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Review article

Comprehensive study of land transportation external costs (Iran)

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ABSTRACT

This research is a comprehensive study of land transportation external costs that influence on the national economy. It includes detailed analysis of various land transportation costs by using the best available data. It provides monetized estimate approaches for estimate external costs. There are many efforts to get these external costs from consumers and producers. External costs are much expanded that this report is going to present a lot of information about the external costs of land transportation and different ways of estimating them in financial terms. So this study has an economical approach to turn the externalities into the monetized and it can help to assess the planning and policies in Iran. This work is done due to the people and society's decision for choosing policies, according to benefits and social costs that it's known as a good approach in the world. Environmental economists discover some new methods to account these effects as financial facts, in order to change the view point of traditional cost benefit analysis and instead of that, replace marginal social cost and marginal social benefit. External effects are a general expression that includes costs and benefits which can't reflect the market's prices. The costs and benefits are so important for planning of land transportation. It is one of the most comprehensive studies in Iran, including many costs categories that are often overlooked. It is help to apply economic evaluation techniques. The costs that are in the attention of the past studies and recognition of land transportation

divided to 20 groups. In this study after study economic evaluation techniques Hedonic approach that depends on the real exchanges of market can have more real results. Hedonic is better than the others approach. The avoid cost and controlling costs are not the same with real costs. The contingent valuation method not based on the market exchanges and people reveal their willingness to pay. Due to limited time and resources when decisions have to be made, it's offered to use the benefits transfer method for Iran. The benefits transfer method is a way that we can use the studies of external costs and we also use them in a reasonable way and in some more places.

1. Introduction

External costs are important as loss-making factors affecting the society and national economy and they should be controlled. Now, hard efforts devoted to take these costs from goods and services costumers and producer. This could be done by rising the cots, tax like carbon tax, which was brought up in Kyoto conference or tariff. Since the external cost cannot be computed in Iran, Taking them from producers and costumers is not in economic program of work. On the other hand, goods and services costs are very high due to inefficiency of most of economical sections, and government still pay obvious and secret subsidy for these goods and services become of law purchasing power, and carrying charge of load and passenger in transportation section rather than existing tariff costs are examples of it. Transportation has been important for human for a long time and it has had considerable improvement along with science and technology growth as a vital issue in his life. Unfortunately, in common approach of benefits costs analysis and land transportation costs many carrying charges are ignored. For the purpose of access to benefits and land transportation, social cost, awareness of external costs (negative external effects) of this kind of transportation is one of the necessities (Clarkson and Deyes, 2002). According to the lack of computing and receiving mechanism of external costs in Iran, the useful policy is cost preventive policy or consideration to, or compatible sections with environment which as a whole is low cost.

There are a lot of concerns about the rapid growth in number of cars, especially according to this fact that half of the Co_2 in atmosphere produced by cars. Transportation is the main activities for producing the greenhouse gases. Greenhouse gasses (Co_2, Metan …) are produced either directly by consumption of fossil fuel or indirectly during the production of all other kinds of energy from fossil fuel. Land transportation is responsible for producing 1/4 of whole greenhouse gasses in EU (equal to 823 million tons). In developed and developing countries transportation portion in producing greenhouse gasses is increasing rapidly. For instance, green house production rate of Asia transportation, which was 10% in 1990, will increase to 65% in India in 2010 (United Nations, 2015).

In Canada, transportation and travel by cars are responsible for production of 42% of greenhouse gasses in Transportation and 11% of the whole produced greenhouse gasses. Cars are the main source of Co_2 production in urban areas and make half of the diffused Co_2 in atmosphere. The developing countries conditions are worse than it. In these countries due to consumption of leaded gasoline and old engines and since most of pollutants are repaired and preserved rarely, they are more exposed to diffusion of pollutants. Voices and sever vibrations of engine are other effects of land transportation that not only cause erosion of buildings constructions but also in long term effect on human health and lead to never diseases and lack of hearing and finally, physical and nervous shocks cause to people grow old before their time and increase the psychological diseases. The vibration produced by traffic of large amount of vehicles in cities has 10 to 30 Hz frequency, which includes most of the sound pollutions in big cities. Today, attentions to other negative external and irreparable effects of transportation on society and environment have started a global movement for recognition, prevention and control of these costs. External effects of land transportation in Iran, like other parts of the world has influenced physical and chemical, biological and social economic environment which most of them are public goods, according to the portion of this part in national economics and international trade and social benefits from this service, land transportation activities produce external costs (negative external effects) like air pollution, water pollution consumption of energy and other natural resources of country, crowded and accidents which influence the society and

