The Cost of Private Car Use in the city of Algiers, Algeria

تكلفة استخدام السيارة الخاصة بمدينة الجزائر العاصمة، الجزائر

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Abstract:

Several years ago, developed countries have undertaken analysis of private car use cost, and now it is time for Algeria to do the same. On this premise, the current study attempted to assess the internal cost of the private car use in the city of Algiers. The study showed a high financial loss resulting from the use of the private car at the expense of urban public transport systems (U.P.T.S) in Algiers, where the total annual average cost was nearly DZD181.014 for diesel cars, DZD175.665 for gasoline cars and DZD122.242 for L.P.G cars. Based on the obtained results, the study tried to draw some suggestions and recommendations which would support responsible authorities to take some actions that can help in individuals' shift from the private car use to U.P.T.S instead.

Key words: *Private car, cost of use, standing cost, running cost, city of Algiers*

JEL Classification Codes : R41, R48

ملخص:

منذ عدة سنوات، أجرت الدول المتقدمة تحليلا لتكلفة استخدام السيارة الخاصة بها، والآن حان دور الجزائر للقيام بمثل ذلك. على هذا الأساس، حاول البحث الحالي تقييم تكلفة استخدام السيارة الخاصة في مدينة الجزائر العاصمة. أظهر البحث خسارة مالية مرتفعة جراء استخدام السيارة الخاصة على حساب أنظمة النقل الحضري الجماعي، حيث بلغ متوسط التكلفة السنوية لاستخدام السيارة الخاصة 181.014دج للسيارات التي تعمل على وقود الديزل، و175.665دج للسيارات التي تعمل على وقود البنزين، و122.242دج للسيارات التي تعمل على غاز البترول المسال. بناء على النتائج المتوصل إليها، حاول البحث صياغة جملة من الاقتراحات والتوصيات والتي من شأنها أن تساعد السلطات المسؤولة في اتخاذ إجراءات تساعد على تحول الأفراد من استخدام السيارة الخاصة إلى استخدام أنظمة النقل العام بدلاً من ذلك.

الكلمات المفاتيح: السيارة الخاصة، تكلفة الاستخدام، التكلفة الثابتة، تكلفة التشغيل، مدينة الجزائر العاصمة.

تصنيف JEL: **R41**، **R48**

Introduction:

It is now well established that urban public transport systems in many developing countries, including Algeria, are facing lots of critical problems and challenges which are caused by the increasing private car use in urban areas (Dhwani, 2016). According to data from the World Health Organisation's Global Status Report on Road Safety 2015, some countries have more than one vehicle for every resident. Finland has the highest vehicle ownership per capita in the world with 1,07 vehicles per person. In second place is Andorra with 1,04 vehicles per person. Italy, United States of America (U.S.A) and Malaysia complete the top five vehicles per capita, with 0,84 vehicles per person for Italy, 0,83 vehicles per person for U.S.A, and 0,8 vehicles per person for Malaysia (Myers, 2015). This rapid growth of vehicles ownership continued at an accelerated pace over the time until the world's vehicles population exceeded the threshold of one billion-unit in 2007 (Planet Scope Statistics, 2019). Perhaps calculating the total number of vehicles on the planet is an inexact science, but some studies predict that the world's fleet will reach two billion vehicles or more by the year 2040 (Berggren & Kageson, 2017).

The level of private car ownership is increasing every day because people expecting several benefits from using their cars. The main advantage of using a car is the door-to-door convenience which means the passenger is assisted from the door of their residence to the door of their destination without the need to interchange (TFL, 2013). Cars also give the freedom to travel because of its availability 24/7, so then people don't need to be limited to fixed routes and timetables, which could be translated into supposed saving of time (Steg, 2005). At the same time, this freedom can also give a feeling of autonomy, independence and comfort (Beirao & Cabral, 2007). Furthermore, unfortunately most people nowadays believe that owning a car signifies high social rank, class, status and superiority which play important roles for making trips by car (Steg, 2003). All of these advantages of car ownership and use could explain why car has been rated the second most popular item on people's wish list possessions (Corbett, 2011).

