Environmental impact of online banking: positive externalities on fuel consumption and greenhouse gas emission

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Summary
This study estimates the amount of fuel saved, and reduced greenhouse gas emissions, as the positive externalities of online banking along with marginal external cost of traditional banking which can be removed by employing online banking. The data were collected through interviewing a sample of 400 SMEs' owner/managers from the UAE free zones and to estimate the externalities a benefit transfer method was employed. The results show considering even if all the vehicles used are fuel efficient and low-emission, if all SMEs in the UAE free trade zones utilized online banking services, the fuel consumption will reduce by about 1,143,250 liters/year. the greenhouse gas emission by about 16,706 kg/year, and in sum the external costs of traditional banking removed by online banking will be equal to about $6,554,232 per year.

Key words:
online banking; green service; fuel consumption; greenhouse gas emissions; externality, benefit transfer.

1. Introduction

Today, environmental issues are a concern around the world as in the United Nations resolutions for sustainable development in 2015, four goals have been devoted to environmental conservation, namely goal 3, 6, 13, and 15. Goal 3.9 refers to reduction of the number of deaths and illness from pollutions (air, water, and soil pollutions) (United Nations, 2015).

A major source of air pollution is the combustion of fuel in vehicle that emits gases such as carbon dioxide, carbon monoxide (CO), sulfur dioxide (SO2), and oxides of nitrogen (NOx) that are harmful for human's health (Ghose, 2002).

Online banking simplifies the execution of banking transactions since it is available anytime and anywhere. Thus an important attribute of online banking is reduced automobile trips which reduces traffic flow and mitigates its consequences. Actually this sustainable service alleviates the negative externalities of road transport and forces the market toward efficient equilibrium in which marginal social costs and marginal social benefits are equivalent (Santos et al, 2010). At first glance online banking positive externalities can be grouped into three categories: its impacts on road, the reduced fuel consumption, and the travel time saving. The impacts on road can be categorized into three groups, namely the reduced road damage, the reduced number of accidents, and the reduced noise pollution. Another impact of the reduced numbers of travel is the decreased fuel consumption which leads to the reduced healthcare costs. Figure 1 shows the positive externalities of online banking. The figure indicates that all those externalities end up reducing social costs.

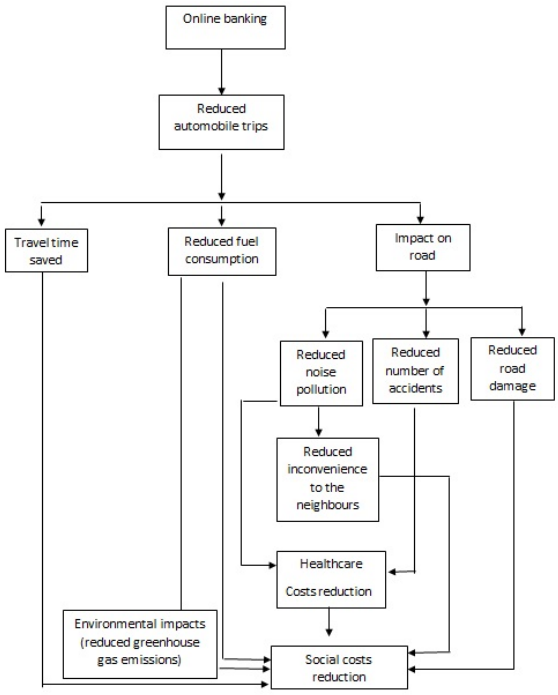

Fig. 1 Positive externalities of online banking

Although the road transportation is an essential service in the world, it creates some negative externalities such as traffic congestion and traffic accident (Wang et al., 2009; and Parry and Timilsina, 2015). Scholars investigated the impact of road traffic flow on accident and external marginal cost of driving. In their study Dickerson et al. (2000) on the association between road accident and road

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traffic flow showed that as the traffic flow increases the ratio of marginal accident risk to the average accident risk raises. Edlin and Karaca-Mandic (2006) studied vehicle accident externalities. They estimated an external cost per driver per year of $\$1725 \pm \$817$.

Other negative externalities of transportation are air and noise pollution which affect people's health. In their study, Van Kempen et al (2012) concluded that noise pollution affects primary school students' performance either it occurs at home or at school. The noise pollution affects exposed people's health, its primary impact is a headache. Pathak et al. (2008) showed 90% of respondents stated that the main source of their headache and high blood pressure were resulted from road traffic noise pollution.

