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Delimiting Regional and Constituency Boundaries: Considering the Impact of Malapportionment, Population Size, Population Density, and Area Size

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This paper focuses on the challenges facing the Third Delimitation Commission of Namibia on the Determination of Regions and Constituencies in its task to find the optimum number of constituencies for each of the country's thirteen administrative regions. It highlights data constraints and draws attention to the issue of malapportionment. Furthermore, it investigates the relationship between three core variables - population size, population density and area size - when determining the number of constituencies for each region. The paper presents two linear regression models and concludes that population size and density are the two significant variables for predicting the number of constituencies. In line with the results of the models, the IPPR recommends that in four regions, Caprivi, Kavango, Khomas and Ohangwena, an additional constituency must be added, whilst in two regions, Omusati and Oshikoto, the number of constituencies must be reduced. Although these reforms would have a positive impact on the degree of malapportionment, it would not remove the problem altogether because of the legal limitations on the number of constituencies any region may have. For malapportionment to be reduced more significantly the existing legal framework must be reviewed.

1. INTRODUCTION

This briefing paper was produced with the intent of highlighting two problems that will affect the workings of the Third Delimitation Commission Of Namibia on the Determination of Regions and Constituencies. These are 1) problems with access to reliable data that will influence the determination of the optimal amount of constituencies per region, and 2) the issue of malapportionment as it influences equal and just representation. In regards with the second issue the Institute for Public Policy Research (IPPR) seeks to highlight the importance of the relationship between three variables. These are: 1) population size, 2) population density, and 3) area size. In this paper, the IPPR developed two linear regression models as an aid for addressing the problem of malapportionment. The first model that included population size, area and population density was modified because one of the variables (area) was found to have no significant predictive value. The second model with only population size and density has more or less the same predictive value as the first but in this model all variables are significant predictors. Our recommendations are based on the second model.

2. REGIONAL AND CONSTITUENCY BOUNDARY DELIMITATION

The term *boundary delimitation* has three meanings. Usually it refers to the process of drawing electoral district boundaries (IDEA, 1998a). Alternatively it refers to the creation of polling areas for

the purpose of assigning voters to those areas. It can also refer to the process of demarcating administrative boundaries, e.g. regional and constituency boundaries. The function of a delimitation commission is to demarcate administrative boundaries that will aid in the effective governing of a country. Namibia has already had two Delimitation Commissions – in 1991 and 1998. The First Delimitation Commission was charged with the original delimitation of regional, local authority, and constituency boundaries (First Delimitation Commission, 1991:3-4). The Second Delimitation Commission was charged under Section 5 of Act 22 of 1992 to make recommendations in regards with: changes of boundaries of existing administrative regions; creation of new regions; or the division or re-division of regions into constituencies (Karuaihe, Hangula & Mbambo, 1998:3). The Third Delimitation Commission is to review the boundaries of the existing regions and constituencies. Currently the issue of concern is not the revision of regional boundaries, but those of constituencies. Whether parts of existing constituencies should be merged with other constituencies, new constituencies added, or old ones removed will be some of the issues the Third Commission will have to address.

Boundary delimitation has always been a political issue and will always remain one. Political parties focus on the impact that boundary delimitation could have on their support base. The reason why boundary delimitation can be so controversial is that where a majority/plurality electoral formula is used, where a boundary is drawn, and who is inside or outside that boundary, literally can determine the outcome of an election¹. Political parties that benefit from the *status quo* tend to resist reform. However, incumbent political parties may manipulate boundaries to improve their position. Boundaries of regions or constituencies are redrawn to include geographical areas that are believed to hold significant electoral support, or to exclude areas of significant opposition, thus improving the chance of winning within a given region or constituency. This practice is known as *gerrymandering*. The term was inspired by the Governor of Massachusetts, Elbridge Gerry (1744-1814), who in 1812 signed a bill that legalized the manipulation of the boundaries of an electoral district in Massachusetts allowing his party to win (Farell, 1997:9). The boundaries of the district had been so distorted that it had assumed the shape of a salamander (Gerry's salamander), therefore the word *gerrymander*. Gerrymandering has little or no effect where a proportional electoral formula is used. Gerrymandering aside, opposition political parties too may also attempt to influence the delimitation process if it is open to lobbying. In Namibia this process is open to lobbying.