There is no doubt that the private car offers many advantages for its users, but it has disadvantages and negative effects that outweigh any benefits. In fact, various car-related problems are manifested in urban areas, such as congestion, pollution, parking problems, road accidents, and financial burdens (Schuitema *et al*., 2010). Traffic congestion is a condition on road networks that occurs while road use increases characterized by slower speeds, longer trip times, increased number of vehicles (Das *et al.*, 2018). It occurs at peak hours on working days and usually in a single direction because of too many vehicles trying to use a giving road facility at the same time (ECMT, 1999), and that is why private car users stay longer hours on traffic jams. Economically, when a person makes a journey using his private car, he only consider the marginal private cost (M.P.C) such as time, fuel and maintenance of the vehicle, rather than the full cost of the journey, which may include costs imposed on society such as pollution, noise and time lost due to the congestion. When added to the private costs, these are termed the marginal social costs (M.S.C), the difference between the two representing the externality imposed by the private car driver (Arnott, 2001).

Besides the lost time and productivity, traffic congestion also exacerbates pollution such as air pollution and road traffic noise caused by motor vehicles. Air pollution is one of the most serious and complicated environmental problems in major urban areas. It refers to the presence of foreign substances in the air that don't belong there, or excessive amounts of certain impurities that wouldn't harm us otherwise (Araujo, 2014). Cars produce numerous harmful air pollutants in their exhaust such as: carbon monoxide (CO), nitrogen oxides (NOx), hydrocarbons and lesser amounts of particulate matter and sulphur oxides (SO) (Mohd Sadullah, 2003). These pollutants are known to cause various dangerous respiratory and other health issues such as cancer, asthma, heart disease, birth defects, eye irritation ..etc. On the

other hand, traffic noise pollution is also recognized as a serious health problem. Noise pollution refers to any unwanted and unpleasant sound in the environment that brings discomfort and restlessness to human beings (Anant, 2018). Decibel (dB) is unit for measuring the loudness of sounds. For a normal human ear pain is expected at sound pressures of around 130 dB. Recommended urban residential noise levels generally range from 45 to 55 dB depending on the time of day and location of measurement (King *et al.*, 2012). Due to the increase in number of vehicles and rapid urbanization of cities, noise level generally during rush-hour traffic periods range from 80 to 130 dB, which is harmful to both physiological and psychological health of human being, and can cause annoyance and aggression, hypertension, high stress levels, hearing loss, sleep disturbances and child development (Amrutha, 2016).

Also, following the rapid incense of car ownership and use, parking and road accidents became growing problems in urban areas in both developed and developing countries. Many cities are suffering from lack of car parking areas due to the imbalance between parking demand (number of cars in need for parking spaces) and supply (number of parking spaces sufficient to cars in need to park) (Ibrahim, 2017). The overuse of private cars in urban areas has not only increased the demand for parking spaces, but also its occupancy which means cars stay parked for a long period of time. Furthermore, free or under-priced parking has led to significant increases in traffic congestion (Roseland, 2012), as some studies say that 40% of traffic congestion in cities is caused by drivers looking for free or low-cost parking spaces to save money (Bouchard, 2012).

On the other hand, increased traffic has adverse impacts on public activities which once crowded the streets such as popular markets, parades and processions, games, and community interactions, which have gradually disappeared to be replaced by cars (Rodrigue, 2006). Also, growing traffic in urban areas is linked with a growing number of accidents and fatalities, especially in developing countries, where more pedestrians and car passengers have been injured or died by road accidents, however, these accidents may be less severe (Wang, 2009). Moreover, fossil fuels consumption has dramatically increased as more private cars are used by people, leading other generations to face a shortage of these fuels (Burapatana, 2011).

The private motorized transport does not only induce congestion, pollution, parking problems and safety issues, but also imposes significant financial and economic costs (Weisbrod, 2001). In fact, the increasing use of the private car has the clear disadvantage, in its high cost of use for both users and society. Private car use cost can be divided between internal and external costs (Litman, 1999). Internal costs (also called user costs or cost of use) are costs borne by the car user, including price paid for the car, depreciation, taxes, insurance, fuel, maintenance, repair and improvements, and parking costs, while external costs (also called social costs) are costs borne by the society, in the form of congestion, environmental pollution, parking problems and accident costs (Litman, 2002). Today, the car is the main item of individual consumption directly after housing needs are met, but most people greatly underestimate what it costs to drive a private car.

I- Elements involved in private car using cost:

Previous research efforts describe the various factors affecting the private car use cost (the internal cost) which includes registration tax, insurance, technical inspection, road tax, fuel (including fuel tax), maintenance and repairs, parking and depreciation. The Victoria Transport Policy Institute (V.T.P.I) divides these costs into two basic types of costs: standing costs and running costs (Litman, 2017).

