MEASURING THE RELATIVE EFFICIENCY OF CITY POLICE DEPARTMENTS IN TURKEY BY USING DATA ENVELOPMENT ANALYSIS

İl Emniyet Müdürlüklerinin Verimliliklerinin Veri Zarflama Analizi ile Ölçülmesi

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Özet

Türkiye'de polislik hizmetlerinin etkililiği yıllardır sorgulanmaktadır. Polis örgütlerine tahsis edilen kaynaklarının kullanımı ve dağıtımı da birçok vatandaş ve araştırmacı tarafından tartışılmaktadır. Emniyet müdürlüklerinin performanslarını değerlendirecek bir sistem olmadığı için, her emniyet müdürlüğünün kaynaklarını ne kadar etkili kullandığı bilinmemektedir. Bu araştırma, Veri Zarflama Analizi (VZA) kullanarak emniyet müdürlüklerinin karşılaştırmalı olarak etkili yönetilmesini sorgulamaktadır. Bu çalışmada amaç, VZA çerçevesinde, harcama-etkililik (veya faydamaliyet) analizi yaparak emniyet müdürlüklerinde iyi yönetim uygulamalarını tespit etmektir. Emniyet hizmetleri personel sayısı, emniyet müdürlüklerinin harcamaları ve kaydedilen suç sayısı girdi olarak kullanılmakta iken; gözaltı sayısı ve çözülen suç olaylarının sayısı çıktı olarak kullanılmaktadır. 81 emniyet müdürlüğünden 10 tanesinin etkili yönetildiği bulunmuştur (100%). Buna rağmen, birçok emniyet müdürlüğünün etkililik skorları 100'e oldukça yakındır. İlginç olarak, hemen hemen bütün polis müdürlüklerinin etkililik skorları yüzde 70'in üzerindedir. Emniyet müdürlüklerinin etkililik skorlarının yüzde 50'den az olmaması dikkat çekicidir.

Anahtar Kelimeler: Veri Zarflama Analizi, Türk Polisi, Etkililik, Polis girdileri ve çıktıları, Performans ölçümü.

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Abstract

The efficiency of the police service has been called into question for decades in Turkey. Similarly, many researchers and citizens have reservations concerning the effectiveness of police resource allocation. It is unknown as to how efficient each department is in their use of resources because there are no set performance evaluation systems in place for each police department. This paper investigates the relative efficiency of all local police departments in Turkey via Data Envelopment Analysis (DEA). The goal was to identify good management practices in the police departments by evaluating cost-efficiency within a DEA framework. This research used the number of sworn police personnel, the total expenditures of police departments, and the number of recorded crimes as input data. Outputs were the number of arrests and the number of cleared cases. The results showed that only 10 out of 81 police departments are 100% efficient. However, most of the efficiency scores of police departments were very close to 100, and interestingly, almost all departments had efficiency scores above 70%. Notably, none of the local police departments in Turkey had efficiency scores of less than 50%.

Key Words: Data Envelopment Analysis, Turkish Police, Efficiency, Police inputs and outputs, Performance measurement.

Introduction

The Turkish National Police (TNP) is one of the most visible public organizations in Turkey. Its successes and failures are widely publicized in the media (Gultekin, 2005:33, 54). The problem of efficiency and the quality of policing service in Turkey has been called into question for decades. Recent increases in street crime have resulted in an increased scrutiny of police efficiency and effectiveness (Göktas, 2005). The efficacy of police work is a very controversial issue in Turkey because some consider police service to be effective, whereas others characterize the police as being ineffective (Türk Hukuk Sitesi, 2010; TBMM Tutanak, 2006). However, there is not enough evidence to support either claim.

Similarly, many researchers and citizens question the effectiveness of resources used by law enforcement organizations. Some local police departments have large numbers of sworn police officers and adequate equipment to effectively carry out their responsibilities. In contrast, other local police departments state the need for more officers and equipment to cope with increased amounts of criminal activity (Cerrah, 2006; Dede,

2005; Ovur, 2005) which, in turn, necessitates larger budgets for these agencies. An inadequate number of officers is the most commonly cited complaint among police administrators tasked with preventing crime and ensuring public safety. Clearly, most police departments would like to hire additional officers to fight crime effectively and efficiently (Walker, 2001:77).