More common than gerrymandering is *malapportionment*. Malapportionment refers to: "... a situation in which there are imbalances in the population densities of constituencies which favour some parties over others" (Farell, 1997:8). There are two forms of malapportionment. Where a majority/plurality electoral formula is used, malapportionment is expressed in the form of constituencies that have unequal population sizes but enjoy equal representation. Proportionality is distorted if constituencies with unequal population sizes are allocated the same number of representatives. In multi-member constituencies malapportionment amounts to constituencies having magnitudes out of proportion to their population size². The advantage of this is clear. If one controls a constituency the easiest way to increase representation for one's party is to increase the number of representatives that a district may elect or, if one does not, decrease the number representatives that that constituency may elect. If two constituencies have an equal voting population, but the one say a magnitude of two and the other one of three that clearly constitutes unequal representation. It implies that some constituencies count for more than others.

Malapportionment may occur naturally due to death in or migration of the population, but as with the case of gerrymandering, political parties too may engineer the situation. Of course, malapportionment could be used to promote greater representation from among minority political



identity groups. According to Lijphart (1995:128) malapportionment is hard to avoid where a majority/plurality electoral formula is used in conjunction with single-member districts because it would require a large amount of small districts with equal populations. It is less of a problem where a proportional formula is used in combination with large electoral constituencies and geographically pre-determined seat allocations. This problem does not occur where a country constitutes a single electoral district. Lijphart (1995:15) notes that malapportionment often takes the form of rural and regional overrepresentation. The key issue is the voters/representatives or population/representatives ratio. If no prescription is in place to dictate the number of voters or size of the population to be represented by a representative or representatives, then it becomes possible for great inequalities to develop or be created, with implications for political stability.

The only way to mitigate political interference in boundary delimitation is to utilize a set of criteria for boundary delimitation that can counter-balance political interference. This is not to say that political opinion is irrelevant to the issue of boundary delimitation, but that it is not the only consideration. An absolutely fair delimitation system would ensure that the population of a region or a constituency would be the same across all regions and constituencies irrespective of any other factors. This is the theory. In practice, trade-offs will always have to be made. In its report the Second Delimitation Commission (Karuaihe, Hangula & Mbambo, 1998: vii, 4) outlined some of the factors it had to consider: the number of eligible voters normally resident within a region or constituency; the geographical features thereof; the infrastructure, available resources, and means of communication therein; the socio-economic milieu; the boundaries of districts, local authorities, and settlements; factors that would influence the performance of the Regional Council and its members within the region or constituencies; distance from the administrative centre of a region; migration trends; and any other factors considered relevant to the objectives of the Commission. "The views expressed by the public in general were regarded by the Commission as very important and they were accordingly afforded due weight and consideration in the decision-making process" (Karuaihe, Hangula & Mbambo, 1998: vii).

The Second Boundary Delimitation Commission used a statistical formula as a guideline as to how many constituencies each region should have (Karuaihe, Hangula & Mbambo, 1998:11). First, it was used to determine the average number of voters per constituency. The number of eligible voters in the country was taken and divided by the number of constituencies in the country in order to arrive at the average number of voters per constituency ($658,943/95 = 6,936$). Then the number of eligible voters for a region was divided by the average number of voters per constituency in order to determine how many potential constituencies there should be in that region.

