Cost of Road Traffic Accidents in Egypt

Mohamed A. Ismail and Samar M. M. Abdelmageed

Abstract—The main objective of this paper is to estimate the cost of road traffic accidents in Egypt. The Human Capital (HC) approach, specifically the Gross-Loss-of-Output methodology, is adopted for estimation. Moreover, cost values obtained by previous national literature are updated using the inflation rates. The results indicate an estimated cost of road traffic accidents in Egypt of approximately 10 billion Egyptian Pounds (about $US 1.8 billion) for the year 2008. In addition, it is expected that this cost will rise in 2009 to 11.8 billion Egyptian Pounds (about $US 2.1 billion).

Keywords—Cost, Gross-Loss-of-Output, Human Capital Approach, Road Traffic Accidents.

I. INTRODUCTION

ROAD traffic accidents became a growing problem that threatens the lives of many people around the world. According to [20], road traffic accidents cause the death of more than 1.2 million and the injury of between 20 and 50 million people annually worldwide with more than 90% of deaths in low and middle income countries. Besides human casualties, other aspects of losses include material damages such as the vehicles involved in these accidents or the publicly-owned properties that lie on the road and the bad physical and psychological effects on the survived victims as well as the families and friends of the casualties. Reference [9] points out that in 1997, traffic accidents cost the developing and transitional countries $US 65 billion against $US 453 billion for the highly motorized countries. Reference [2] states that traffic accidents cost the developing countries annually between 1 to 3% of their GDPs. Reference [19] points out that road traffic accidents cost the low and middle income countries annually what is more than the total aids they receive for development purposes.

The importance of estimating the cost of road traffic accidents stems from the importance of drawing attention to this problem not only as a social problem that costs a lot of people their lives but also as an economic problem that costs the society a lot of money and adds an undesirable economic burden on it. Moreover, cost estimation helps to clarify the size of this problem and the economic benefit arising from preventing such accidents. This can be done through a cost-benefit analysis that may guide policy makers, especially in

developing countries with limited resources, to allocate road safety investments optimally as much as possible. For more details, see [1], [8], [10], and [19].

The Human Capital (HC) approach and the Willingness To Pay (WTP) approach are the most important and widely used approaches in estimating the cost of road traffic accidents. The HC approach estimates the cost of road traffic accidents as the lost earnings endured by casualties, whereas the WTP approach estimates this cost as the amount individuals are willing to pay for reducing the risk of experiencing a road traffic accident. Differentiation between HC and WTP depends on the objectives or priorities and data availability. If the main concern is to maximize the national output then the HC approach is the appropriate methodology to use, whereas the WTP approach is the suitable one when the main concern is to increase social welfare by reducing injuries and fatalities. On the other hand, the lack of data needed to apply the WTP approach especially in the developing countries makes the HC approach an attractive choice [8]. Several developed countries such as USA, UK, New Zealand, and Sweden adopt the WTP approach in cost estimation. A number of other developed countries uses the HC approach to estimate the cost of road traffic accidents such as Australia, Canada, Germany, Norway, Portugal, Japan, and Austria (for more details refer to [15] and [17]). On the other hand, most of the studies that estimate the cost of road traffic accidents in developing countries use the HC approach. Examples include among others: Indonesia, Bangladesh, India, Vietnam, the Philippines, and Thailand (see [1], [4], [5], [7], [11], and [18]). For Arab countries, [10] uses the HC approach to estimate the cost or traffic accidents in Jordan.

Several attempts are conducted to estimate the cost of road traffic accidents in Egypt. Reference [3] shows that the total cost of road traffic accidents in 1986 was about 54 million Egyptian Pounds with an average cost of approximately 14 thousand Egyptian Pounds per accident. Reference [12] estimates the cost of road traffic accidents in Egypt for 1993 to be $US 577 million (0.8% of GDP) with an average cost of $US 8190 per accident. Reference [14] finds that for the year 2005/2006, the average cost of a fatal or a serious accident, which causes at least one fatality or one serious injury, is 118 thousand Egyptian Pounds. For the same year, the average cost of a slight accident that causes one or more slight injuries with no fatalities or serious injuries is 13.4 thousand Egyptian Pounds. Moreover, the average cost of a property damage only accident for the year 2005/2006 is 12.8 thousand Egyptian Pounds. Reference [6] reports that the average cost of a road traffic accident is estimated to be about 8500

Mohamed A. Ismail is a statistics professor at Cairo University and a consultant at the Information and Decision Support Center (IDSC), Cairo, Egypt (e-mail: m.ismail@idsc.net.eg).