Nevertheless, it is unknown as to how efficient each department is in their use of resources because there are no set performance evaluation systems in place for each police department. Although each police department compares their current crime statistics against the previous year's, this does not mean that they use their resources more efficiently or achieve the desired outcomes. Therefore, statistical analysis is needed to measure the efficiency of police departments and to determine whether departments actually need more officers and higher budgets as indicated by police administrators.

Are police departments understaffed? Do they have sufficient budgets to effectively perform policing functions? Do they use resources efficiently? Do they need more resources? To answer these questions, we performed Data Envelopment Analysis (DEA), a special statistical technique, to calculate efficiency scores of organizations that perform the same or similar functions, to evaluate and investigate the relative efficiency of all the local police departments in Turkey. Our goal was to identify good management practices in the police departments by evaluating cost-efficiency within a DEA framework. The results of this research can be used to assist police departments in delivering more efficient services to the community and to better use governmental resources. Accordingly, this research employed the number of sworn police officers, expenditures, and the number of recorded crimes as inputs, since the police make use of these resources to arrest criminals and to clear cases. The number of arrests and the number of cleared cases were used as outputs in DEA analysis because the police are expected to act accordingly. The results of DEA showed the relative efficiency scores of police departments and will enable researchers, policymakers, and readers to compare these scores among the departments. In other words, DEA results will reflect whether local police departments use their resources efficiently to catch criminals and to clear crimes.

1. Literature Review

Data Envelopment Analysis (DEA) is a technique that is widely used to assess the efficiency of organizations, particularly nonprofit and public ones. DEA is a valuable analytical instrument that may be used to compare the performance of public organizations, which perform the same or similar functions. DEA, in other words, is another approach to the comparative performance evaluation and can measure the relative performance of numerous public agencies (Nyhan and Martin, 1999:18).

DEA focuses on finding efficient and inefficient decision making units (DMU) by comparing the inputs and outputs for a DMU to the levels allowed by the model's production possibility or reference set (Li, 1996:27). Policy makers and policy evaluators can use DEA while comparing service providers as an alternative approach to ratio analysis and regression analysis (Choi, 2005:219). The results of DEA may be of important managerial value because DEA provides an efficiency score for each DMU relative to all other DMUs in the sample. Furthermore, it gives recommendations for potential improvement. In addition, it helps managers and regulators to concentrate their attention on the DMUs that DEA has shown to be inefficient (Sexton, 1986).

A DMU may be a public agency which has similar inputs and outputs in comparison to other agencies. For instance, local police departments in different cities are decision-making units because they use similar resources and they produce similar outputs. DEA employs paired data components such as inputs and outputs, and ranks DMUs based on their comparative performance (Nyhan and Martin, 1999:19).

DEA can assist researchers to determine the relative efficiency of units and to compare efficiency scores, to make vital information evident, to utilize resources more efficiently, to attain information for planning strategy, to identify low performers, to discover high performers, and to dig deeper than the "bottom line" (Hussein and Jones, 2001).

As Hussein and Jones contended, the public sector, hospitals, schools and other "unit based" organizations can use Frontier Analyst Software, which runs DEA, to examine the relative efficiency of their units. This computer program calculates the ratio of output to input for all of the variables, and calculates an efficiency score for each of the units under

examination. The program also identifies potential improvements for inefficient units.

When the comparative efficiency of police organizations is measured, appropriate inputs and outputs must be used (Drake and Simper, 2003:708). As an example, the authors evaluated the inputs and outputs utilized to measure the efficiency of English and Welch police organizations. They pointed out that in order to produce relative measures of policing services, police organizations must use resources (inputs) for delivering services (outputs). Thus, only related inputs and outputs should be used for DEA. According to the authors, the validity and strength of the relative efficiency results depend on the specification of a suitable set of inputs and outputs. In addition, they emphasized that the efficiency analysis should be related to inputs employed during a given period and outputs generated in the same period.