environment. These costs are not compensated by their producers and imposed to others (Karimzadegan, 2007). According to the importance and amount of these costs which is evaluated to 5% of GPP in some countries for road transportation, based on pollutant payment rule these costs should be recognized and compensated (Quinet, 2004).

The main purpose of this research is to provide detailed information about land transportation external costs and different method for estimating its negative effects to monetary units. So, this research will be done with economic approach for changing these effects to monetary units for analyzing the policies and just programming that concerning the modern world is increasing gradually and transportation economy expert have endeavored in this case. Clearly, by this work people and society decisions making for selecting and future policies will be done based on resources and social costs that is proper decision making approach in today world. Therefore, purpose of current research could be stated as follows.

- ✓ Main purpose:
- Recognition of land transportation external effects and their evaluation method.
- ✓ Secondary purposes:
- Analysis of theoretical principles of land transportation external effects and their evaluation methods.
- Providing the approaches for evaluation of land transportation external effects.

2. Methodology

Different methods were invented by environment economists for estimate external costs and change traditional point of view of Cost Benefit Analysis (CBA) and substitute Marginal Social Costs (MSC) and Marginal Social Benefit (MSB). Evaluation of Marginal External Cost (MEC) and Marginal External Benefit (MEB) is essential that this research analyze it. It is hoped that by estimating of them to comparable figures with other economic system services in second phase, a great work be done in proper decision making for land transportation in country. In this research, at first the subject generalities, theoretical principles and studies inside and outside of country reviewed and in next section the negative of land transportation in physical, biological and socioeconomic environments in establishment and operation phases will be studied and categorization and explanation of land transportation external costs will be done. Then, after analysis of theoretical methods of quantifying the external costs, quantifying method of any costs will be explained according to above said methods. In this section, we attempt to suggest a method of land transportation external costs with minimum cost and time by introducing a low expense method.

3. Importance of research

Following evidences are important for evaluation of land transportation external costs and its application in proper economical evaluation of land transportation projects:

✓ Economical evaluations of transportation projects are essential for defining the special choice costs and awareness of choice which has the most benefit. In common methods often most of negative effects of transportation projects are ignored that lead to providing an imperfect solution for problem and aggravating the seriousness of other problems. Evaluation of external costs provides a comprehensive framework for economic analysis of transportation projects may help the complete cost evaluation of land transportation and compare final costs of different choices. Evaluation of these effects could lead to proper decision making concerning the social costs and direct the new investment projects of land transportation in correct path with minimum social costs.

✓ In macroeconomics, national accounts are widely used, that register the contracts and currency in economy area. The main purpose of these effects is not evaluation of welfare in country, but it is the registration of economic activities. However, national accounts are widely used for presenting the welfare and amount of its change indexes like grass national production are explained as "development" standard. Now, if these evaluations over designed for registration of economic activities or measurements of welfare or both of them, they would have many problems for attention to most of external costs.

✓ For evaluation of amortization fund of natural invests in performance of land transportation projects for measurement of sustainable income, evaluation of external costs are needed sustainable income means an income which a country could earn without depreciation its natural resources.

✓ On the other hand, related information to external costs could help the defining process of land transportation natural and regional priorities.

✓ Also, government can direct the new investments in the private sector by evaluation of land transportation external costs and transfer responded in this sector to private owner by effective taxes.