Road surfaces are damaged once vehicles pass on it (Newbery, 1988). The reduced number of travels, as an attribute of online banking, lowers the damage and postpones the date at which the roads need to be fixed.

Since online banking services reduce the number of travels, it causes a reduction in fuel consumption directly as a result of reduced number of drives. However, this attribute reduces the fuel consumption indirectly as well, as the fuel consumption depends on time spent driving (Wang et al., 2008) and a lower level of traffic congestion decreases the time spent. In one hand this conserves the world scarce fuel resources and in the other hand it plays an essential role in decreasing greenhouse gas emissions. Although advanced countries impose strict vehicles emission standards, reducing road transportation decreases air pollution significantly.

In addition to abovementioned externalities, online banking creates many important positive externalities such as: reduced number of bank branch needed to serve the clients, and reduced in-branch energy and paper consumption.

Regarding to importance of sustainable development issues, the aims of this study is to estimate the amount of fuel consumption saved and air pollution reduced as the positive externalities of online banking services. To the best of our knowledge this is the first study on the environmental impact of online banking with a particular attention to reduced greenhouse gas emissions and fuel consumption.

1.1 Policies to decrease greenhouse gas emissions

Greenhouse gas emission is an important issue in all countries around the world since in addition to its impact on climate change; it affects human health and causes additional healthcare costs. Policies to reduce greenhouse gas emissions created by vehicles are different historically and from a country to one other. Scholars tried to monetarize the external cost of road transportation and recommend some policy instruments to decrease air pollution. For instance, Parry et al., (2007) investigated externalities of road transportation and recommended the electronic road pricing and Timilsina and Dulal (2010) suggested fuel taxes.

Transportation service can be considered a complement service for traditional branch banking. Imposing a tax on transportation increases the cost of travel for doing banking and decreases the number of travels but as demand for these types of travels is less elastic therefore the reduction in the number of travels won't be much. This is especially the case for SME firms whose businesses for the banking services are crucial. Thus to achieve of the goal of reduced number of automobile trips, more effective policies are needed. Increase in demand for online banking as a close substitute service for traditional banking has two important impacts on the demand for transportation service. First, it creates an elastic transportation demand curve and second, it decreases the demand for that.

Although today reduced environmental impact of vehicle produced is considered to be a competitive tool in auto industry, as the production of vehicles raises dramatically, looking for profit maximization, firms avoid to internalize environmental costs. The most important advantage of a service such as online banking is that besides its convenience for the user, time and cost saving, and as a result economic efficiency, it lowers environmental pollution.

In this study we discuss about a kind of policies to conserve environment with no cost as applying the services affects environment positively. Unlike traditional banking, online banking offers environmentally-friendly services, thus it can be considered a green service (Kirkwood and Walton, 2014).

2. Methodology

2.1 Benefit Transfer

Benefit transfer employs the output of other existing researches to forecast welfare estimates for other studies (Johnston and Rosenberger 2010). While benefit transfer is frequently used in the welfare estimates framework, other research results could be conveyed (Johnston et al., 2015). Furthermore, it is utilized by public decision makers but there is a debate among scientists over the circumstances which in benefit transfer can be used (Kirchhoff, et al., 1997). It is especially useful for the studied in which the data are not available or difficult to collect and costly. Ready and Navrud, (2006) conducted a study on international benefit transfer. They debated over the validity of using a value estimated in a country in another country. However this discussion is true for the values which may be affected by the geographical, cultural, and behavioral aspects, this method is probably valid for

the present study since the values are associated with the fuel consumption which are approximately equal throughout the world.

This study uses the output of some studies as primary information to estimate the positive externalities of online banking namely: reduced fuel consumption, reduced air pollution resulting from decreasing the number of travels or reduces vehicle kilometers of travel, and in sum the external costs of traditional banking removed by online banking.

To estimate the amount of fuel saved the results of Miller & Spoolman, (2011) was used. In their study they showed that the average fuel consumption for a new car is 8.9 litters per 100 kilometers in 2008. To predict the amount of reduced air pollution the regulation of EU for the average emissions of vehicles was used. It was 130 grams per kilometer of CO2 in 2012 which was equal to 5 liters per 100 kilometers (European Commission, 2011). Finally, to assess the marginal costs of traditional banking result from traveling to bank which can be removed by online banking we applied the results of a research conducted by Rizzi, Luis Ignacio, and Cristobal De La Maz (2017). They estimated the marginal external cost per kilometer for vehicles in Santiago. They estimated a cost per kilometer of $ 0.51 for petrol cars in at peak times and $ 0.12 at off-peak times.

