

Response to the consultation on reform of police funding
arrangements in England and Wales

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The Home Office recently proposed a new model for the allocation of government funds for the 43 police forces in England and Wales. They state that there are five principles for a good funding model. Principle 1 is that it should be robust “the model should be analytically sound, and use objective indicators based on robust data to allocate funding on the basis of relative need”

The method that the HO propose to use to determine funding is problematic and as such compromises this principle. There are a number of reasons:

1. No adequate empirical or theoretical justification is provided for the use of the list of variables

A full list of variables to be considered in the task of measuring demand are chosen on the basis that they are considered to be indicators of three broad elements that are argued to be indicative of demand – population levels; characteristics of a local population; the environmental characteristics of police force areas. However, it is not clear on what basis this decision has been made. The decision as to what factors best indicate need should be based on the best available evidence as the resulting full list of variables and consequent final variables are obviously crucial in determining funding allocation. The only evidence referred to appears to be a police college report. There is a wealth of literature on drivers of crime rates and given the point made in point 4 below it is reasonable that this literature should be considered when drawing up a preliminary set of variables to be examined. See for example Blumstein and Rosenfeld (2008); Farrell, et. al. (2010); Zimring and Fagan (2000)

2. There is no empirical evidence that the five variables chosen in the proposed model adequately measure demand.

In the first stage of the analysis reliability analysis¹ was used to identify which variables best describe each of the three broad elements that are assumed by the Home Office to be indicative of police demand. It is important to be mindful again of the need for a theoretical and empirical justification for the choice of these variables as considered point 1 above. Despite the lack of such a justification, a number of potential variables are discussed as useful indicators for each of these elements. Cronbach’s Alpha is used to measure reliability. That is, for each element, to what extent are the relevant variables measuring the same underlying construct. For each element the variable that accounts for the largest share of the variability in the underlying construct is chosen as the variable of choice. However, this statistical technique is purely exploratory and does not provide any statistical evidence that these variables are in fact valid indicators of the individual elements. Rather, in this case Cronbach’s Alpha simply describes how well related each of the variables under consideration are related to one of the three unobserved elements that is **assumed** to be related to total demand. If there is no justification for trying to measure the three broad elements then there is no justification that the final five variables are actually indicators of demand.

¹ Reliability analysis is used to determine whether it is justifiable to use aggregated scores as a measure of some underlying construct

3. Even if the final five variables do measure demand adequately there is no statistical evidence that these variables are related to demand in the way suggested by the weights.

It is standard practice in statistics to attempt to explain variability in social phenomena by fitting statistical models. This is because it is accepted that observed measures come from some probability distribution. That is, chance is operational in the mechanisms generating social data. Therefore what is observed/measured in a particular year may not be a true reflection of the phenomena. A related reason why statistical models are used is so that claims can be made about how well the model fits the data. Without being able to determine how well a model fits the data it is not possible to determine the nature or strength of the relationship each variable has with the outcome. For example it is not possible to argue that population is the variable that accounts for the largest share of the variability in demand.

The five final variables used are analysed via principal component analysis (PCA). PCA is a variable reduction procedure. As with reliability analysis, there is no statistical model underlying principal component analysis. It is an exploratory method used to for the extraction of a solution, from a large set of variables, of latent variables which are of a lower dimension. As no assumptions are being made about the underlying probability distributions of the variables included in the analysis it is not possible to make inferences about how well the model fits the data and in turn it is not possible to make statements about the relative importance of each variables and so it the weights given to each variable in the proposed model should not be relied upon.

4. The Home Office claim to be trying to account for variation in demand but there are inconsistencies in this respect

Although the consultation claims that police recorded crime (PRC) is not being used as the outcome, on a number of occasions the justification for examining the chosen indicators is their (apparent) close relationship with PRC. In order to lay the foundations for the choice of indicators, Chapter 5 is devoted to drivers of crime. Furthermore, in paragraph 6.5 the size of the population is described in terms of how well it relates to PRC. And paragraph 6.7 states that “a broad range of factors were examined to identify which most closely describe differences between forces in terms of variations in crime...Using [reliability analysis] two socio-economic factors that are ***closely correlated with the patterns of crime seen between different areas over time*** were identified”.

5. Police demand is multidimensional.

The way in which principal component analysis has been used in developing the proposed model makes the assumption that there is only one dimension to police demand. What evidence is there for this? What about other dimensions such as rurality? A better approach to the analysis that would take this into account is outlined briefly in the conclusions.

6. The proposed model assumes that the five variables used to measure demand are mutually exclusive. This is completely contrary to the requirements of a set of variables that are considered as a principal component in PCA.

By definition, the variables that make up a component being analysed by principal component are all correlated. They are not mutually exclusive. If the variables are not mutually exclusive then

interactions should be considered. If they are not then the importance of these variables to demand cannot be determined.

7. The proposed model assumes that the same relationship between the five variables and demand hold in all police forces.

One size does not fit all. The proposed model assumes that the relationship between each variable and demand is identical in each police force. If PRC is used as a proxy for demand then it can be seen that this is highly problematic. An examination of PRC across the 43 police forces shows that each force is characterised by a different mix of crime. This means that a more nuanced approach is required in determining the factors that explain demand (for each force). Evidence has shown time and again that different drivers are needed to explain different types of crime and that the effect of the different drivers is different for different types of crime.

8. The population variable is problematic

Paragraph 5.3 states that “determining the relative resource required in each force area means understanding more about the population of that area and the demand that this creates on local police services.” However, the final measure used for the population is simply the number in each the population for each police force area. More consideration is needed here of a more suitable measure. For example, is demand related to potential victims or offenders? If it is related to victims and significant proportions of the population in a police force area are of an age that are more likely to be victimised then this should be reflected in the measure used.

9. Excluding other variables (especially those related to non-crime activity) is based on the erroneous assumption that the variables in the model adequately account for variability in demand

The reasoning for not including other variables (e.g. MAPPA offenders, missing persons, and alcohol related hospital admissions) is that these variables were found to be correlated to the five variables used in the proposed model. But as already stated there is no justification for the five variables and only the five variable to be in the model.

10. The model is too simple

Whilst parsimony is something that is desired in much statistical work, this should always be balanced with ensuring that models or summaries of data capture the complexity of the phenomena that they attempt to measure. The model proposed here needs to be far more nuanced if it is to explain demand.

11. The level of detail of analysis is inadequate

For example, it's not clear what the sample size is for each variable. Is it 43 (one value for each force)? Or is it bigger – are there a number of measures for different years. It is impossible to determine the adequacy of the data used for the task in hand without this type of detail. Furthermore without this detail it is not possible to conduct a rigorous and fair consultation.

Conclusions/recommendations

The Home Office state that “the methodology underpinning funding allocations should be based on standard statistical techniques”. The methodology used in developing the proposed model is by no means standard and rather ad-hoc. Furthermore the Home Office argue that “a police funding model ... needs to draw on information which can help explain why crime and demands on the police are different between force areas so that relative resources required across force areas can be determined”. There is no evidence that appropriate efforts have been made to incorporate relevant research that explains drivers of resource.

It is understandable that PRC should not be used as an outcome measure and the full list of variables whilst there is no justification for using these (and not using) others does seem prima facie reasonable. At the very least, a more acceptable approach would have been to enter all the variables into a principal component analysis to produce a multidimensional measure of what could be considered demand.

References

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