Efficiency may be described as the association between appreciated inputs and desired outputs (Dilulio, 1993; 146). Efficiency can also be defined as "maximizing outputs from a given set of inputs, or minimizing the inputs necessary to achieve a given level of outputs" (Dilulio, 1993; 146). This indicates that while keeping its resources constant, an organization will put all of its efforts toward increasing its outputs. In other words, while maintaining outcomes, such as products or services, at a constant level, the organization can put all of its efforts toward decreasing the resources used, such as spending less money and/or hiring fewer people.

DEA is used in the calculation of many countries' law enforcement efficiency. Verma and Gavirneni (2006:125-145), for example, measured police efficiency in India's 25 states by DEA. The authors utilized total expenditure, number of sworn personnel, number of investigators, and number of investigated cases as inputs. In addition, the authors used the number of arrests, number of people charged, number of people convicted, and number of trials completed as outputs. The authors selected these inputs and outputs based on data availability and personal experience. They used "reported crime" as an input, because the number of reported crimes was an input for investigation and prosecution of crimes. The authors found that eleven out of the twenty-five states had efficient police agencies.

Law enforcement efficiency in Taiwan was also measured through DEA. Sun (2002:51-71) employed DEA to measure the comparative efficiency of the 14 police divisions in Taipei City. The author collected data from Taipei Municipal Police Department Statistics between the period of 1994 and 1996. The author used four inputs: the number of sworn officers, the number of recorded burglary cases, the number of recorded offences, and the number of other recorded crimes. In addition, the researcher employed three outputs: the number of cleared burglary cases, the number of cleared offense cases, and the number of other cleared crimes.

Likewise, Drake and Simper (2000:58-61) investigated the comparative efficiency of the English and Welsh police agencies. Inputs used in their research included: employment cost, premises-related expenses, transport-related expenses, and capital and other expenses. Their outputs were: the number of traffic offenses and the number of cleared crimes. They separated their sample police agencies into four groups: the Metropolitan English, Welsh, and the Metropolitan and London police forces. These groups were used by the researchers to compare police agencies based on geographic conditions and economic dimensions.

Nyhan and Martin (1999:22-24) compared the performances of numerous municipal and county governments by using DEA, and they also measured law enforcement efficiency. The authors selected 20 police departments and used: cleared cases, including property and violent crimes, response time, and the crime rate as outputs. In addition, they employed population, median income, and geography as inputs. They concluded that DEA provides insights into the comparative performance of public agencies and the resulting data and analysis can be used by decision makers for improving public agencies' service delivery.

The efficiency of the New South Wales (NSW) police services was analyzed by Carrington et al. (1997:424). They employed 163 police patrols as DMUs. The researchers used the number of sworn officers, number of civilian officers, and number of cars as inputs, while the number of crimes, arrests, summons, major car accidents recorded, and kilometers that police cars had traveled were used as outputs.

In another law enforcement efficiency study utilizing DEA, Thanassoulis (1995:641-657) examined 41 police departments in England and Wales. The inputs used by this author were: the number of sworn officers, number of violent crimes, number of burglaries, and number of other recorded crimes. The outputs were the number of cleared violent crimes, number of cleared burglaries, and number of other recorded crimes that were cleared. The research indicated that increasing the number of personnel in the agency would help in clearing more crimes.

Citizens and elected officials have sought a bottom line for evaluating law enforcement performance for years, because citizens demand that their hard-earned tax dollars are spent efficiently (Alpert and Moore, 2001:265). The authors identified the traditional key measures of efficient police performance as: reported crimes, arrests, cleared cases, and response times. They used these measures to compare the results of previous years in order to gauge police performance. However, it is possible that these types of performance measures do not reflect the entire picture of performance of police organizations.

2. Research Design, Methodology and Data

This research aimed to calculate efficiency scores for the police departments in all (81 cities) cities in Turkey. As in many law enforcement efficiency studies, the technique of Data Envelopment Analysis (DEA) was used, through statistical analysis by Frontier Analyst Software. DEA allows researchers and policymakers to compute the efficiency of organizations whose functions are the same or similar, by entering inputs that are used to produce the desired products and outputs of the organizations. That is to say, DEA produces efficiency scores for organizations regarding their use of resources to produce desired outputs. When relevant inputs and output data is entered into the software and the analysis is performed, DEA provides an efficiency score for each DMU (each local police department) in this research.