Samar M. M. Abdelmageed is a statistical researcher at the Information and Decision Support Center (IDSC), Cairo, Egypt (e-mail: smahmoud@idsc.net.eg).

World Academy of Science, Engineering and Technology
International Journal of Humanities and Social Sciences
Vol:4, No:6, 2010

Egyptian Pounds. Reference [13] claims that road traffic accidents cost Egypt 16 billion Egyptian Pounds annually.

As previously seen, there have been a limited number of attempts to estimate road traffic accidents cost in Egypt. These attempts have different limitations as some of them suffer from data deficiencies, and others lack cost components in their calculations or an adequate clear methodology for cost estimation. This study tries to estimate the cost of road traffic accidents in Egypt using an integrated methodological framework. In this regard, the study introduces a detailed and comprehensive technique for cost estimation that can be modified and updated regularly.

The rest of this paper is organized as follows: section 2 discusses the methodology employed to estimate the cost of road traffic accidents in Egypt, whereas section 3 highlights the data and assumptions used in cost estimation. Section 4 shows the estimation results. Section 5 forecasts cost in 2009. Finally, the sixth and last section summarizes the paper with some conclusions and discussions.

II. METHODOLOGY

The study adopts the HC approach to estimate the cost of road traffic accidents in Egypt. The general guidelines in estimating the cost put by [2] and [16] are followed. The HC approach equates the cost of lost life or time due to being injured in a road traffic accident to lost earnings. Among different variations of the HC approach the Gross-Loss-of-Output is the easiest and most frequently used one. It calculates the cost as the present value of the expected earnings that could have been achieved by the injured or the deceased person if not experienced the accident. The study adopts the Gross-Loss-of-Output of HC approach to estimate the cost of road traffic accidents in Egypt for the year 2008.

The study uses two different techniques of the HC approach in calculating the cost of road traffic accidents. The first technique begins by estimating the average costs of a fatality, an injury, and a damaged vehicle. These averages are then multiplied by the corresponding totals and summed together with other cost components to find the total cost of road traffic accidents for the year 2008. The cost of a fatality or an injury is calculated as the sum of lost output, family and community loss, which refers to the activities the casualty would have conducted after working hours if not experienced the accident (see [10]), medical treatment costs, lost experience of the fatality or the injured, and lost quality of life (pain, grief, and suffering). The cost of damages per vehicle is calculated by summing the average repairing costs, the average costs during the vehicle detention period, and the average cost of a deteriorating vehicle performance after repairing. Other cost components of road traffic accidents include the cost of damages in properties other than vehicles, the cost of police service, and the cost of insurance administration.

The second technique of using the HC approach depends on obtaining the average accident cost according to its severity level (fatal, serious, slight, and property damage only).

Accordingly, the cost of accidents can be estimated for each severity level, and consequently, the total cost of all accidents is the sum of these of all severity levels. The cost of a fatal road traffic accident includes: the cost of fatalities, cost of injuries, cost of property damages, administrative costs, and travel delay cost. The cost of an injury (serious or slight) road traffic accident consists of the same items of a fatal accident cost except for the cost of fatalities, whereas the cost of a property-damage only road traffic accident includes: the cost of property damages, administrative costs, and travel delay cost.

In addition to the two HC techniques employed to obtain the cost of road traffic accidents in Egypt, the study also updates the estimates reported in previous national literature. To derive the corresponding figures for the year 2008 the inflation rates are applied on cost estimates indicated by these national studies. At the end, all the resulting cost estimates are compared together in order to find a sensible estimate for the cost of road traffic accidents in Egypt for the year 2008.

III. DATA AND ASSUMPTIONS

Cost estimation requires several data items. Available raw data items in Egypt include the total numbers of road traffic accidents, fatalities, injuries, and damaged vehicles. For the unavailable data items, which have corresponding available estimates in the national literature, the study obtains their current values using the inflation rates. The other remaining required data items, which are not available whether as raw data or as estimated figures in previous national literature, are estimated using a group of assumptions recommended in previous international literature.