4. Concepts and definition of research words

4.1. External effect

External effect is term including costs and a benefit which is reflected in common costs of market. These costs and benefits are important for programming in transportation part in long term. According to its meaning, external effect is the effect of an outside factor. It means that a person makes an effect which influences on others. One external effect produced when benefits and costs (expenses) of one economic agent is influenced by others actions.

Negative external effect is named as an external non-economic effect or external cost. This effect becomes negative when influenced person will have loss in utility and this loss doesn't be compensated. Air, water and noise pollution are some examples of these negative external effects. Positive and negative external effect occurs when the resulted effect is useful for the influenced person. One of the positive external effects is safe making the roads which reduces the physical damages, so this measure is useful for others. Other example of positive external effects is when technology of one agency helps other industrial agencies which haven't helped to research costs benefit from them.

4.2. Negative external effect or external costs

It indicates that a person or a group makes damage and its results have no effects on others. Damage and polluting the environment by land transportation is one of the negative external effects that lack of consideration in this regard has led to low application of more suitable methods for the health of society and environment.

4.3. Social costs

For fundamental evaluation of external costs, concept of social costs is used. Theoretically, social costs are required costs of compensation of resources of society, in a way that the desirability level of society remains stable. Classification of land transportation external costs: Transportation has a lot of advantages for society and people, but its considerable costs should not be ignored. In developed countries, 15 to 20 percent of households' income and GNP is allocated to transportation costs. In addition, transportation has some non-monetary effects like accident, ruining the environment and social effects, in this section, total costs made by land transportation are divided into 20 main groups (Table 1) according to result of previous researches and recognition of land transportation effects, and then base on this categorization external costs were selected based on provided definition (ExternE, 1998).

5. Method of accident external costs evaluation

✓ Direct cost method

✓ Evaluation method of human life value

- Gross production method or human capital approach
- Net production method
- Life insurance method
- Implying evaluation method of society
- Value of statistical life

✓ Evaluation of psychological external costs

✓ Evaluation of Travel External cost

- Production method- production based method
- Cost of time

- Revealed preference
- State preference method
- Transport of price (TP) method
- Contingent validation method

✓ Evaluation of air pollution external costs

Air pollution from land transportation could have negative effects on human, plant and animal, building (erosion and pollution) and landscapes. Its effects on health includes respiratory diseases, asthma attacks, cardiovascular disease, cancer, different systems and complains like headaches, children learning disorders or even death. Most of the researches on air pollution lay its effects on human health. Different reaction doses for communication of vehicles diffusions and increasing the air pollutants and effects of them health has been resulted. Although, some of these relations expose to lack of certainly. After making relations, total evaluation of air pollution costs will be obtained by multiplying the cost of each effect on health in its occurrence probability and influenced population. In this section, after defining the reaction does, methods of direct cost, prevention costs, value of statistical life, human capital approach, willingness to payment and Hedonic could be used. One of the useful principles for evaluation of air pollution cost includes evaluation of required costs for reaching to purpose to decrease the pollutant (prevention costs). This method could be used for evaluation of climate charges due to greenhouse gasses of land transportation (Maries, 2003).

Table 1
Classification of land transportation costs.

Costs	Internal/ External	Fix/ Variable	Market/non Market	Costs	Internal/ External	Fix/ Variable	Market/non Market
1. Purchasing of car and train	Internal	Fix	Market	11. Land value	External	Fix	Market
2. Preserving of car and train	Internal	Variable	Market	12. Traffic services	External	Variable	Market
3. Government subsidy	External	Fix	Market	13. Selection value (Various transportation systems)	External	Variable	Non Market
4. Travel time	Internal	Variable	Non Market	14. Air pollution and world heating	External	Fix	Non Market
5. Internal accidents	External	Variable	Non Market	15. Noise and vibration	External	Variable	Non Market
6. External accidents	External	Variable	(Half market) Compound of market and non-market	16. Consumption of natural resources and energy	External	Fix	Both
7. Internal parking	Internal	Fix	Market	17. Effect of obstacles	External	Variable	Non Market
8. External parking	External	Variable	Market	18. Applicable change of land and view	External	Fix	Both
9. Crowd	External	Variable	Half market	19. Water pollution and hydrological effects	External	Variable	Non Market
10. Road and railway facilities (Public facilities)	External	Variable	Market	20. Soil pollution and repelling of waste material	External	Variable	Non Market