This approach is flawed for several reasons. Firstly, it assumes that the voters' registration roll is accurate and up to date. The voters' roll for Namibia was compiled between 1992 and 1999 but was scrapped in 1999 because of the unacceptable amount of flaws it contained. Secondly, not all eligible voters are registered. Thirdly, eligibility to vote does not necessarily translate into political activity. Fourthly, not only eligible voters are entitled to representation. Children, migrant workers, political refugees, and economic refugees also have valid interests. Fifthly, and related to the fourth point, this approach cannot provide one with a realistic understanding of the potential workload a representative may face given the fact that he/she has to deal with issues pertaining to the total population of a constituency, and ultimately a region. Therefore, it is more realistic to take the total population size of the country, and regions, as the base for the calculation. Of course, this implies that up to date census information be available.



3. POLITICAL ORGANIZATION AT THE REGIONAL AND CONSTITUENCY LEVEL

Namibia is divided into thirteen administrative regions. Each region is split into constituencies. Each constituency elects a councillor whom is allocated a seat in the Regional Council of that region. Councillors are elected by means of a plurality electoral formula. Each region must have a minimum of six constituencies, but no more than twelve. This translates to a possible 156 regional councillors for the country. The 13 Regional Councils fall under the supervision of the Ministry of Regional and Local Government and Housing, which is directly responsible for the planning and administration of the towns and villages in Namibia (McLean, 2000). The Regional Councils Act of 1992, the Townships and Division of Lands Ordinance of 1963, and the Town Planning Ordinance of 1954 provide the legislative base for the Regional Councils. The direct planning tasks of the Regional Councils are mostly confined to the rural areas. Urban areas fall under the control of Local Authorities (municipalities). The Regional Councils have four principal tasks: to assist in the drafting of proposed legislation impacting on the regions; to identify settlement areas in need of local authorities; to assist the President or any Minister on matters pertaining to the regions and/or constituencies; and to make recommendations to the Minister of Finance on financial matters affecting the regions and/or constituencies. Each Council elects a Regional Governor whom *inter alia* chairs that Council.

Councillors that supervise rural constituencies face different pressures from those that supervise urban constituencies. Councillors of urban constituencies enjoy the benefits derived from the existence of Local Authorities. Citizens living in urban have a choice whether they approach the Local Authority or their Regional Councillor in order to address any grievances they may have. These councillors enjoy the additional advantage that though they may have to supervise a large concentration of people, they have a much smaller geographical area to cover in order to reach constituents. Infrastructure in urban areas also tends to be better developed. In Namibia, Councillors working in rural constituencies face the opposite. Their constituents tend to be more dispersed with poorer infrastructure at their (the Councillors') disposal and vast distances to travel. The same holds for the constituents who face the same difficulties in reaching their Councillors. This does not factor in the relative prosperity and level of education of the constituents or the level of cultural cohesion among those constituents. In theory, constituents living in urban areas could enjoy higher quality of representation.

4. FINDING RELIABLE DATA SOURCES

The terms of reference for the Commission stipulates that the number of eligible voters be used as a variable when deciding on the number of constituencies for each region. Herein, lies a potential problem as currently no accurate data on the exact number of eligible voters exists. This is due to the fact that the *2001 Population and Housing Census* data has not been released yet. This problem is compounded by the fact that the logical alternative data source, the existing voters' registration roll, has serious shortcomings and hence, cannot be used either. Without accurate data, the Commission's work will be compromised.

The most preferred solution to the data problem is that the Commission approach the Census Office of the National Planning Commission for the required census data. If it is not possible to access the latest census data, the IPPR proposes that the Commission use the total population and not just eligible voters as the basis for its decisions. This is in line with mainstream democratic theory that states that all citizens, not just eligible voters, are entitled to equal and fair representation, and under human rights theory that foreign citizens too are entitled to humane and



just treatment. From this it logically follows that the total population should be used when deciding upon the number of constituencies in a region. This data is available in the Preliminary Report of the *2001 Population and Housing Census*. Although this report contains a breakdown of the total population by region and constituency, it contains no information regarding eligible voters. Since the IPPR did not have access to data on eligible voters, it used the preliminary total population data from the *2001 Population and Housing Census* for the models presented here.