I-1- Standing costs of private car use:

Standing costs of private car use, also called fixed costs are defined as the costs that are unaffected by the distance travelled by the vehicle, and which the owner must pay to keep the

car ready for use on the road (Lum *et al.*, 2010). Standing costs include vehicle registration tax, insurance, technical inspection, road tax and vehicle depreciation.

I-1-1- Registration tax:

Motor vehicle registration tax is a tax that is chargeable on registration of a motor vehicle with a government authority. It must be paid at the time that a vehicle is registered in the State. All vehicles that move upon public roads must be registered, and only registered vehicles display a registration plate and carry a vehicle registration certificate. The purpose of vehicle registration is to establish a link between a vehicle and an owner. This link might be used for taxation or crime detection purposes (Idara, 2016).

How to calculate registration cost?
Annual using cost = Annual registration bill
Cost per kilometre = Annual registration bill / Annual car kilometres

I-1-2- Vehicle insurance:

Vehicle insurance is an insurance designed for cars, trucks, motorcycles, and other road vehicles. It serves to provide financial protection against physical damage and bodily injury resulting from traffic collisions and against liability that could also arise there-from. Vehicle insurance may also offer financial protection against theft of the vehicle, and against damage to the vehicle sustained from events other than traffic collisions (Silvie, 2014).

How to calculate insurance costs?
Annual using cost = Annual insurance bill
Cost per kilometre = Annual insurance bill / Annual car kilometres

I-1-3- Vehicle technical inspection:

The technical vehicle inspection is a procedure mandated by national government that aims to reduce the incidence of road accidents by mechanical failures in road safety. The purpose of these inspections is to ensure that the general condition of the vehicle and its safety features meet the requirements that allow it to circulate without posing a danger to its occupants, other road users or the environment, and to control the level of pollutant emissions from motor vehicles. Technical vehicle inspection is required on the transfer of title to a vehicle or periodically every year or every two years. When a vehicle passes technical inspection, often a sticker is placed on the vehicle's windshield to simplify later controls.

How to calculate technical vehicle inspection Cost?
Annual using cost = technical vehicle inspection bill
Cost per kilometre = technical vehicle inspection bill / Annual car kilometres

I-1-4- Road tax:

Road tax is an annual direct tax that the owner of a vehicle must pay in order to drive it on a public road legally. Road tax is determined according to a scale that takes into account some vehicle characteristics such as the vehicle age which is must be calculated from the date of registration, number of seats, vehicle load capacity, engine fuel type and horsepower.

How to calculate Road Tax Cost?
Annual using cost = Road tax bill
Cost per kilometre = Road tax bill / Annual car kilometres

I-1-5- Depreciation:

According to Institute of Cost and Management Accounting, London (I.C.M.A) depreciation is a measure of the loss of value of a depreciable asset arising from use, lapse of time, or obsolescence through technology and market changes. Depreciable assets, such as vehicle, are assets which are expected to be used during a period and have a limited useful life (Srinivas, 2017). The depreciable amount of a depreciable asset is its historical cost in the financial statements, less the estimated residual value. Depreciation rate is an annual average reduction rate of the vehicle value, and every single vehicle depreciates at a different rate. Vehicle

depreciation rate varies by many factors such as vehicle manufacturer, make and model; its age, kilometres, history and condition; and supply and demand for it in a particular area.

How to calculate vehicle depreciation cost?
Annual depreciation cost = (Value when bought - Current value) / Years owned
Cost per kilometre = Depreciation / Annual car kilometres

I-2- Running costs of private car use:

Running costs of private car use also called variable costs are defined as the costs that are affected by the distance travelled by the car, and which depend on the use of the car. Running costs include fuel, maintenance, repair and improvements and parking fees.

I-2-1- Fuel:

According to European Expert Group on Future Transport Fuels, a motor fuel is a fuel that is used to provide power to motor vehicles. Currently, the majority of motor vehicles worldwide are powered by gasoline or diesel. Only few cars use other energy sources such as liquefied petroleum gas (L.P.G), ethanol, biodiesel, propane, electric batteries charged from an external source, and hydrogen. In terms of car fuel cost, it is better to know that fuel type, price and consumption are the main factors that affect fuel cost per kilometre (American Automobile Association, 2018). Even when fuel prices are low, putting gasoline or diesel in car is one of the biggest expenses of driving. Diesel drivers get more kilometres per litre than gasoline drivers, but the bigger the price gap, the longer it will take to recover the extra cost on buying a diesel car in the first place, and this is why fuel economy is one of the most important factors that people consider when buying a new car.