6. Evaluation of noise pollution external costs

Evaluation of noise pollution external costs of land transportation could be done by some methods. Which some of them are just about tendencies and personal valuation of influenced individuals and vice versa, some

others provide approximation of losses rate base on real losses on individual health and its combination with people mental valuation from their quality of life. According to environmental economics literature where accurate approximation base on works could be provided, it is possible to follow the best political tools in comparison to other methods (either law or economic dimension). So, methods of analyzing the works are the best acceptable method in environment economics.

In this study, applications of works analysis method are suggested. Therefore, application of Hedonic method, contingent valuation, and prevention cost are the best choices. Also, benefit transfer method could be used as based on global studies related to sound pollution level and comparative and complementary method of transfer of resources and balance of transportation of value results could evaluate sound pollution external costs (like transfer of coefficient and contingent evaluation).

6.1. Evaluation of water pollution external costs and hydrological effects

Defining the prevention costs and water pollution control in land transportation part is one of the main practical methods for determination of land transportation external costs. Although, as said above, control costs are not equal to real loss costs. Control costs; depend on type of drainage system, length of drainage path, rain level and area of drained waterway. In this case, costs will be highly related to the place of study.

Reaction dose method is one of the best methods for determination of external costs of water pollution effects in land transportation. But, this method is very expensive and it is not suggested for Iran. Also, it has not enough ability for determining the water pollution level may be caused by land transportation. Willingness to pay is used for evaluation of water pollution effects on land transportation (Ellwanger, 2000).

7. Evaluation of land value external costs and land use

Establishment of road and railway infra-structure lead to change of land application from other potential applications. So, land should be evaluated apart from other generating application and its opportunity costs. Lands considered for land transportation purpose may be evaluated as residential, farm lands or regional jungles and base on which one makes the most benefits. Technically, economic value of farmland is the total value of its market production and its wale fare non market value ecological measures and its cultivation. However, market value, usually used in practice because evaluation of land cultivation value and its wale fair value may be mental.

Increasing the land value near or in adjacent of related infrastructure could determine application cost of land from trade point of view. Although, from economic view, this positive external costs have great impact on reducing the costs of road and railway users. Since determination of land value in regional market and variety of land in these areas are simple, evaluation of costs for using the land usually occurs based on market direct costs method. Although, social services costs and other social costs as a whole may be evaluated by land trade values (Forkenbrock, 2001).

7.1. Evaluation of vibration external costs

Vibration caused by land transportation damage the buildings, infrastructures and pipes, sewages, erosion of sea sides and banks and so on. Although, damage by vibration usually could not be directly related to the land transportation, but application of direct costs methods (repairing costs) is the most popular method for evaluation of its external costs. Method of determination of direct cost shows the rate of exactly social costs made by vibration lower than its real level because this method considers the disorders related to structural destruction such as leakage of water pipe, cutting of electricity and soon. If probability of non-compensatory damage predicted in one historic work, tendency to payment method should be used. Social effects of vibration like lack of sleep usually evaluated in noise costs made by land transportation. Therefore, doing a separate evaluation for this vibration effect, may lead to double evaluation (Clarkson and Deyes, 2002).

7.2. Evaluation of soil pollution and solids waste disposal

Land transportation produces a different dangerous solid waste that causes external costs. Most of old cars before reproducing remains for years and some them should be discarded by governmental costs. Tire mass, especially in time of fishing cause health and environmental dangers. These solid wastes cause a lot of external costs. Even in case of proper disposal of solid waste some effects remain. The purpose of some rules and new

policies is internalizing of these costs. Evaluation of these external costs by prevention costs methods, substitution cost Hedonic and willingness to pay is possible (Pearce, 2001).