A. Assumptions for the First HC Technique

Applying the first technique of the HC approach in cost estimation, the following assumptions are adopted.

The lost output of a fatality is calculated using the equation in [18], which is:

$$Loss = \sum_{i=1}^{N} \frac{W(1+g)^i}{(1+r)^i}. \tag{1}$$

where: W is the average annual GDP per capita, g is the growth rate of the economy, r is the discount rate that is used to obtain the present value of future lost output, and i refers to the years of lost output that last N years. The average GDP per capita in 2007/2008 is chosen as an estimate of W, g is the average rate of the growth rates that are available from 1982/1983 until the expected rate of 2008/2009, and r is obtained as in [10] by subtracting the growth rate value from the interest rate (interest rate on treasury bills (91-day bills)) value of 2007/2008. The average age of a road traffic accident fatality is assumed to be 30 years as in [2], [7], [10], and [18]. Moreover, the age distribution of road traffic fatalities in Egypt supports this assumption. Therefore, the number of years of lost output for a fatality, which is the difference between the average age of a fatality and the

World Academy of Science, Engineering and Technology
International Journal of Humanities and Social Sciences
Vol:4, No:6, 2010

retirement age, is 30 years. For injuries, lost output is calculated using (1) assuming that the average time of lost output in this case is one month as in [18].

The family and community loss of a fatality or an injury is obtained as a percentage that is assumed to be 55% of the corresponding lost output (see [10]). The average medical treatment cost of a fatality or an injury is derived from the data of 1986 included in [3] by applying the inflation rates on the average medical treatment cost of a fatality or an injury whether at hospital or at home. The average cost of lost experience of a fatality or an injury is obtained for the year 2008 by applying the inflation rates on the corresponding figures in [3]. The cost of pain, grief, and suffering for a fatality or an injury is estimated using an average percentage, which is 28.7%, of the percentages indicated by [5] and [16] to estimate a component for the lost quality of life for fatal, serious, and slight accidents.

The average cost of damages per vehicle for the year 2008 is calculated by applying the inflation rates on the corresponding figures in [3]. The total cost of damages in public or private properties other than vehicles is also obtained for the year 2008 by the same way.

The assumptions in [16] are used to obtain the administrative costs, which include the costs of police service and insurance administration. The cost of police service is estimated as 0.6% of the noncasualty based costs, which consist of property damages and travel delay costs. Similarly, the insurance administration cost can also be estimated as 2.8% of the noncasualty based costs. The travel delay cost due to road traffic accidents is obtained by applying the inflation rates on the corresponding figure in [3].

B. Assumptions for the Second HC Technique

A classification of accidents according to severity levels (fatal, serious, slight, or property damage only) is necessary for calculating the cost of road traffic accidents in Egypt using the second technique of the HC approach. The distribution or the classification of road traffic accidents according to their severity levels is unavailable for all accidents in Egypt. However, it is partially available for accidents that only took place on the network following the General Authority for Roads, Bridges, and Land Transport in Egypt. These accidents are distributed as about 25% fatal accidents, about 75% injury accidents, and less than 1% property damage only accidents. This distribution is generalized to obtain a classification of the total road traffic accidents according to their severity levels.

Classification of the injury accidents further into serious and slight accidents uses the percentages included in [3]. Reference [3] indicates that 82% of injured individuals were hospitalized (i.e. seriously injured) due to road traffic accidents in the surveyed area, while 18% of injured individuals were medically treated and left without hospitalization (i.e. slightly injured). Therefore, serious road traffic accidents are assumed to be 82% of total injury accidents against 18% slight accidents. This assumption may be inaccurate and lead to an overestimation of the number of serious road traffic accidents. However, it is more appropriate than other assumptions adopted in the literature such as assuming that the ratio of fatal to serious to slight accidents is 1 to 13 to 72 as mentioned in [1].