How to calculate fuel cost per kilometre?
Cost per kilometre = Litres x Fuel price / Number of kilometres
Annual using cost = Cost per kilometre x Average kilometres

I-2-2- Maintenance:

Regular car maintenance is a series of maintenance procedures carried out at a set time interval or after the car has travelled a certain distance. It keeps the car in good condition and runs smoothly. Regular car maintenance is relatively inexpensive. It depends on the vehicle itself, but there are some services that almost all cars require periodically. Car parts which might need to be replaced regularly under normal driving conditions include brake materials, oils, filters, bulbs and wipers. However, it might sometimes need to replace a bigger part like an exhaust (American Automobile Association, 2018).

How to calculate maintenance cost per kilometre?
Annual maintenance cost = Total of all items bought for car maintenance
Cost per kilometre = Total cost / Annual car kilometres

I-2-3- Repair and improvements:

The concept of car repair differs from car improvement. In fact, car repair means the application of parts and labour to damaged cars for the purpose of repairing them and fixing the damage or deterioration, while car improvement is the change that occurs when the condition or value of the car is enhanced beyond its original state at the time of purchase.

Costs of car repairs and improvements can be charged by garages to cover replaced parts and labour. Car parts prices vary by the make, model, and year of the car, as well as the components unique place in the car. Labour rates also vary depending on garages engaged in performing automobile repairs.

How to calculate repair and improvements cost per kilometre?
Annual cost of repair and improvements = Total of all items bought for car repair and improvements
Cost per kilometre = Total cost / Annual car kilometres

I-2-4- Parking:

The parking charge has immerged as one of the most powerful policies of efficient utilisation of the existing traffic infrastructure and traffic demand management. Parking charge means

that the drivers directly pay for the use of parking space (on-street or off-street) and it represents the most practical method of introducing or modifying the charge drivers are paying to use their passenger cars (Jelena, 2012). Parking costs vary depending on where car users live and the way they use their cars, so then it could be simply a small amount of money or a large regular cost.

How to calculate maintenance cost per kilometre?
Annual parking cost = Total of all parking expenses
Cost per kilometre = Total cost / Annual car kilometres

II- Problem, objectives and outlines of the study:

This section provides an overview of the problem statement, objectives and outlines of the study.

II-1- Problem statement:

Several years ago, developed countries have undertaken analysis of private car use cost in order to reduce the increasing private car use particularly in urban areas. Compared to the other urban public transport systems, the private car has a high cost per person and per kilometres travelled (Diesendorf, 2002). In U.S.A, the annual cost of driving a single-occupant vehicle in 2018 is between $4.488 for a small car, and $6.655 for a large car (American Automobile Association, 2018), while the annual average cost for public transport for one adult ranges from $200 to $2.000, depending on used services (Goodwill, 2004). In United Kingdom, the average annual cost of owning and using a new car also in 2018 is $7.904. In Europe, also in 2018, the average cost of using a car varies hugely between countries, from $5.922 in Poland to $10.059 in Italy. Weighted for Gross Domestic Product (G.D.P), drivers in Finland and Belgium have the highest total cost of car ownership and use after Italy with $9.795 and $9.200 respectively, while drivers in Poland, Ireland ($8.076) and Switzerland ($8.327) have the lowest cost (Lease Plan Corporation, 2018). With these values, what is Algeria's place in it?

Now it is time for Algeria to do the same and try to assess how much the individual is paying to use his own car. In fact, like most cities in developing countries, for nearly three decades into the 20th century, the private car was still the personal mode of transport the most used for many people in Algiers. According to a report of the Algerian Forum of Business Leaders, in 1990 there were 155.000 vehicles in use in Algiers, to reach 377.160 vehicles in 2002. In 2017, Algiers car park exceeded the threshold of one-million unit and reach 1.600.000 cars, which means an average growth of 28,25% every year over the period 2002-2017. Today, the private car is the most used mean of transport in Algiers for nearly 50% of people, where 88,26% of private car users visit Algiers regularly from 3 to 5 times per week. In the same context, almost 50% of their trips are pendulum movements (between residence and work), and three main reasons are behind the increasing use of the private car in Algiers: (1) the door-to-door convenience; (2) the car comfort; and (3) the lack of efficient alternatives to the private car. After all these horrible facts about the private car ownership and use in the city of Algiers, the question that could be asked now is how much it costs the individual to use his private car in Algiers.