5. REGRESSION ANALYSIS

Regression analysis is a method that relates the variance in one or more independent (or predictor) variables to the variance in the dependent variable³. The outcome of the analysis is usually an equation that takes the form of: $y = c + b_1x_1 + b_2x_2 + b_3x_3 + e$, where c is a constant, b is the slope and e is the prediction error. In this paper, two linear regression models were developed to predict the number of constituencies (dependent variable) that a region should have, taking into account 1) its population size; 2) its population density; and 3) its area in square kilometres (these three are the predictor variables). This model thus *predicts* how many constituencies a region should have, and our recommendations are based on the difference between the model's predicted number of constituencies and the actual number of constituencies that each region have at the moment. The overall prediction value of the model is displayed as the value of R^2 . The value of R^2 is somewhere between 0 and 1 where 0 represents no relationship (or prediction) and 1 a complete relationship (or prediction). Thus, the closer the value of R^2 to 1, the stronger the explanatory (predictive) value of the model.

6. THE ISSUES

Equal and Just Representation: The Issue of Malapportionment:

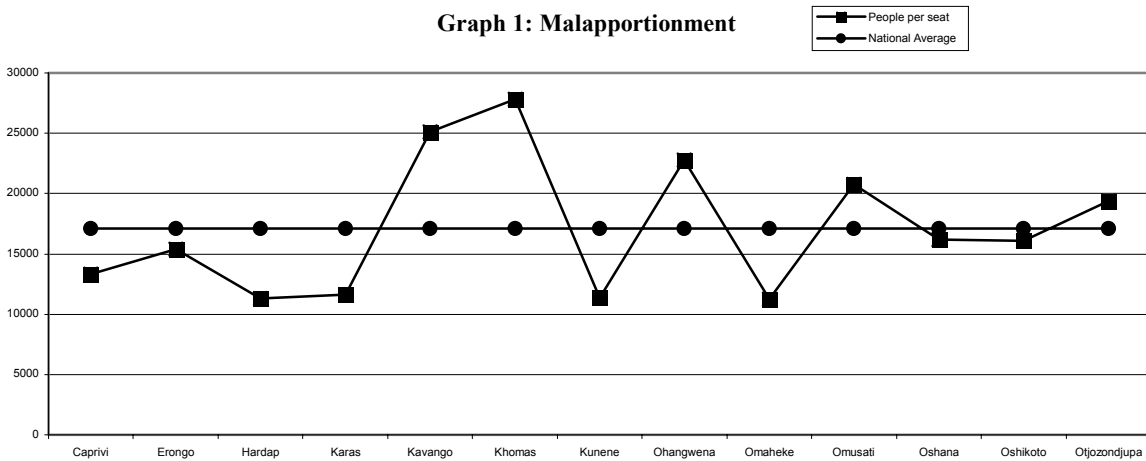
The IPPR is concerned with the degree of *malapportionment* that currently exists in the country. Generally malapportionment develops where legal limits on the number of constituencies exist (as is the case in Namibia) or due to natural changes in population numbers. Where these two factors combine, malapportionment develops more rapidly.

Graph 1 shows that in some regions, representatives have more citizens to represent than others. These are the regions that currently appear above the national average in the graph⁴. It is our position that, as far as possible, all representatives should have the same burden and that the Commission take this into account when deciding on the final number of representatives (constituencies) in any given region. Since malapportionment also develops naturally in all societies due to migration, births and deaths, it is always necessary to periodically review the degree of malapportionment and introduce changes to offset its impact. Such changes will improve the quality of representation, as it will reduce the burden for those that are over-committed with the number of citizens they have to represent.