To calculate the average number of casualties per accident distributed according to the casualty class (fatalities, serious injuries, and slight injuries) and the accident severity level, the averages of the corresponding numbers mentioned in [16] are adopted. These numbers are used to estimate the cost of road traffic accidents in Bangladesh, Indonesia, and Nepal. According to these figures, on average, a fatal accident results in 1.4 fatalities, 0.7 serious injuries, and 1.9 slight injuries, whereas a serious accident results in one serious injury and 1.2 slight injuries, and a slight accident results in 1.2 slight injuries.

The lost output for a fatality, a serious injury, and a slight injury, is calculated by applying (1) as in [18] with the same previously stated assumptions used for the first technique. The average lost time is assumed to be 35 days for a serious injury and 5 days for a slight injury (as in [16]). To calculate the family and community loss of a fatality or an injury (serious or slight), it is assumed to be 55% of the corresponding lost output (as in [10]). The medical treatment cost for a casualty (fatality, serious injury, and slight injury) is obtained by updating the corresponding cost included in [3] using the inflation rates and considering that the medical cost of a serious injury includes both the cost at hospital and at home, whereas the medical cost of a slight injury includes only the treatment cost at home. Similarly, the average cost of lost experience of a fatality or an injury (serious or slight) is estimated by updating the corresponding figures in [3]. The cost component for pain, grief, and suffering is estimated as 28%, 50%, and 8% of the total costs of a fatal accident, a serious accident, and a slight accident respectively as indicated by [5] and [16].

The average number of damaged vehicles per accident for each severity level is estimated by dividing the corresponding total number of damaged vehicles by the total number of accidents during 2008. The average cost of damages per vehicle is obtained by updating the corresponding average in [3]. The average cost of damaged vehicles per accident according to its severity level is obtained using the multipliers suggested by Transport Research Laboratory in the UK and indicated by [11]. These multipliers are 1.55 for a fatal accident, 1.4 for a serious accident, 1.25 for a slight accident, and 0.85 for a property damage only accident. To estimate the average costs of damages in public or private properties other than vehicles and travel delay per accident, the corresponding updated average costs in [3] are used. These averages are assumed to be the same for all severity levels of accidents. Finally, following [2], the average administrative costs are assumed to be 0.2%, 4%, 14%, and 10% of total resources costs in a fatal accident, a serious accident, a slight accident, and a property damage only accident respectively, where the resources costs include: lost output, medical treatment costs, and cost of vehicle or any other property damages.

World Academy of Science, Engineering and Technology
International Journal of Humanities and Social Sciences
Vol:4, No:6, 2010

IV. RESULTS

This section estimates the cost of road traffic accidents in Egypt for the year 2008. The two techniques of the HC approach explained in section 2 are applied using the data and assumptions presented in section 3. The cost estimates using the two techniques are presented and discussed in next subsections A and B respectively. Moreover, other cost estimates reported in the previous national literature are updated for 2008 using the inflation rates. These updated cost estimates are presented in subsection C.

A. Cost Estimates Using the First Technique of the HC Approach

The first technique of the HC approach is applied using the data and assumptions previously explained, and the results are displayed in Tables I and II. The values of cost components of road traffic accidents in Egypt for 2008 are shown in Table I. The results indicate that by using the study's first technique in applying the HC approach, the total cost of road traffic accidents in Egypt for 2008 is about 10.6 billion Egyptian Pounds. The corresponding average cost per accident is 506.9 thousand Egyptian Pounds. The biggest portion of road traffic accidents cost comes from fatalities, whose cost accounts for 67.3% of the total cost. The costs of damages in vehicles and injuries account for 6.4% and 2.9% of the total cost respectively. Damages in properties other than vehicles, travel delay, and administrative costs (the sum of police service and insurance administration costs) each represent less than 1% of the total cost. The cost component for pain, grief, and suffering is estimated to be about 2.4 billion Egyptian Pounds, which accounts for 22.3% of the total cost. To obtain cost estimates in $US, one should divide by 5.5, as the current exchange rate is $US = 5.5 Egyptian Pounds.

