0.0045Y + 0.070M + 0.9622VC)(1 + X/Y)$

Scheme M4:  $Q_4 = 0.005Y + 0.044M + 0.044X + 1.044V$

Scheme M7:  $Q_5 = 0.0045Y + 0.039M + 0.039X + 1.304V$

Modified Formulae on Set II Data (that use data for trade, invisible transactions and transfers):

The coefficients remain the same but  $V$  and  $X$  are replaced by  $VC$  and  $C$ , respectively, for each scheme.

Scheme III:  $Q_2^* = (0.0065Y + 0.078P + 0.5065VC)(1 + C/Y)$

Scheme IV:  $Q_3^* = (0.0045Y + 0.070P + 0.9622VC)(1 + C/Y)$

Scheme M4:  $Q_4^* = 0.005Y + 0.044P + 0.044C + 1.044VC$

Scheme M7:  $Q_5^* = 0.0045Y + 0.039P + 0.039C + 1.304V$

Calculated quota:

$$Q_c = \text{Max}[\text{Mean}(Q_i, Q_i^*), Q_i]$$

where:  $Q_c$  = Mean of the lowest two of the Mean ( $Q_i, Q_i^*$ ),  $i = 2$  to 5 and the value of  $Q_i$  ( $i = 2$  to 5) and  $Q_i^*$  ( $i = 1$  to 5) have been normalized so that their totals equal that of  $Q_1$ .

**1981/82 Revision of the 1962/63 Formulae** (that use GDP data and a broader definition of reserves)

There are four changes made. First, the five formulae of Set I Data are eliminated and those of Set II Data are utilised exclusively. Second, national income was replaced by GDP for  $Y$ . Third, the measure of  $R$ , reserves, is broadened. Finally the coefficients of four derived formulae are reduced by 20 percent to soften the impact of the sharp price rise due to the oil shocks of 1973/74 and 1979.

Bretton Woods:  $Q_1 = (0.01Y + 0.025R + 0.05P + 0.2276VC)(1 + C/Y)$

Scheme III:  $Q_2 = (0.0065Y + 0.0205125R + 0.078P + 0.4052VC)(1 + C/Y)$

Scheme IV:  $Q_3 = (0.0045Y + 0.03896768R + 0.07P + 0.76976VC)(1 + C/Y)$

Scheme M4:  $Q_4 = 0.005Y + 0.042280464R + 0.044(P + C) + 0.8352VC$

Scheme M7:  $Q_5 = 0.0045Y + 0.05281008R + 0.039(P + C) + 1.0432VC$

where:  $Y$  = GDP in a recent year

$R$  = Average value of gold, SDRs, ECUs, IMF reserve positions, and foreign exchange reserves in a recent year

$C, P, VC$  = as defined in 1962/63.

Calculated Quota

$$Q^c = \text{Max}(Q_1, \text{Mean of lowest two of } Q_2, Q_3, Q_4, Q_5)$$

where the values of  $Q_i$  ( $i = 2$  to 5) have been normalized so that the totals of  $Q_i$  equal that of  $Q_1$ .

## Appendix B: Source of variables

### Contribution

WTO contribution share is determined proportional to each Member's share (%) of total trade of all Members, including trade in goods, services and intellectual property rights for the recent past three years for which data is available. When a Member has less than 0.015 share of total trade, a minimum contribution of 0.015 per cent is allocated in such case.

The contribution of 2003 is used for the calculation of voting weight, which covers the trade period of 1998–2000. The source to WTO contribution calculation is Balance of Payments statistics (BoP) from the IMF<sup>21</sup>. When IMF BoP is not available, National Accounts, IMF International Financial Statistics (IFS) or World Bank Development Indicators (WDI) are referred to. The IMF BPM5 components included in goods and commercial services are:

- *Goods*: (same as BPM5 goods except nonmonetary gold held as a store of value)  
General Merchandise, Goods for processing, Repairs on goods, Goods procured in ports by carriers, Non monetary gold (except nonmonetary gold held as a store of value);
- *Commercial services*: (same as BPM5 services except government services)  
Transportation, Travel, Communications services, Construction services, Insurance services, Financial services, Computer and information services, Royalties and license fees, Other business services, Personal, cultural and recreational services.

### GDP

The level of GDP is calculated as average over three years (1998, 1999, 2000). The data is taken from WDI On-line, whose original data source is World Bank national accounts data and OECD National Accounts data files. The exceptions to this are for the following countries:

- *Cyprus*: National Statistics – current GDP in local currency is converted into US\$ by the exchange rate of the same year;
- *Liechtenstein*: UN Statistics Division (Internet: <http://unstats.un.org/unsd/cdbdemo>). The number is the UN estimate, derived only from 1990;
- *Taiwan*: National Statistics (GNP, not GDP);

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21 For details see WTO, *Methodological Note on The Assessment of Budget Contributions Budget 2003*.

- *Myanmar*: UN Statistics Division (Internet: <http://unstats.un.org/unsd/cdbdemo/>) The number is the UN estimate, derived only from the 1990.

The current GDP in US\$ is used for voting weight calculation, rather than PPP GDP (current GDP is the GDP in local currency converted into current US dollars whereas the PPP GDP is converted into international dollars using purchasing power parity rates). Although the latter may be more appropriate for the purpose of WTO voting weight calculation, the former is utilised for its easiness of data availability.

### **Openness**

Openness is the percentage of average import value to average GDP level both for the period of 1998–2000. The import value is taken from WDI On-line, which takes the data originally from IMF BoP and World Bank staff estimates. The exceptions to this are for following countries:

- *Democratic Republic of the Congo*: DOTS taken from IMF Direction of Trade Statistics 2001;
- *Brunei Darussalam*: DOTS taken from IMF Direction of Trade Statistics 2001;
- *Taiwan*: National Statistics, the undefined imports (C.I.F.), undefined whether goods and services are included (Internet: <http://www.stat.gov.tw/bs8/stat/english1.htm>);
- *Cyprus*: IFS taken from IMF Direction of Trade Statistics 2001;
- *Liechtenstein*: Government website; the import figure was not available and it is substituted by the figure of industrial exports, originally denoted in CHF then converted into US\$ for 1999 and 2000 (Internet: <http://llvweb.liechtenstein.li/lisite/html/liechtenstein/index.jsp>). Exchange rates for 1999 and 2000 are taken from Balance of Payments Yearbook 2002, Country Tables, IMF;
- *Qatar*: IFS for 1998 and 1999 and DOTS for 2000;
- *United Arab Emirates*: IFS taken from IMF Direction of Trade Statistics 2001;
- *Members of European Union* (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Portugal, Spain, Sweden and United Kingdom): The imports from other EU members are subtracted from WDI data. Such intra-EU import statistics is taken from Direction of Trade Statistics – Yearbook 2001, IMF.

### **Population**

The source WDI On-line taking data originally from World Bank staff estimates from various sources including the UN Statistics Division's

Population and Vital Statistics Report, country statistical offices and Demographic and Health Surveys from national sources and Macro International.

The exceptions to this are for following countries:

- *Taiwan*: National Statistics;
- *Liechtenstein*: Office of National Economy, the figure in 2001 is not available is taken from 2000.

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