DEA is a very effective and convenient way to measure the efficiency of both for-profit and non-profit organizations. DEA is also used because this computer program offers flexibility in data enty. Moreover, unlimited decision-making units can be included.

DEA requires that at least twelve DMUs be used in the analysis. In addition, the researchers should only include the most relevant inputs and outputs in the analysis (Hussein and Jones, 2001). An input may be defined as any resource employed by a unit to generate an output, and an output is any product or service generated by a unit.

Police agencies have used a number of measurements, including the number of recorded crimes, number of arrests, number of cleared cases, and response time, in order to measure their efficiency, for many years (Alpert and Moore, 2001:265). The literature regarding the use of DEA in law enforcement organizations suggests that budget, number of employees, number of police cars, total expenditures, and recorded crimes can be used as inputs. In addition, number of cleared cases and arrests can be employed as outputs (Verma and Gavirneni, 2006:138; Sun, 2002:55; Thanassoulis, 1995:645).

This research employed the number of sworn police personnel, the total expenditures of police departments, and the number of recorded crimes as inputs. Outputs were the number of arrests and the number of cleared cases.

DEA allows researchers to include uncontrollable inputs. An uncontrolled input may impact the comparative performance of a public agency, but the agency has little or no control over it (Nyhan and Martin, 1999:21; Hussein and Jones, 2001). Although police organizations may put all of their efforts towards reducing the crime rate, they cannot completely control the number of recorded crimes. Thus, the number of recorded crimes is used as an uncontrolled input.

After data was entered into Frontier Analyst, a decision regarding the type of model that would be used in order to analyze the data must be made. This research used input minimization, so that the inputs could be reduced while keeping the outputs at the same level. The goal being, to determine the minimum level of funding and number of personnel needed by each police department to produce the same number of arrests and cleared cases.

The second decision a researcher must make concerns whether to assume constant or variable returns to scale. The two models that may be employed are “the BCC model [a special type of DEA model that deals with technical efficiency] developed by Banker, Charnes, and Cooper

(1984) for constant returns to scale and the CCR model for variable returns to scale" (Hussein and Jones, 2001:12). The original DEA model is the CCR model and its efficiency is described as "the ratio of the DMU's virtual output, which is the combination of the DMU's multiple outputs by virtual multipliers, to the DMU's virtual input, which is the combination of the DMU's multiple inputs by virtual multipliers" (Li, 1996: 3). The CCR model is suitable when the efficiency of a DMU is not influenced by its size. On the other hand, the BCC model contains scale effects in measuring DMUs' efficiency scores (Koksal and Nalcaci, 2006:175). Many studies including Nyhan and Martin (1999:25) and Thanassoulis (1995:641-657) have used the CCR program and examined "the stability of the efficiency scores due to changes in the variable specifications and/or input weights" (Drake and Simper, 2005:469).

Some researchers have used the technical efficiency scores, calculated using the BCC model, to determine whether external factors directly influence ranks and scores (Drake and Simper, 2005:470, 472). However, this research employs the CCR model because external factors are not used in the analysis. In fact, its aim is to analyze and compare the inputs that police departments use to perform safety and security functions in their jurisdictions and the outputs that are produced by utilizing these inputs.

The data utilized in this analysis was obtained from the Main Headquarters of the TNP. The most important resource of police departments is their personnel, because they are responsible for catching criminals and clearing cases. Police officers are physically involved in the fight against crime and criminals, and the number of police officers is considered to be a vital law enforcement input. Hence, the number of sworn officers was included as an input. The number of sworn police personnel for each police agency was provided by the Department of Personnel of the TNP.

Police departments may also need additional equipment and high-tech devices to effectively perform law enforcement activities. Therefore, police agencies may require large budgets to provide a safe environment for citizens, and expenditures may be considered another vital input of policing. The total expenditures of police departments are provided by the Department of Strategy Development of the TNP.

The number of recorded crimes indicates the workload of police forces. It can be treated as an input because police personnel put all their efforts toward solving crimes by making arrests. Resources of police agencies such as personnel and budgets are used to solve recorded crimes, and for this reason it is considered as another input for policing. The number of recorded crimes for police agencies was provided by the Department of Research, Planning, and Coordination of the TNP.