TABLE I
THE VALUES OF COST COMPONENTS OF ROAD TRAFFIC ACCIDENTS IN EGYPT FOR 2008

Cost component	Value (million Egyptian Pounds)	Percentage (%)
Fatalities	7141.3	67.29
Injuries	304.2	2.87
Damages in vehicles	681.2	6.42
Damages in properties other than vehicles	0.7	0.01
Travel delay	94.7	0.89
Police service	4.7	0.04
Insurance administration	21.7	0.20
Pain, grief, and suffering (lost quality of life)	2364.5	22.28
Total cost of road traffic accidents	10613.0	100

The results show that road traffic accidents fatalities during 2008 in total cost Egypt about 7.1 billion Egyptian Pounds with an average cost per fatality of 1.1 million Egyptian Pounds. In addition, road traffic injuries cost Egypt about 304.2 million Egyptian Pounds with an average cost per injury that is equal to 8.5 thousand Egyptian Pounds. Table II shows the cost of road traffic accidents fatalities and injuries in Egypt for 2008 according to their different components in Egyptian Pounds.

TABLE II
THE COST OF ROAD TRAFFIC ACCIDENTS FATALITIES AND INJURIES IN EGYPT FOR 2008

Cost component	Fatalities		Injuries	
	Per fatality (Egyptian Pounds)	Total fatalities (million Egyptian Pounds)	Per injury (Egyptian Pounds)	Total injuries (million Egyptian Pounds)
Lost output	492430.4	3251.5	998.8	35.7
Family and community loss	270836.7	1788.3	549.3	19.6
Medical costs	375.1	2.5	873.2	31.2
Lost experience	317881.8	2099.0	6094.2	217.7
Total	1081524.0	7141.3	8515.4	304.2

B. Cost Estimates Using the Second Technique of the HC Approach

The second technique of HC estimates the total cost of road traffic accidents in Egypt by 12.5 billion Egyptian Pounds. Table III shows the total cost of road traffic accidents according to severity level in Egypt for 2008. Fatal accidents represent the main bulk of all accidents total cost (85.8%).

World Academy of Science, Engineering and Technology
International Journal of Humanities and Social Sciences
Vol:4, No:6, 2010

TABLE III
THE TOTAL COST OF ROAD TRAFFIC ACCIDENTS ACCORDING TO SEVERITY LEVEL IN EGYPT FOR 2008

Accident severity level	Estimated number of accidents (accident)	Average cost per accident (Egyptian Pounds)	Total cost (million Egyptian Pounds)	Percentage of all accidents total cost (%)
Fatal	5372	1994001.8	10711.8	85.775
Serious	12758	120735.3	1540.3	12.334
Slight	2801	84200.2	235.8	1.888
Property damage only	7	55472.7	0.4	0.003
All road traffic accidents	20938	-	12488.4	100

The total average cost per a fatal accident in Egypt for 2008 is about 2 million Egyptian Pounds, while the average costs per a serious accident and per a slight accident are 120.7 thousand Egyptian Pounds and 84.2 thousand Egyptian Pounds respectively. The average cost per a property damage only accident is about 55.5 thousand Egyptian Pounds. The average accident cost figures according to accident severity level in Egypt for 2008 are displayed in Table IV.

C. Deriving Cost Estimates from Previous National Literature

This subsection updates cost estimates obtained by previous national literature to the corresponding cost figures for the year 2008 by taking into account the inflation effect.

According to [3], the average cost per a road traffic accident in Egypt for the year 1986 is about 14.2 thousand Egyptian Pounds, which reaches to about 118.5 thousand Egyptian Pounds. Multiplying the updated average cost per accident by the total number of accidents in 2008 results in a total cost of 2.5 billion Egyptian Pounds. Reference [12] estimates the total cost of road traffic accidents in Egypt for the year 1993 to be $US 577 million, which corresponds to a total cost of $US 1.6 billion or about 8.8 billion Egyptian Pounds in 2008. By applying the inflation rates on the average costs in [14] of a fatal (or a serious) accident, a slight accident, and a property damage only accident, which are 118, 13.4 and 12.8 thousand Egyptian Pounds respectively in 2005/2006 prices, the resulting average costs for 2008 are 164.4, 18.7, and 17.8 thousand Egyptian Pounds respectively. Taking the weighted average of these cost averages (based on the

TABLE IV
THE AVERAGE ACCIDENT COST FIGURES ACCORDING TO ACCIDENT SEVERITY LEVEL IN EGYPT FOR 2008 (EGYPTIAN POUNDS)

