Macroeconomic Implications of Virtual Shopping: A Theoretical Approach

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Abstract

Recently, parallel to developments in the communication technology, online shopping has become increasingly popular for many products, like books, CDs, software, and computers. Most analysts conjecture that the future will witness a wider basket of products and a higher trade volume via the Internet. This paper investigates the economic implications of Internet shopping in a Ricardian equilibrium framework. First, it shows the necessary and sufficient condition for the shift to Internet shopping. Next, it indicates that macroeconomic variables like consumption and income rise when this shift takes place. Thus, this paper shows that the economic implications of Internet shopping will be higher than the current experience and Internet shopping will become an important element of the 'new economy' when the bulky part of the shopping is done via the Internet.

Keywords: Internet shopping; Internet Economy; The New Economy
JEL classification: D11, D50

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1 Introduction

Trade via the Internet has far-reaching economic implications as it provides a fundamentally new way of conducting transactions. This arises from the fact that it shrinks the physical and economic distance between traders. Physical distance disappears because buyers can 'go' anywhere for shopping at almost zero cost in terms of time. Economic distance shrinks because buyers are able to reach sellers directly without the need for intermediaries. In this paper we focus on business-to-consumer aspect of trade via the Internet. We call commerce between consumers and producers (businesses) through the Internet *virtual shopping*. In computer terminology, virtual is used to denote memory created by software but physically not present in the hardware. Analogously, the Internet technology lets consumers go shopping without being present in the shops physically.[1]

The main characteristic of the new technology is that it uses digital information. Therefore the first wave of expansion of Internet-based commerce is observed in trading 'zeros and ones', such as e-mail, text, graphics, etc. For example, subscribing to the Country Profiles Database of the Economist Intelligence Unit and receiving data *online* falls into this category.[2] However, it is technically not possible to deliver many products in zeros and ones, such as computers or detergents. Therefore, it is not surprising to predict that business-to-consumer Internet transactions *will* shift to nondigitizable goods and services in the future. This shift will support further growth of virtual shopping and necessarily result in a new delivery technology.

In this study, we take Internet shopping to mean a new way of shopping for consumers in all aspects, that is, including the delivery of goods and services purchased via the Internet. Online shopping, currently, uses the conventional delivery system, by and large. We conjecture that as virtual shopping expands, the current postal delivery system will become incapable of handling the delivery of goods and services and a new delivery system, that fulfills the requirements of online shopping,

[1] Throughout this work, we use virtual shopping, online shopping, and Internet shopping interchangeably.
[2] Varian (1999) offers to use the term "information good" to refer to a good that can be distributed in digital form.

will emerge.[3] A good example to the emerging new delivery system is the 'adjustment' of United Parcel Service of America Inc., "an icon of the old economy with fleets of trucks driven mainly by men in brown uniforms", to a gleaming symbol of the digital age. UPS has become one of the major distribution companies in the Internet economy in the United States and this adjustment makes it such a prominent player in the Internet that people are using its performance as a proxy for the Internet and Internet commerce. Analysts also expect that delivery technology will adapt itself to the requirements of the new economy in the near future.[4]

The volume of Internet shopping is still negligible in total trade. Nevertheless, all business analysts predict a growth in online retail sales. There are many indicators of the expansion of Internet trade. First, the size of Web grows exponentially. While experts disagree on which metric is the best for sizing the Web, everyone agrees that it is growing phenomenally. Web sites show up at a rate of more than 4,400 per day resulting in 3.6 million sites in 1999. The number of Web pages, perhaps the best gauge of the expansion of Internet, has also skyrocketed in 1999. NEC Research reports around 1.5 billion Web pages, an 88 percent increase from 1998. IDC expects this number to hit 8 billion in 2002, exceeding the world's population.[5] Second, parallel to the growth of Internet usage, the volume of online trade expands exponentially. Forrester, a Research Company, predicts that electronic commerce will reach 200 billion dollars in 2000 across the globe. International Data Corporation (IDC) forecasts the dollar volume of business-to-consumer sales to reach 50.7 billion for 2000. Forrester Press Release (2000) projects an exponential rise in online retail sales for Europe. The company forecasts that online retail sales in Europe will grow 98% annually over the next five years, soaring from 2.9 billion Euro in 1999 to 175 billion Euro in 2005. Projected U.S. online retail sales also show phenomenal growth. The main indicators of the expansion of U.S. Internet retail shopping are presented in Table 1.