If one examines Graph 1, then only four of the thirteen regions have a level of representation close to the national average. These are Erongo, Oshana, Oshikoto, and Otjozondjupa. Four others (Kavango, Khomas, Ohangwena, and Omusati) are significantly above the national average and thus are "over-represented". The remaining five regions, Caprivi, Hardap, Karas, Kunene, and Omaheke are significantly "under-represented".



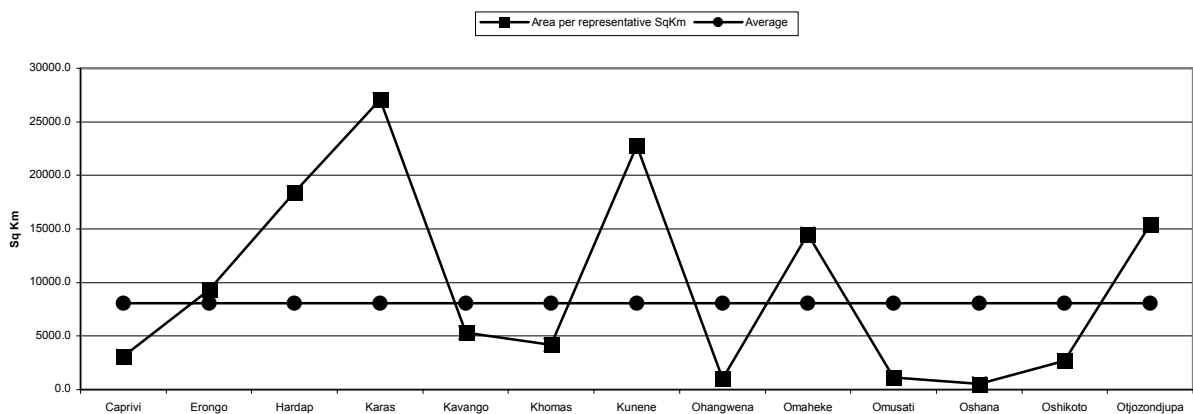
Graph 1: Malapportionment



The Relationship Between Population Size, Population Density, and Area Size

The issue of how many constituencies to allocate to each region would have been easy to resolve if the Namibian population was equally spread across all regions and if all regions were equal in size. Under these ideal conditions, population size, population density, and area size would not be an issue. As indicated by Graph 2, this is not the case in Namibia. It shows that some representatives have much larger areas to cover than others, which in turn, add to their existing burden. This would have a negative impact on the quality of representation for citizens living in large, less densely populated regions, e.g. Karas and Kunene. The three variables have conflicting effects. Small regions with large population sizes also tend have high levels of population density. Representatives in these areas are likely to have a higher burden with regards to demand for service but a lower burden in terms of the distance travelled to reach constituents. The opposite is true for large regions with small population sizes and low levels of population density. Representatives may have a lower demand for service to contend with, but they have to travel greater distances to reach constituents. The challenge is to balance the impact of these three variables against the influence of malapportionment.

Graph 2: Area by representative (Sq Km)



7. THE MODEL



The first linear regression model took into account the size of the region, population density, and the size of the area as measured in square kilometres (km²). This model showed that the three variables explain some 87% of the variance in the number constituencies per region (R² = 0.868). The model is defined by the equation:

$$\hat{Y} = 5.316 + 1.57x_1 + 7.33x_2 - 3.59x_3$$

(Where x_1 is population size; x_2 is population density; and, x_3 is area size.)

Table 1: Regression Coefficients for Population Size, Density and Area^a

		UNSTANDARDIZED COEFFICIENTS		STANDARDIZED COEFFICIENTS	T	SIGNIFICANCE
Model		B	Std. Error	Beta		
1	(Constant)	5.316	1.043		5.096	.001
	Population	1.565	.000	.568	3.316	.009
	Density	7.334	.033	.384	2.197	.056
	Area	-3.585	.000	-.099	-.507	.625

^a Dependent Variable: Seats

Of the three independent variables entered, population size is the one with the strongest predictive value and area, the one with the weakest. In fact, its predictive value is insignificant at both the 0.01 and 0.05 level. This suggests perhaps that past Commissions were less concerned with area size when they designed the number of constituencies than with density and population size.