Accident severity level	Casualty related cost components (except pain, grief, and suffering)	Damages in vehicles	Damages in properties other than vehicles	Administrative costs	Travel delay	Pain, grief, and suffering	Total
Fatal	1486383.8	50426.5	178.9	1444	24857.4	430711.2	1994001.8
Serious	16317.9	45546.6	178.9	1934.9	24857.4	31899.7	120735.3
Slight	8295.8	40666.6	178.9	5819.1	24857.4	4382.5	84200.2
Property damage only	-	27653.3	178.9	2783.2	24857.4	-	55472.7

Table V shows the estimates of the average casualty related cost components (except the cost of pain, grief, and suffering) according to accident severity level in Egypt for 2008 obtained by the second technique of applying the HC approach. A fatal accident causes about 1.5 million Egyptian Pounds attributed only to the casualties without taking into consideration the cost of pain, grief, and suffering. The corresponding casualty related costs of a serious injury accident and a slight injury accident are about 16.3 thousand Egyptian Pounds and 8.3 thousand Egyptian Pounds

assumptions used for the second HC technique about the classification of accidents according to severity levels) and multiplying this value by the total number of road traffic accidents during 2008, the resulting total cost of road traffic accidents for the year 2008 is about 3 billion Egyptian Pounds. Reference [6] indicates that the average cost of a road traffic accident is about 8.5 thousand Egyptian Pounds for the year 1984. The corresponding average cost for 2008 is 98.8 thousand Egyptian Pounds with a total cost of about 2.1 billion Egyptian Pounds. Finally, according to [13], the annual

TABLE V
THE ESTIMATES OF THE AVERAGE CASUALTY RELATED COST COMPONENTS (EXCEPT THE COST OF PAIN, GRIEF, AND SUFFERING) ACCORDING TO ACCIDENT SEVERITY LEVEL IN EGYPT FOR 2008

Cost per casualty (Egyptian Pounds)		Accident severity level					
		Fatal		Serious		Slight	
		Assumed average number of casualties (casualty)	Total cost (Egyptian Pounds)	Assumed average number of casualties (casualty)	Total cost (Egyptian Pounds)	Assumed average number of casualties (casualty)	Total cost (Egyptian Pounds)
Fatality	1081524	1.4	1468168.9	-	-	-	-
Serious injury	8748.7	0.7	5686.7	1	5686.7	-	-
Slight injury	6772.1	1.9	12528.3	1.2	12528.3	1.2	12528.3
Total	-	4	1486383.8	2.2	16317.9	1.2	8295.8

respectively.

cost of road traffic accidents in Egypt, and hence for 2008, is about 16 billion Egyptian Pounds. Fig. 1 is a bar chart which compares the previously mentioned estimates of the total road traffic accidents cost in Egypt for the year 2008.
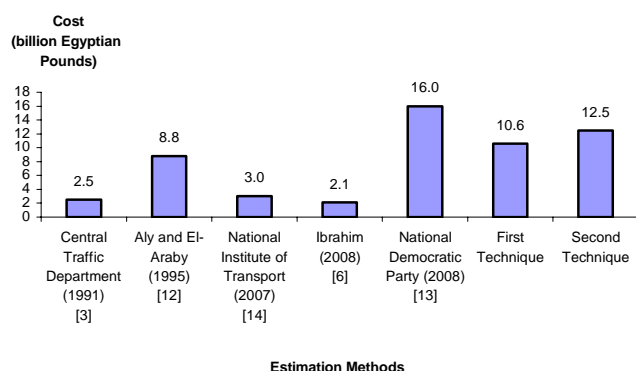
Fig. 1 The cost estimates of road traffic accidents in Egypt for the year 2008

It can be concluded that the cost of road traffic accidents in Egypt for the year 2008 is about 10 billion Egyptian Pounds. According to [2], road traffic accidents can be assumed to cost the economy annually between 1 and 2% of the GDP value. The closest estimate to the lower bound (1% of the GDP) is the estimate obtained using the first technique of the HC approach (10.6 billion Egyptian Pounds). The cost estimate obtained by the second HC technique (12.5 billion Egyptian Pounds) in addition to the estimate derived from [12] (8.8 billion Egyptian Pounds) are still reasonable compared to the remaining cost estimates which are either far below or far above 1% of GDP.