2.2 Sampling method and size

As the banking service as an infrastructure is curtail for firms in their business, a sample of 400 SMEs from the UAE free trade zones were selected. The sampling method was stratified random sampling. Utilizing the UAE free zones directory for 2012, we found 9,976 companies registered in 6 free zones. The numbers of SMEs in each free zone were selected according to the proportion of the companies there. The SMEs were from the free zones as follow: 67 (16.7%) from Dubai, 120 (30%) from Jebel Ali, 14 (3.4%) from Hamriyah, 80 (20.3%) from Sharjah, 33 (8.2%) from Ajman, and 86 (21.4%) Ras Al Khaimah. The research tool was a questionnaire and the data were collected through interviewing the sample SMEs' owners/financial managers.

We applied benefit transfer method to estimate the environmental impact of online bakingservices.

3. Findings

Of 400 SMEs, 376 stated that they had to travel to their bank branch in order to complete their banking transactions. In order to determine the impact of online banking on fuel consumption and air pollution, we needed to find the distance driven by the SMEs to get their bank branch applying traditional banking services. Among the questions in the questionnaire, three were devoted to these issues. In the first one the respondents were asked whether they have to go to their bank branch to perform their regular banking transactions or their bank devote a specific employee for that, the second was about kilometer/s driven of each trip to get their bank branch, and the third one was about the frequency of their banking transactions per month.

Multiplying firms' monthly number of trips to bank branch by their distance per trip we constructed the frequency table which is shown in table 1.

Table 1: Frequencies of the sample SMEs distances driven to get their bank branches

Kilometer per month	Frequency
1 up to 150	317
151 up to 300	47
301 up to 450	6
451 up to 600	3
601 up to 750	3
Total	376

Table 1 indicated that the average distance driven to get the bank branch for the sample SMEs is 107.35 kilometers per month.

Following Miller & Spoolman, (2011), if all the vehicles used by the firms considered to be new the average fuel consumption will be 9.55 liters per month and 114.6 liters per year. Multiplying 114.6 by the number of SMEs in the UAE free zones (9,976), the amount of fuel saved will be about 1,143,250 liters per year.

Following the regulation of EU for the average emissions of vehicles (European Commission, 2011), if all the cars used by the sample SMEs are considered to follow this standard, the reduced emissions will be about 139.55 grams per month and 1,674.6 (1139.55 * 12) grams or 1.675 kilograms per year. Multiplying this amount by the number of firms in the UAE free trade zones, makes about 16,706 kilograms per year. Thus the reduced greenhouse gas emission as a positive externality of online banking is significantly high.

Flowing Rizzi, Luis Ignacio, and Cristobal De La Maz (2017), and as the banking services are mostly performed at peak times, the marginal external cost of traditional banking for each firm will be $54.75 (0.51*107.35) per month and $657 (54.75*12) per year in terms of travel needs. This will be about $6,554,232 (657*9,976) per year for the SMEs in the UAE free trade zones.

4. Conclusion

As the Earth gets older and the world's papulation raises, more products are needed, technology improves, thus the environmental conservation becomes more important, and scarcity of the fuel resources and air pollution come to be more concerned.

Although environmental consideration in auto industry is growing rapidly in advanced countries there are high-

emitter vehicles in developing countries, therefore their road transport contribution to air pollution is higher. In order to reduce the negative externalities of road transport some policies need to be developed.

This study introduces a green service as a policy instrument to alleviate the negative externalities of road transport, and utilising standards of advanced countries for vehicles fuel consumption and greenhouse gas emissions, estimates the reduction in these two essential environmental issues along with the eliminated external cost of traditional banking associated with travel needs. The results show that using online banking by SMEs in only the UAE free trade zones, the fuel consumption will decrease by about 1,143,250 liters per year, the air pollution will reduce by 16,706 kilograms per year, and the external costs of traditional banking which can be removed by online banking are equal to about $6,554,232 per year.

The results of this study highlight the importance of a green service such as online banking service for a small number of SMEs in the UAE. If these services are employed by all firms and individuals around the world the amount of fuel saved and the reduced air pollution will be impressive. We suggest the use of these kinds of innovative services to achieve the environmental goal of sustainable development.

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