This is clear if we omit “area” from our first model. The second model’s equation now reads:

$$\hat{Y} = 4.862 + 8.2x_1 + 1.68x_2$$

(Where x_1 is population size; and x_2 is population density)

This model explains approximately 86% of variance in seats (R²=0.864) showing the insignificance of ‘area’ as predictor. In the new model both population size and density is significant, although the former has stronger predictive powers.

Table 2: Regression Coefficients for Population and Density^a

		UNSTANDARDIZED COEFFICIENTS		STANDARDIZED COEFFICIENTS	T	SIGNIFICANCE
Model		B	Std. Error	Beta		
2	Constant)	4.862	.514		9.457	.000
	Density	8.198	.028	.429	2.968	.014
	Population	1.679	.000	.609	4.216	.002

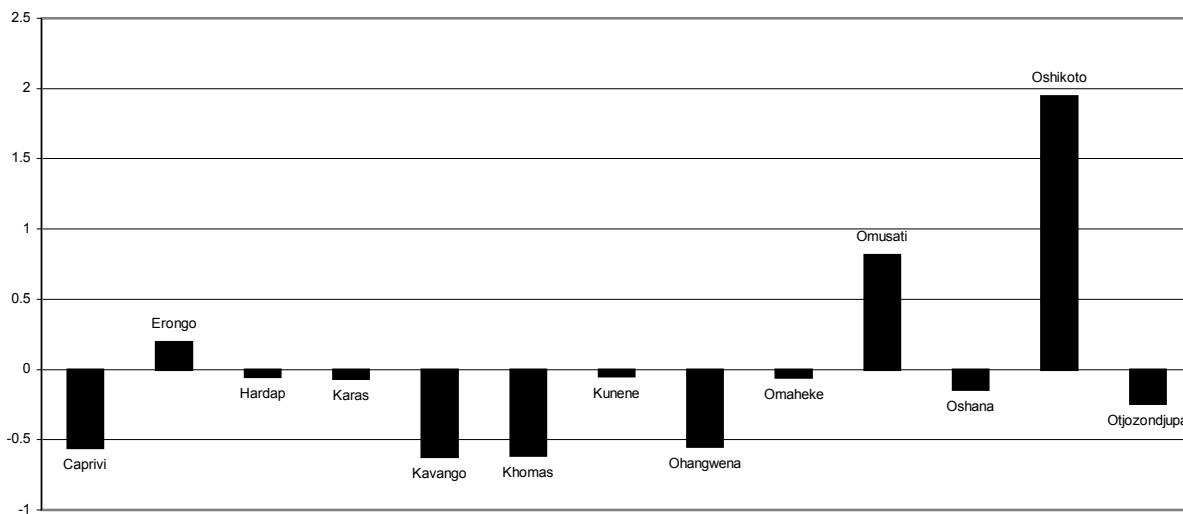
^a Dependent Variable: Seats

Finally, an analysis was undertaken of unstandardised residuals⁵. In this case the residual would be the difference between the actual amount of constituencies per region and that predicted by the model. Where a residual is large, the actual number of constituencies will be significantly more or less than what is predicted by the model. Graph 3 shows that the regions with the largest residuals are: Caprivi, Kavango, Khomas, Ohangwena, Omusati and Oshikoto. The latter two regions have large positive residuals and that means that their current number of constituencies is more than what is predicted by the model. The number should be revised downward. For the other four cases



the opposite applies: the current number of constituencies is less than predicted by the model and, hence, more constituencies should be added to those regions.

Graph 3: Unstandardised residuals - Model 2



8. THE RESULTS

The number of constituencies predicted by the model is contained in Table 3 below. The model does not suggest an increase in the number of constituencies overall, but does identify changes to the existing number of constituencies in six regions⁶.