V. FORECASTING COST FOR 2009

Time series analysis is employed to forecast first the number of accidents and then the cost of road traffic accidents for 2009. The monthly series (y_t) of the number of road traffic accidents from 1990 to 2008 is used, where results show that an adequate model is SARIMA(1,1,1) $(0,0,1)_{12}$, which takes the form: $(1 - 0.38 B)\Delta y_t = (1 - 0.86 B)(1 + 0.27 B^{12})\varepsilon_t$, where ε_t is white noise and B is the backshift operator. This model is used to forecast the monthly numbers of road traffic accidents from January 2009 until December 2009. The forecasted values as well as their lower and upper bounds for the road traffic accidents numbers during (January – December) 2009 with 95% confidence level are shown in Table VI.

TABLE VI
FORECASTS OF THE MONTHLY NUMBERS OF ROAD TRAFFIC ACCIDENTS
DURING (JANUARY – DECEMBER) 2009
(ACCIDENT)

Month	Lower bounds	Forecasts	Upper bounds
January	1227	1739	2252
February	1239	1765	2292
March	1238	1775	2312
April	1221	1768	2315
May	1172	1727	2283
June	1214	1778	2343
July	1172	1746	2319
August	1195	1777	2359
September	1129	1720	2310
October	1192	1791	2390
November	1145	1781	2417
December	1122	1778	2433

The forecasted number of road traffic accidents during 2009 is about 21 thousand accidents. In addition, the 95% confidence interval (C.I.) for the forecasted number of road traffic accidents in 2009 is (14, 28) thousand accidents. The average and total costs of road traffic accidents during 2009 are derived using the corresponding estimates for 2008 (obtained from the first HC technique) and the average rate of inflation rates since 1987 until 2008. Table VII shows the forecasted values as well as their lower and upper bounds of 95% C.I. for the average and total costs of road traffic accidents during 2009.

TABLE VII
THE FORECASTED VALUES AS WELL AS THEIR LOWER AND UPPER BOUNDS OF 95%
C.I. FOR THE AVERAGE AND TOTAL COSTS OF ROAD TRAFFIC ACCIDENTS DURING
2009

Average cost per accident (million Egyptian Pounds)	Forecasted number of accidents (accident)			Forecasted total cost of accidents (million Egyptian Pounds)		
	Lower bound	Forecast	Upper bound	Lower bound	Forecast	Upper bound
0.6	14266	21146	28026	7977.8	11824.9	15672.0

The results show that the average cost per road traffic accident for the year 2009 is expected to be 559.2 thousand Egyptian Pounds. The total cost of road traffic accidents for the year 2009 is expected to reach 11.8 billion Egyptian Pounds. Moreover, the 95% C.I. for the total cost of road traffic accidents for the year 2009 is (8, 15.7) billion Egyptian Pounds.

VI. CONCLUSION AND DISCUSSION

This study estimates the cost of road traffic accidents in Egypt for the year 2008. The estimation process is carried out using different techniques for the Gross-Loss-of-Output of HC approach and updating previous national cost estimates. The study estimates the cost of road traffic accidents in Egypt for 2008 by around 10 billion Egyptian Pounds with an average cost per accident of 500 thousand Egyptian Pounds. Moreover, costs are expected to increase during 2009 to reach 11.8 billion Egyptian Pounds with an average cost per

World Academy of Science, Engineering and Technology
International Journal of Humanities and Social Sciences
Vol:4, No:6, 2010

accident of 559.2 thousand Egyptian Pounds.

It should be mentioned that estimating the cost of road traffic accidents requires a lot of data, which may need a number of surveys in addition to continuous data quality improvement. However, the availability of at least a rough estimate about the cost of traffic accidents at the national level, even with not very accurate data, is very helpful. These estimates can be improved regularly by accounting for underreporting, surveying the casualties, and moving forward towards the WTP approach.

ACKNOWLEDGMENT

REFERENCES

[1] A. Downing, "Accident Costs in Indonesia: A Review", Paper Presented at the International Conference on Road Safety, Andhra University, Visakhapatnam, India, 1997.