7.3. Evaluation of external cost of ecological effects

Value of one biological environment like a wetland may be defined by the application of its resources and existence value as a wall against the natural disorders like flood. Although determination of existent value of one ecosystem is very difficult, but contingent valuation method of this work is possible. So, this plan is applicable for value of environment influenced by a land transportation plan. Shadow project method and substitution cost are other proper methods. But the influence of monetary values of none established effects on ecological process are impossible.

7.3.1. Evaluation of external costs of changing the landscape

Visual effects of land transportation could be stated as visual obstacles unit they block the landscape or they oppose as a visual trouble with their around areas. Visual obstacles probably more in urban construction, also beautiful appearance of rural and urban roads and railway should be considered for users. Improvement of beauty state based on evaluation of effects in project which change the landscape should accompany with designing and planning. Direct information of society values should be determined because visual effects make a main cultural part (Randall, 2006).

- ✓ Visual effects should be evaluated as follows

- Visual obstacle: established visual effects rate by an obstacle depend on the following items.
- Obstacle size should be proportionate to the point where the landscape is viewed.
- Quality of obstacle made against it.
- Visual quality of obstacle.
- Number of people or properties influenced by that obstacle size of obstacle could be determined by three physical measurement tools which require determination of views and size of obstacle scale.
- Visual trouble: It is related to the appearance of landscape and it includes more expanded conception rather than visual obstacle. Determination methods of numerical measurement of visual trouble have not yet accepted by the public. So, evaluation of visual trouble should be according to the mental evaluation of appearance choices. The existence landscape could be observed, but the imagined landscape just could be imagined. Or be illustrated as a photo monetary or physical modeling. Today, photo montage is done by processing the computer picture like a real one.
- Landscape from road or railway: different lands of landscape and ability of tourists for observation of landscape should be considered. Most of roads pass the slightly areas, but they have many turns which separate watching the landscape and concentration on safe driving. These changes could be illustrated by road building project as art concepts or montage. Contingent valuation method is proper for evaluation of visual effects and landscape. When the willingness to pay method is not used experts recommendation should be used (Delucchi, 2005).

8. Conclusion and suggestions

After analyzing the method of evaluation of external effect, it was cleared that Hedonic method which depends on market real contracts, expected to have more real evaluations. Availability of more real evaluations has been caused the Hedonic method becomes the superior method. Although, application of Hedonic method doesn't concern the effects on public, trade non habitants and residents of trade buildings. Also, purchasers aren't aware of effect of pollutant when they purchase a property. Prevention and control costs may not be equal to damaging costs. Contingent valuation method is very subjective (it's not based on market contracts) and respondences don't show their real willingness to pay when they face with research questions and their WTP are less in real payment.

Benefit Transfer is suggested for saving the costs and time for evaluation of land transportation external costs in Iran. Because performance of this evaluation plan directly is time wasting and expensive, and this case may make delay in study. So, application of this method is recommended. Benefit Transfer method is a device for

generalization of economic costs for doing research on land transportation external costs by previous studies and in the same place and it's used in more places (Kirchhoff et al., 1997).

Benefit Transfer method (BT) is created for two reasons. First, it can make on index from priority level of one social and environmental issue. Second, BT could be applicable in decision making. This issue especially for global effects like global warming is very important as if in the absence of one million dollars research, resulted transfer from such in other parts of the world is in fact a second optimum. But, if a country needs to know all wide dimensions of land transportation external costs, it should be the expensive and great studies by stated methods in chapter 6. Otherwise, application of transfer of resources method which guarantees the transfer of coefficients, or benefit value to results of researches in other countries is acceptable way. As about said, BT in fact a way for transferring economic benefits and values of credible studies in one country from study site to policy site. Idiomatically, the place where comprehensive study is done is called study site. Attractiveness of BT is clear, studies with main methods like C.V analysis in high sample volume or dose-response study are expensive and wasting studies, so if we could do the BT process accurately and completely, there will no need to do expensive research.

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