II-2- Objectives and scoop of the study:

This study is based on the premise that the private car use in urban areas involves large standing and running costs. Thus, the objectives of this private car use costing study are to:

- Find out the cost of using the private car in the city of Algiers, and show the high financial loss resulting from that, particularly since most people greatly underestimate what it costs to use a private car;
- Encourage responsible authorities to take corrective actions or approaches that can help motivate individuals to shift from using private cars to using public transport systems instead;

- Bring the importance of further improving urban public transport systems to the attention of both governments and society.

For the purpose of this study, the study area concerns the urban area of the city of Algiers, the capital of Algeria, and the year of study is 2018, from which data of the private car use and cost figures are to be computed. On the other hand, "DZD" in this study refers to Algerian Dinar, and "$" to US dollar.

II-3- Outline of study:

The current study is organized into five sections. Section 1 provides a brief discussion about the problems related to the increasing use of the private car in urban areas, with a particular focus on its clear disadvantage of high cost of use for both users and society. It also identifies the elements involved in the private car use cost, which could be divided into two basic types of costs: standing and running costs. Section 2 presents the problem statement, and states the objectives and scope of this study. Section 3 provides an overview of the study area (city of Algiers) and detailed explanation of data collection and analysis considerations. This is followed by Section 4 which contains a presentation of socio-demographic profile of the respondents and the private car use cost computation in the Algiers context. Finally, Section 5 is the conclusion. It summarizes the discussions on the implication of the findings.

III- Methods and materials:

This section provides an overview of the study area and detailed explanation of data collection and analysis considerations.

III-1- The study area: Algiers:

The study area concerns the urban area of Algiers province, the capital of Algeria. Algiers is a coastal metropolitan province situated on the Mediterranean Sea. Algiers is the largest province in Algeria; it consists of 57 communes and covers an area of 1.190 km². It has a population of more than 2,98 million inhabitants at the 2008 census, which gives an urban density of 3.690 persons/km². The urban area of Algiers is served by a transport system made up of busses, tram, subway and taxis. Algiers has only one tram line with a length of 16,2 km, served by 28 stations, and only one subway line with a length of 9,9 km served by 14 stations.

The tram of Algiers which began operating on May 08th, 2011, made Algiers the first province in Algeria that has implemented a tram system. The single ticket of the tram of Algiers costs DZD40, and the 10-trip ticket is discounted to DZD320. A monthly travel card costs DZD1.500, discounted to DZD990 for juniors and to DZD830 for adults. A single integrated travel card valid for tram and subway costs DZD70, where costs are reduced to DZD600 for 10-trip tickets and to DZD2.500 for the monthly travel card.

The subway of Algiers which began operating on October 31st, 2011, making Algiers only the second capital city in Africa (after Cairo) that has a subway system. The single ticket of the tram of Algiers costs DZD50, and the 10-trip ticket is discounted to DZD400. A monthly travel card costs DZD1.820, discounted to DZD1.200 for juniors and to DZD1.000 for adults. A single integrated travel card valid for tram and subway costs DZD70.

III-2- Data collection and analysis considerations:

Along with the information available in official reports and statistics, the current study employed the survey method which is the best way for collecting the needed information to calculate the cost of the private car use in Algiers. Based on literature review and opinions of academics and professional experts in the discipline, a preliminary questionnaire containing two main parts with total of 23 questions was designed to collect data on elements involved in car operating costs in Algiers as follows: Part 1 included socio-demographic profile of private car users, and Part 2 was about collecting data on standing (fixed) and running (variable) costs of running a private car in Algiers. Besides dichotomous and multiple choices questions, the

questionnaire included numeric questions which are used to capture numerical information such as kilometres and amounts of money.

Prior to the start of the study, the preliminary questionnaire was tested on 40 study subjects selected randomly, for validity and reliability. In order to determine these lasts, split-half reliability and Cronbach's alpha tests have been applied. Split-half reliability and Cronbach's alpha values were 0,844 and 0,719 for Part 1 of the questionnaire (socio-demographic characteristics of respondents), and 0,817 and 0,932 for Part 2 of the questionnaire (costs of running a private car in Algiers). After the validity and reliability were confirmed, the definitive questionnaire administrated to a sample of 384 motorists selected randomly. This sample size is truly representative of the study population, knowing that using Krejcie and Morgan's formula (Krejcie *et al.*, 1970) for determining the required sample size for a given population of 1,6 million private cars in Algiers, and at the 0,05 confidence level, gives the result of 384 respondents.