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[3] For example, suppose that a book is purchased via the Internet. The transaction has two parts. While the ordering and the payment can be made via the Internet, the completion of the transaction, that is the delivery of the book, can be done through the conventional postal system. In that respect, purchasing a book via the Internet is mainly a hybrid of the new and the old ways of trade.

[4] See, for example, the Forrester Report (1998, p.13), making the same prediction.

[5] A general overview of Internet Economy can be found in the reports of the U.S. Department of Commerce (1998, 1999).

Table 1 U.S. Online Retail Sales and Shopper Projections

	1998	1999	2000	2001	2002	2003
Total U.S. Online Retail Sales (Billions)	$7.8	$18.1	$33.0	$52.2	$76.3	$108.0
_Total Convenience(Billions)[a]	$2.8	$5.6	$9.7	$15.2	$22.7	$32.3
_Total Researched (Billions)[b]	$4.4	$11.0	$20.0	$31.0	$43.0	$56.2
_Total Replenishment (Billions)[c]	$0.7	$1.6	$3.3	$6.0	$10.7	$19.4
U.S. Households Shopping Online (Millions)	8.7	13.1	17.7	23.1	30.3	40.3
U.S. Households Online (Millions)	28.6	33.5	38.3	43.5	48.6	52.8

Source: The Forrester Report (1998). The sum of subtitles may not add up to aggregate due to rounding errors.

a: Convenience goods are software, books, music, tickets, etc.

b: Researched goods are leisure travel, electronics, and housewares.

c: Replenishment goods are food and beverage, health and beauty products.

Table 1 and the Forrester Report (1998) indicate that more people shop, more retailers sell and more categories become available in the coming years in the U.S. online retail sales market.

Internet shopping is facing some more obstacles, apart from lacking a new delivery system, that limit its expansion in all aspects. Briefly summarizing, two main areas can be listed: first, user (consumer) trust in electronic transactions has to be built.[6] Second, regulatory uncertainty in the new electronic environment has to be minimized. These impediments support the 'traditional' consumer behavior, the pro-real shopping behavior. We assume that these obstacles will be eliminated through time due to improvements in technology, legal structure, education level etc., and this will ease building a voluminous trade through the Internet. Consumer sales today are dominated by services and intangibles like travelling and ticketing services, software, entertainment and financial services. On the goods side, few highly standardized commodities, like books, CDs, and computers can be mentioned. When above-mentioned obstacles are overcome, the business-to-consumer sales via the Internet will replace real shopping significantly.

The main aim of this study is to show the macroeconomic implications of virtual shopping. Starting from micro-foundations, we build a static model in Ricardian

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[6] For example, 80 percent of companies say that security is the leading barrier to expand e-commerce links with customers and suppliers. See Jarvenpaa et al. (2000) on the importance of consumer trust on Internet shopping. In this paper, the authors show that the size and reputation of an Internet merchant are important to form customer trust. Credit card security of online transactions is another

equilibrium framework. First, we investigate the traditional way of in-store shopping, which we call 'real' shopping in this study. This study assumes that in-store shopping is characterized by physical appearance of customers in stores. Brown (1989), analyzing the store-shopping behavior of consumers, finds that store location and the associated travel costs play an important role in store selection. Bell et al. (1998) show empirical evidence for households having linear disutility over the total shopping cost that includes travel distances. Bakos (1997) and Alba et al. (1997) argue that 'electronic marketplaces' will lower the buyers' cost to acquire information about seller prices and product offerings, which leads to a reduction of inefficiencies caused by buyer search costs. Palmer (2000) argues that in-store shopping may cause the shopper to spend more time in the shopping process owing to the fact that it contains a rich level of information for the shopper, like face-to-face interaction with the opportunity for iterative questions and personalized responses. We sum up these findings by assuming that time cost is the differentiating aspect of real shopping. More specifically, this study assumes that each unit of real shopping, which is represented by consumption, requires the consumer to spend some time on shopping.