[2] Asian Development Bank, "Road accident costing", in *Road Safety Guidelines for the Asian and Pacific Region*, Asian Development Bank, 2003, Retrieved May 6, 2009, from http://www.adb.org/Documents/ Books/Road-Safety-Guidelines/chap4-14.pdf

[3] Central Traffic Department, "Analyzing Road Traffic Accidents" (in Arabic), Academy of Scientific Research and Technology, Egypt, 1991.

[4] D. Mohan, "Social Cost of Road Traffic Crashes in India", in *Proc. 1st Safe Community Conf. on Cost of Injury*, Viborg, Denmark, 2002.

[5] Department of Highways, "The Study of Traffic Accident Cost in Thailand: Final Report", Sept. 2007, Retrieved May 6, 2009, from http://siteresources.worldbank.org/INTTHAILAND/Resources/333200-1177475763598/Sept07-traffic_accident-full-report.pdf

[6] E. M. Ibrahim, "Road Traffic Accidents in Egypt: A Spatial Security Study" (in Arabic), *Arab Journal for Security Studies and Training*, vol. 23, no. 46, pp. 301-357, 2008.

[7] Economics Circle, "RHD Road User Cost Annual Report for 2000 – 2001", Roads and Highways Department, Ministry of Communications, Government of the People's Republic of Bangladesh, Dhaka, 2001.

[8] G. D. Jacobs, "Costing Road Accidents in Developing Countries", in *Proc. 8th Road Engineering Association of Asia and Australasia (REAAA) Conf.*, Taipei, Taiwan, 1995.

[9] G. Jacobs, A. Aeron-Thomas, and A. Astrop, "Estimating Global Road Fatalities", TRL Report 445, Transport Research Laboratory, Crowthorne, 2000.

[10] H. R. Al-Masaeid, A. A. Al-Mashakbeh, and A. M. Qudah, "Economic costs of traffic accidents in Jordan", *Accident Analysis and Prevention*, vol. 31, no. 4, pp. 347-357, July 1999.

[11] M. De Leon, P. Cal, and R. Sigua, "Estimation of Socio-Economic Cost of Road Accidents in Metro Manila", *Journal of the Eastern Asia Society for Transportation Studies*, vol. 6, pp. 3183-3198, Sept. 2005.

[12] M. S. Aly, and K. A. El-Araby, "Valuation of traffic accidents in Egypt", in *Proc. Road Safety in Europe and Strategic Highway Research Program (SHRP) Conf.*, Prague, the Czech Republic, 1995, pp. 101-110.

[13] National Democratic Party, "Party Positions and Visions: The Draft Law of Amending Some Terms of the Traffic Law No.66 for the Year 1973" (in Arabic), National Democratic Party, Egypt, 2008.

[14] National Institute of Transport, "The Impact of Trucks' Movement on Safety Levels on Main Roads in Egypt" (in Arabic), Ministry of Transport, Egypt, 2007.

[15] R. Elvik, "An Analysis of Official Economic Valuations of Traffic Accident Fatalities in 20 Motorized Countries", *Accident Analysis and Prevention*, vol. 27, no. 2, pp. 237-247, April 1995.

[16] Ross Silcock, and Transport Research Laboratory (TRL), "Guidelines for Estimating the Cost of Road Crashes in Developing Countries: Final Report", Project R7780, Department for International Development, 2003.

[17] T. Risbey, H. De Silva, and A. Tong, "Road Crash Cost Estimation: A Proposal Incorporating a Decade of Conceptual and Empirical Developments", in *30th Australasian Transport Research Forum*, Melbourne, Australia, 2007.

[18] T. T. Anh, N. X. Dao, and T. T. Anh, "The cost of road traffic accident in Vietnam", *Proceedings of the Eastern Asia Society for Transportation Studies*, vol. 5, pp. 1923-1933, 2005.

[19] World Health Organization, "World Report on Road Traffic Injury Prevention", Edited by Margie Peden [et al.], World Health Organization, Geneva, 2004.

[20] World Health Organization, "Global Status Report on Road Safety: Time for Action", World Health Organization, Geneva, 2009.