Thereafter, the survey study was carried out from April 07th to July 24th, 2018, covering all the days of the week and the time periods from 7:00am to 6:00pm. The questionnaires were distributed randomly to respondents intercepted at different possible points of Algiers' urban area. In order to reduce errors due to inconsistency of respondents, data collected were processed and checked for illogical or missing data, after that it was coded and entered into S.P.S.S V.21 software (Statistical Package for Social Sciences software) to perform statistical analysis. Due to the nature and the type of the analysis to be carried-out, descriptive statistics were mainly used to analyse the collected data. Cronbach's Alpha and split-half reliability tests were, first, used to assess the reliability of the study as showed before, and frequencies, percentages and mean scores were used to determine varying degrees of response-concentration regarding the questions included in the survey questionnaire and to calculate standing costs, running costs and the total cost of using a private car in Algiers.

IV- Results and discussions

In this section, socio-demographic profile of private car users in Algiers, and the computation of average using cost for each type of car (diesel, gasoline and L.P.G) will be shown. The estimates are based on values of the different variables explained earlier (under ELEMENTS INVOLVED IN CAR USING COSTS) and follow the calculation procedure given for each cost component.

IV-1- Socio-demographic profile of car users in Algiers:

The socio-demographic characteristics and the travel habits of private car users in Algiers are showed in Table n° 1. Table n° 1 shows that the sample of the study is made up mainly of male car drivers (76,6%). Regarding age, the sample consists of 52,34% of people aged between 17 and 29 years, followed by 30,46% between 30 and 39 years, then 14,32% between 40 and 49 years and finally 2,86% are between 50 and 65 years of age. In term of employment status, the sample consists of 66,7% of employed people (Including all the employment categories), followed by students (24%), jobless (8,6%) and retired (0,8%). Despite the existence of university specialized transport that concerns the students, where buses operate according to the university schedule, and run every day of the university week from 8am to 5pm, transporting the students free of charge from residence to campus or between campuses, but an important proportion of students prefer using the private car rather than any public transport mode.

Table n°1: Socio-economic characteristics of private car users in Algiers

Characteristics	Categories	Percentage
Gender	Male Female	76, 60% 23,40%
Age (years)	17-29 30-39 40-49 50-65	52,34% 30,46% 14,32% 2,86%
Employment status	Student Employed Retired Unemployed	24% 66,70% 0,80% 8,60%
Residence place	Algiers Out of Algiers	85,40% 14,60%
Car type	Diesel Gasoline L.P.G	38,30% 59,90% 1,80%
Area of car use	Urban area Non-urban area	77,30% 22,70%

Source: Survey data

Table n° 1 also revealed that most of the respondents (85,4%) live in Algiers, while the rest (14,6%) live out of it. Regarding the type of car that people drive, more than half of cars (59,9%) are cars that run on gasoline, and more than one-third (38,3%) run on diesel, while a minority (1,8%) run on L.P.G. At the end, in terms of car use area, the urban area of Algiers is the most area visited by respondents (77,3% of respondents visit the urban area of Algiers regularly, i.e. between 3 and 5 times per week).

As a result, the study shows that the main car user in Algiers is an employed male, aged between 17 and 29 years old, owns a gasoline car and use it regularly in the urban area of Algiers.

IV-2- Calculating standing costs of using a private car in Algiers:

The estimation of the annual average standing costs per car for each car type (diesel, gasoline and L.P.G car) requires the calculation of the five cost components: registration tax, insurance, technical inspection, road tax and depreciation. As shown in Table n°2, the annual average standing costs per car ranges between DZD14.927,64 and DZD47.027,76.

Table n°2: Annual average standing costs per car

Item	**Diesel car**	**Gasoline car**	**L.P.G car**
Registration tax	DZD3.528,47	DZD2483,82	DZD2536,21
Insurance	DZD39.075,51	DZD28.155,22	DZD11.428,57
Technical inspection	DZD1.609,83	DZD1.730,04	DZD962,86
Road tax	DZD2.813,95	DZD2.056,52	DZD0
Depreciation	-	-	-
Annual average standing costs	**DZD47.027,76**	**DZD34.425,60**	**DZD 14.927,64**

Source: Survey data

As seen in Table n°2, it is clear that diesel-fuelled cars have the highest annual standing costs with an average value of DZD47.027,76 versus DZD34.425,60 and DZD14.927,64 for gasoline and L.P.G-fuelled cars. This high cost could be attributed at first to the high cost of building diesel engine cars, and the fact that they require generally more expensive parts to repair, it costs more to insure them, and insurers are pricing in the extra expense if the car is stolen or damaged. In this respect, it is of note that the cost of insurance constitutes about 90% of the annual average standing costs of using a private car in Algiers. On the other hand, the cost of registration and road tax for a diesel car is more than that of a gasoline or L.P.G car; the difference is up to 40% depending on the age of the car, number of seats, vehicle load

capacity, engine fuel type and horsepower. According to the Algerian Ministry of Finance, road tax revenue is divided as follows: 20% goes to the Roads and Highways National Funds, 30% to the Fund for the Guarantee and Solidarity of the Local Communities, and 50% to the government's public budget.