Table 3: Current and Predicted Number of Constituencies by region

	CURRENT	PREDICTED
Caprivi	6	7
Erongo	7	7
Hardap	6	6
Karas	6	6
Kavango	8	9
Khomas	9	10
Kunene	6	6
Ohangwena	10	11
Omaheke	6	6
Omusati	11	10
Oshana	10	10
Oshikoto	10	8
Otjozondjupa	7	7
Total	102	102

The model predicts that in Caprivi, Kavango, Khomas and Ohangwena there is a need to add one (1) constituency to the existing number in each region. In Omusati, one constituency should be removed, perhaps by merging it with one or more constituencies, and in Oshikoto two (2) constituencies should be removed. In the remaining regions, the number of constituencies should remain the same.



It is important to understand that changes to the number of constituencies in a particular region are suggested because the relationship between the number of constituencies on the one hand, and the population size, and population density on the other hand, is imbalanced compared to the rest of the country. These recommendations are thus presented in this spirit. It is also important to understand that our model was developed within the existing legal framework that predetermines the range within which new constituencies can be proposed. It is this legal threshold that is the main source of malapportionment and as such it should be reviewed at some stage in the future to account for changes to the population size. Thus, this model does not provide a complete answer to the problem of malapportionment, but it does reduce it within the boundaries of the *status quo*.

9. CONCLUSION

In this paper the IPPR highlighted some of the challenges faced by Namibia's Third Delimitation Commission when reviewing the number of constituencies for each of the country's thirteen regions. We have also argued that it is well in line with mainstream democratic theory to use total population instead of eligible voters as the basis for determining the number of representatives and this is recommended because of the unavailability of reliable and up-to-date census data. The models that we developed showed that population size and density, are the two significant predictors of the number of constituencies in each region. The results of the modelling exercise show that four regions, Caprivi, Kavango, Khomas and Ohangwena, are in need of an extra constituency. Also, two regions, Omusati and Oshikoto, need to have their number of constituencies revised downward. Because of the legal limit on the number of constituencies that currently exists, these reforms will not remove malapportionment completely, but will reduce it significantly.

With this paper, we also showed that statistical techniques could aid in the effort to determine regional and constituency boundaries. The linear regression model the IPPR presented here is but an example of a model that can be developed. The aim was to produce a statistical model that can serve as a frame of reference alongside other factors considered in the delimitation of regional and constituency boundaries. By statistically quantifying representation, and by controlling for factors that impact on the quality of representation, the IPPR hopes to contribute on the quantitative side of the debate on boundary delimitation. Much of the Commission's information will be qualitative in nature and is therefore hoped that the model presented here could serve as a counterpoint to political expediency.

¹ What distinguishes a majority and a plurality electoral formula is that one of two principles is applied in order to elect representatives. A Candidate has to achieve either a *minimal* or an *absolute majority* to become eligible for office. A candidate achieves an absolute majority when he/she unites at least fifty percent plus one more votes of all the valid votes cast. He/she achieves a minimal majority or plurality of the valid votes cast when he/she polls at least one more vote than his/her closest rival. Only that candidate is elected. Where a proportional electoral formula is used all the votes are pooled for political parties and the available seats proportionally distributed between the parties according to a specific quota formula. It cannot be used where single representatives are elected.

² Magnitude here refers to the amount of representatives that a constituency can elect, and not the size of the voting population or the population size of that constituency.

³ Variance is a quantity equal to the square of the standard deviation. The standard deviation is a measurement of dispersion of values around a mean (an average).

⁴ The national average was calculated by dividing total population of a Namibia by the number of constituencies in the country.

⁵ The observed value of the dependent variable minus the value predicted by the regression equation, for each case. Large absolute values for the residuals indicate that the observed values are very different from the predicted values.

⁶ There is a legal limit to the number of constituencies in any given region.



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