Police personnel are expected to identify and arrest criminals and to solve crimes, and law enforcement agencies are created and designed for these purposes. This is why the main outputs of police agencies are the number of cleared cases and the number of arrests. The number of cleared cases was provided by the Department of Research, Planning, and Coordination of the TNP. The number of arrests was recorded from the official website of the TNP (Emniyet Genel Müdürlüğü, 2006).

Inputs	**Outputs**
Number of sworn police officers	Number of cleared crimes
Expenditures	Number of arrests
Number of recorded crimes	

The data used in this analysis was obtained from the Main Headquarters of the Turkish National Police. The researchers were allowed access to the Main Headquarters (MHQ) of the TNP to obtain data from the various MHQ departments at TNP. Having received authorization, the relevant departments at TNP provided the data of the inputs and outputs for this study from the 2006 official records of the TNP. The main goal of this study was to calculate efficiency scores for local police departments. The second objective was to develop a model to measure the efficiency of police departments in Turkey and to provide guidance for inefficient departments, by indicating how much they could decrease inputs while keeping the number of arrests and cleared cases at the current level.

3. Findings

In the DEA analysis, the most efficient DMU had an efficiency score of 100%. If the efficiency score of a given department is 100, these departments can be considered as efficient police agencies. That is to say,

these agencies can be considered as being efficient in using the resources and/or inputs to achieve organizational objectives. The results, as shown in Table 1, indicate that only 10 out of 81 police departments are efficient. The police departments of Ardahan, Yozgat, Zonguldak, Şanlı-urfa, Kırklareli, Muğla, Balıkesir, Diyarbakır, Kocaeli, and Gaziantep have 100% efficiency scores, signifying that these departments used their manpower and budget the most efficiently, in 2006, to fight crime and criminals, compared to other police departments. According to the analyses, 71 city police departments had efficiency scores lower than 100. However, most of the efficiency scores of police departments were very close to 100, which is the most efficient score, and interestingly, almost all departments had efficiency scores above 70%. Notably, none of the local police departments in Turkey had efficiency scores of less than 50%. Nevertheless, one might argue that efficient police departments should have a 100% efficiency score and, by that standard, only 10 police departments were efficient. With respect to this, since most of the efficiency scores were above 70%, it appears that local police departments, in general, do not misuse public resources.

Table 1: Efficiency Scores of Local Police Departments in 2006

Police Departments	Efficiency Scores (%)		Police Departments	Efficiency Scores (%)
Ardahan	100		Tokat	84.87
Yozgat	100		Ordu	84.37
Kırklareli	100		Uşak	84.35
Muğla	100		Rize	83.79
Şanlıurfa	100		Artvin	83.41
Balıkesir	100		Aydın	83.23
Zonguldak	100		Hakkari	83.02
Kocaeli	100		Burdur	82.90
Diyarbakır	100		Bitlis	82.57
Gaziantep	100		Bolu	82.45
Karabük	98.75		Mardin	82.35
Kastamonu	98.65		Sakarya	81.96
Tekirdağ	98.50		Bayburt	81.96
Şırnak	96.92		Erzincan	81.83
İstanbul	96.80		Malatya	81.71
Sinop	96.78		Bingöl	81.31
Manisa	95.49		Aksaray	80.27
Antalya	94.94		Erzurum	80.07
Konya	94.55		Muş	80.06
Afyonkarahisar	94.54		Osmaniye	80
Bartın	93.99		Samsun	79.53
Çanakkale	93.62		Ağrı	79.51
Tunceli	93.22		K.Maraş	79.42

Çankırı	93.02		Bursa	78.57
Niğde	92.45		Kayseri	77.83
Giresun	92.12		Elazığ	77.61
Kırıkkale	91.84		Yalova	73.12
Gümüşhane	91.47		Siirt	72.55
Bilecik	91.10		Edirne	72.42
Karaman	90.84		Düzce	72.41
Isparta	89.95		Adıyaman	72.04
Çorum	89.27		Van	70.98
Nevşehir	88.66		Trabzon	70.71
Kilis	88.36		Denizli	69.67
Kars	88.25		Eskişehir	69.50
Kırşehir	88.08		Hatay	63.36
Mersin	87.47		Batman	62.29
Kütahya	87.37		Adana	59.56
Sivas	87.25		İzmir	59.19
Amasya	85.83		Ankara	51.23
Iğdır	85.44			