On the other hand, if it is common knowledge that a new car loses value as soon as it leave the forecourt, it is important to note that this is not the case with cars in Algeria, which generally do not lose much value over time and depreciate very slowly regardless of its costs or use, and in many cases cars may increase in value for a time, then decrease decades later. This abnormal cars market situation can be explained by different factors. At first, a complete absence of vehicles at the level of accredited dealerships and points of sale, especially with the government's delays in licences distribution and the quota of each dealership, then the severe scarcity at the assembly plants which still unable to respond to the heavy demand on new cars and its size, and finally the domination of brokers and mediators on cars market which contribute to inflaming the market in an unprecedented way (huge rise in prices at the level of used cars market) and raise their profit margin noticeably. On this basis, the annual depreciation cost was not taken into account in the calculation of standing costs.

IV-3- Calculating running costs of using a private car in Algiers:

The estimation of the annual average running costs per car for each car type (diesel, gasoline and L.P.G car) requires the calculation of the four cost components: fuel, maintenance, repair and improvements, and parking. As shown in Table n°3, the annual average running costs per car ranges between DZD107.314,35 and DZD141.239,95.

Table n°3: Annual average running costs per car

Item	Diesel car	Gasoline car	L.P.G car
Fuel	DZD48.579,60	DZD67.669,92	DZD34.285,68
Maintenance	DZD26.418,00	DZD26.840,88	DZD30.171,48
Repair and improvements	DZD38.850,34	DZD27.577,39	DZD34.285,71
Parking	DZD20.138,76	DZD19.121,76	DZD8.571,48
Annual average running costs	**DZD133.986,70**	**DZD141.239,95**	**DZD107.314,35**

Source: Survey data

Based on Table n°3, it is pretty clear that gasoline-fuelled cars have the highest annual running costs with an average value of DZD141.239,95 versus DZD133.986,70 and DZD107.314,35 for diesel and L.P.G-fuelled cars. This high cost could be attributed at first to the high prices of gasoline fuel (gasoline fuel price ranges between DZD38,95 and DZD41,62, diesel is DZD23,06 and L.P.G is DZD9,00). In fact, gasoline is generally more expensive than diesel, because it is less heavy and less volatile than diesel, which makes it simpler to refine from crude oil, and as a result, diesel tends to be cheaper than gasoline in most countries around the world, as in Algeria where diesel is 40,79% or DZD15,89 cheaper than gasoline as showed in Table n°1. On the other hand, it is also noted that the cost of maintenance and repair of diesel cars is higher than gasoline ones. In fact, diesel powered cars are more expensive to service than gasoline ones. If diesel cars need to be maintained less often than gasoline cars, they are more expensive when they need maintenance and repairs, because their engines require expensive part such as high-pressure fuel-system components in order to improve the car efficiency.

IV-4- Total cost of private car use in Algiers:

The estimation of the annual average cost of use per car could be calculated by summing the annual average of standing and running costs for each type of car (diesel, gasoline and L.P.G). As shown in Table n°4, the annual average cost of use per car ranges between DZD122.241,99 and DZD181.041,46.

As seen in Table n°4, diesel-fuelled cars have the highest annual total cost with an average value of DZD181.014,46 versus DZD175.665,55 and DZD122.241,99 for gasoline and

L.P.G-fuelled cars. Running costs of private car use in Algiers are higher than standing costs, and the difference ranges between 64,90% and 86,08% based on the car type (diesel, gasoline or L.P.G). In other words, in order to use the private car in Algiers, the individual spend between 24,82% and 36,75% of the Algerian gross domestic product per capita.