4. Discussion

Police administrators often assert that their departments are lacking in manpower and equipment. If we compare their organizations' outputs to their inputs, we can conclude that most of the local police departments in Turkey are well staffed and well equipped. However, one might also argue that most of the departments have efficiency scores lower than 100% and are, therefore, inefficient. The reasons for the less efficient scores in most of the local police departments include a high number of police officers and a large budget, as well as a greater number of recorded

crimes, since the same outputs could be produced with a lesser number of officers and a lower budget. Accordingly, it can be stated that inefficient police departments are overstaffed, even though they may actually need more manpower. There are several reasons why police departments may need additional police personnel, even though DEA analysis shows that they are inefficient.

First, it can be said that police organizations may not always achieve maximum efficiency, and policing outputs may not always be measurable or visible for most policing tasks. Most of the time, police personnel perform invisible tasks, such as responding to riots, securing public events, securing sporting events, and conducting proactive policing tasks, such as community-oriented policing activities. These tasks cannot be evaluated in terms of efficiency because they do not produce concrete (or countable) outputs. In other words, while most of the manpower is used for these purposes, these activities do not include output variables, such as arresting criminals or solving crimes. Most personnel in local police departments work to prevent crime and secure the living spaces of people in urban areas. Accordingly, the successes and activities of such divisions do not count in an analysis of efficiency through DEA, even though the total number of sworn officers is considered as an input. Hence, DEA analysis indicates that overstaffed police departments may need additional manpower to effectively deal with both the management of public events and the prevention of crime and arrest of criminals.

Second, the DEA analysis revealed that the expenditures of inefficient police departments are higher than they need to be with respect to the outputs they produce. Seventy-one out of the 81 police departments spend more money than is needed to achieve the given outputs. To reiterate, one problem with budgetary planning in police departments is that a substantial portion of the budget is used to pay salaries, to prevent crime, to develop a stable and healthy relationship between the police and the public, and to provide security for social, sports, and public events in addition to conducting proactive policing. And these expenditures are not directly applied to increasing the number of arrests and number of cleared cases. Therefore, even though total expenditures may be included as an input in DEA analysis, it is extremely difficult, if not impossible, to measure the effectiveness of all expenditures in local police departments.

Third, the most important reason for overstaffing and increased spending is terrorism. Terrorist activity in the eastern and southeastern territories of the country is the main reason for increasing the number of personnel and expenditures. Because of terrorism, the TNP employs more police personnel in the eastern and southeastern regions of Turkey. In other words, terrorist activity in these parts of the country requires the TNP to spend more money and employ more sworn officers to effectively deal with it. Because of the mandatory assignment and appointment of police personnel to the eastern and southeastern provinces' police departments, we determined that these departments are overstaffed.

Fourth, the main objective of police agencies is to provide a safe and secure environment to citizens, rather than to have efficient organizations. Those agencies, in this study, with effective policing had higher numbers of cleared cases and criminal arrests. Because citizens want to live in a safe environment, they initially focus on effectiveness of the police not their efficiency. Accordingly, the TNP will increase the number of police personnel so that it can be effective in preventing crime and catching criminals. The effectiveness of the TNP, in this regard, can be measured through citizen satisfaction or fear of crime surveys. Such surveys can provide hints concerning the effectiveness of the TNP and the results can be analyzed in conjunction with the results of this research.

Fifth, not all sworn officers work at divisions that directly deal with crime and criminals, in addition to providing other services, such as securing sporting events, and conducting proactive policing. Some officers work in bureaus and perform administrative work, for example, while others work for the passport division, and still others work for the division that deals with vehicular records. In other words, these personnel have no direct effect on crime and criminals. The number of sworn officers used as an input in our DEA analysis included these officers, even though they were not directly connected with the outputs of the analysis: number of arrests and number of cleared cases. This may be another explanation for the DEA analysis' findings of overstaffed police organizations.

Sixth, the Main Headquarters of the TNP administers personnel appointments and recruitment, distribution of financial resources, and equipment purchases for police departments. As a result, police

administrators in local police departments have limited discretionary powers over their resources. For example, the Main Headquarters assigns police personnel to agencies and the police chiefs in local police departments have almost no influence on this policy. For that reason, police departments in some cities may be overstaffed, while others are understaffed, to effectively provide policing services to citizens.

Finally, The Code of Appointment and Replacement of Turkish Sworn Police Personnel (1992, article 4, amended on February 15, 2002) influences the number of sworn personnel assigned to each local police department. Based on this code, Turkey is geographically divided into two regions, the East and West parts, in terms of appointments and replacements of police personnel. The selection criteria for personnel distribution are the differences and similarities among cities in terms of security, crime, economic, social, culture, travel and transportation aspects. In fact, because the developmental level of the east part of the country is lower than in the west, there is a mandatory police personnel assignment to the east part for two, three, or four years, depending on the city and its risk and development level. In the west part of Turkey, there are 52 cities and 52 police departments, while in the east part of Turkey, there are 29 cities and 29 police departments. The analyses indicated that the local police departments in the eastern and southeastern parts of Turkey are overstaffed and spent more money, in 2006, in comparison to the other police agencies. One explanation for this may be the mandatory assignment and appointment of personnel by the TNP to the local police departments in the eastern and southeastern parts of Turkey.

5. Limitations

The goal of this research was to measure the efficiency of local police departments throughout Turkey. However, not all variables could be included in the analysis because of the unavailability of the data. For example, the number of vehicles would be an excellent input for policing, since vehicles are needed and used to provide effective policing, and it could be shown that the police might need additional vehicles to catch more criminals and solve more crimes. However, the researchers could not obtain data for the number of police cars in each police department.

Likewise, the number of computers used by police agencies might be a useful input for DEA, because a substantial portion of today's policing services need and require the use of computers. However, the existing literature suggests that such data should not be used for efficiency analyses because there is no quantifiable data on the impact of computers on policing functions (Drake and Simper 2000:60; Sun, 2002:59; Thanassoulis, 1995:645). Thus, the researchers did not use the number of computers as an input even though the data was available.

In addition to statistical data, some external factors that are believed to influence crime statistics are used in measuring police efficiency. For example, socioeconomic, geographical, educational, and political variables are important to consider when analyzing police efficiency. However, it is difficult to quantify the effects of these variables on police work. Accordingly, they are not taken into account in this study. Those variables may be used in a regression analysis in conjunction with the outputs and inputs that were used in this research.

Conclusion

This analysis revealed that most police departments in Turkey are overstaffed, with 71 out of the 81 examined in this study employing more officers than were needed. Overstaffing of some local police departments might be an indicator of the TNP's ineffective personnel policy. Therefore, the employment policy of the TNP should be revisited and be revised.

However, it is also true that police personnel perform a variety of activities including: responding to riots, securing public events, securing sporting events, and conducting proactive policing tasks, such as community-oriented policing activities. The outputs and outcomes of such activities are difficult to measure by using them as inputs to DEA to calculate efficiency scores. As a consequence, one might take these factors into consideration while evaluating personnel policy and expenditures of local police departments.

A police department's main goal is to provide effective policing services to citizens. This goal may undermine the importance of

efficiency for the TNP, because public agencies, particularly police departments, do not aim solely for efficiency. However, the efficient use of public resources is one of the main concerns of the public and the media. In view of this, local police departments and the Main Headquarters of the TNP should make efficiency a priority, in addition to effectiveness.

Further research is needed to compare the efficiency scores of local police departments in Turkey and those of other countries. For example, Choi's (2005:224) study of fire and emergency services revealed that more than half of the relevant organizations had efficiency scores of less than 65%. Comparing the efficiency scores of police in Turkey to those in other countries might provide a truer picture of the efficiency of local police departments. Future research should also address the effect of administrative leadership on organizational efficiency of police departments. It seems likely that good leaders can better guide their organizations toward the efficient use of resources.

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