Table n°4: Average total cost of use per car

Item	Diesel car	Gasoline car	L.P.G car
Kilometres driven per year	30.612,24 km	26.152,17 km	35.714,29 km
Registration tax	DZD3.528,47	DZD2483,82	DZD2536,21
Insurance	DZD39.075,51	DZD28.155,22	DZD11.428,57
Technical inspection	DZD1.609,83	DZD1.730,04	DZD962,86
Road tax	DZD2.813,95	DZD2.056,52	DZD0
Depreciation	-	-	-
Annual average standing costs	DZD47.027,76	DZD34.425,60	DZD 14.927,64
Fuel	DZD48.579,60	DZD67.669,92	DZD34.285,68
Maintenance	DZD26.418,00	DZD26.840,88	DZD30.171,48
Repair and improvements	DZD38.850,34	DZD27.577,39	DZD34.285,71
Parking	DZD20.138,76	DZD19.121,76	DZD8.571,48
Annual average running costs	DZD133.986,70	DZD141.239,95	DZD107.314,35
Average total cost per year	**DZD181.014,46**	**DZD175.665,55**	**DZD122.241,99**
Average total cost per month	**DZD15.084,53**	**DZD14.638,79**	**DZD10.186,83**
Average total cost per day	**DZD495,93**	**DZD481,28**	**DZD334,91**
Average total cost per kilometre	**DZD5,91**	**DZD6,72**	**DZD3,42**

Source: Survey data

On the other hand, the results also reveals that the average total cost of use per month is DZD15.084,53 for diesel cars, DZD14.638,79 for gasoline cars and DZD10.186,83 for L.P.G cars. Thus, individuals using the private car in Algiers spend approximately DZD482 per day. This cost is equivalent to more than 50% of the monthly subscription of the tram of Algiers which is DZD1.500, and 25% of the monthly subscription of the subway which is DZD1.820.

Despite the current high cost of private car use in Algiers did not seem to inhibit individuals from using the private car in their urban movements. On this basis, the individuals' shift from the private car to the use of urban public transport means depends on making this last on a high level of quality, efficiency, reliability and attractiveness compared with that of the private car or more.

V- Conclusion:

The objective of the current study was to estimate the cost of private car use (the internal cost) in Algiers, Algeria. The paper adopted the survey methodology and estimated in the light of the survey results the standing costs (also called fixed costs) which include registration tax, insurance, technical inspection, road tax and depreciation, and running costs (also called variable costs) which include fuel, repair and improvements, maintenance and parking fees. The annual average total cost of private car use in Algiers was calculated by summing the annual average of standing and running costs for each type of car (diesel, gasoline and L.P.G). Thereafter average total cost of private car use in Algiers per day and kilometre were calculated.

This study clearly demonstrates the high cost due to the increasing ownership and use of the private car in Algiers. In fact, the estimated annual average cost of use amounted to nearly DZD181.014 for diesel cars, DZD175.665 for gasoline cars and DZD122.242 for L.P.G cars, representing respectively 36,75%, 35,67% and 24,82% of Algerian gross domestic product per capita. On the other hand, the annual average total cost of use per month amounted to DZD15.084,53 for diesel cars, DZD14.638,79 for gasoline cars and DZD10.186,83 for L.P.G cars. While a monthly travel card costs DZD1.500 for the tram of Algiers and DZD1.820 for the subway of Algiers, nearly 50% of individuals living in Algiers prefer to use the private car instead of urban public transport systems for three main reasons which are: (1) the door-to-

door convenience; (2) the car comfort; and (3) the lack of efficient alternatives to the private car. This means that the problem of the increasing ownership and use of the private car in Algiers is not a matter of money at all.

Based on the horrible obtained results, the study concluded that it is imperative for the relevant authorities in Algiers to invest more in researches and programs that addresses the issue of reducing private car use in urban areas, to better understand the causes of the increasing use of the private car in urban areas, and control the rates of private car ownership and use in Algiers, which have been increasing annually with an average growth of 28,25% every year over the period 2002-2017, until the car fleet reached 1.600.000 cars in 2017 which means a vehicles per capita of 0,53.

To end, it is important for the government to declare the increasing ownership and use of the private car in urban area of Algiers as an urgent problem, and use modern strategies and tools to raise awareness about this issue, and motivate individuals to shift from using the private car to using urban public transport systems instead, where the quality of service (availability, accessibility, information, time, customer care, comfort, security and environment) of these last must be improved in order to attracts new passengers. Also, there must be cooperation across many sectors in Algiers, not only in transport, but also in education, health, and law enforcement, and a workforce that will tackle the motorized transport and its negatives (i.e., in media and communication, economic analysis, and policy development) must be built.

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