Second, we examine the new way of shopping, namely virtual shopping. The major benefit of the Internet marketplaces for consumers is the time gained due to being freed from going to a physical store for shopping. Obviously, online shoppers also spend some time on shopping via the Internet. For two reasons we ignore these direct time costs. Firstly, relatively speaking, the time cost of online shopping is substantially less than the time spent by real shoppers.[7] Secondly, the cost of online shopping is primarily attributed to connection costs. Subsequently, it is not the 'raw' time cost but the income cost of the use of online connections that matters. Connection cost is related to the amount of online shopping, represented by consumption, by definition. Consequently, when we compare two shopping technologies, consumers in one hand gain time and on the other hand incur income

aspect of consumer trust. We consider especially the latter as pure technical constraint that will be overcome.

[7] Nielsen NetRatings shows that the average at-home Internet-use is approximately two and half-hours per week for a Japanese and three hours for an American. Let us suppose that half of this time is spent on virtual shopping. Compared to in-store shopping, the time spent is quite small.

loss. This constitutes the main tradeoff between real shopping and Internet shopping. In reality, data also supports this argument.[8]

Third, by comparing the welfare effects of the two different shopping behaviors, we derive a necessary and sufficient condition for shifting to virtual shopping. Wigand (1997) argues that the rise of Internet marketplace in retail sales involves not new retail spending, but a *switch* of customers from shops to online sales. This switching behavior is captured in our necessary and sufficient condition. Next, we investigate the macroeconomic implications of the expansion of virtual shopping. We find that when the bulky part of business-to-consumer trade shifts to the Internet, the economy will realize higher consumption and income, and a higher labor supply in aggregate. In all, the expansion of the Internet economy will surpass current predictions due to a boom in business-to-consumer transactions conducted via the Internet and the economic implications of this expansion will be significant. Finally, we make an introductory attempt to policy analysis. More specifically, we investigate under which conditions online consumers may tolerate being taxed. The interesting feature of this section is the introduction of a new tax, namely, online investment tax, which is hardly discussed in the Internet literature.

The next section models real shopping. The third section models Internet shopping. The fourth section presents the welfare analysis. The fifth section considers macroeconomic implications of Internet shopping. One interesting finding is that aggregate consumption and labor supply increases when the bulky part of retail shopping goes online. The sixth section provides an introduction to the policy implications of Internet shopping. The last section concludes the paper.

2 Real Shopping

Suppose there exists a large number of identical individuals. Furthermore, assume that firms use only labor to produce a composite good. Prices (normalized to one) and wages are determined in the markets for goods and labor and therefore taken as given. There is no capital (hence no saving) and no uncertainty.

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[8] See the discussion in section four.

Suppose that the production function is:

$$Q = x \cdot n \cdot N \,. \tag{1}$$

where Q is aggregate output, x is the productivity parameter, n the amount of time spent on working by each worker (individual), and N the number of workers. Under the assumption of constant returns to scale, market equilibrium is obtained such that real wages w/p are equal to productivity x. An individual with real wage x earns real income y:

$$y = x \cdot n \tag{2}$$

where income is measured in real units.

Suppose that households can consume only by doing some shopping. This necessarily requires, in the 'real' world, the physical appearance of a household on the market and therefore will cost some time. We shall call this real shopping. Let us label consumption via real shopping as real consumption, c_r. Since there are no savings, real consumption c_r equals real income (given in equation (2)).

Assume that the representative household's utility function $u(c,l)$ is strictly concave in consumption c and leisure l. We suppose a Cobb-Douglas type of utility function:

$$U_r = \theta \log(c_r) + (1-\theta)\log(l_r) \tag{3}$$

where subscript r stands for real shopping. A rational household has to decide how to allocate time among leisure l_r, working n_r, and shopping n_1. A unit of time is allocated as follows:

$$n_r + n_1 + l_r = 1 \,. \tag{4}$$

A very simple assumption about the time spent on shopping is that there exists a constant linear relationship between the amount of consumption and the time spent on shopping. We argue that households rarely make ‘odd-size’ purchases compared to the time spent on shopping. Therefore, as a first approximation, it is realistic to assume that

$$n_1 = \delta c_r \tag{5}$$

where $\delta > 0$ is a parameter. The solution of the model yields $n_r^* = \theta/(1+\delta x)$, $l_r^* = 1-\theta$, $n_1^* = (\theta\delta x)/(1+\delta x)$, and $y_r^* = c_r^* = (x\theta)/(1+\delta x)$. This part of our analysis investigates how households allocate their time between working, leisure, and shopping when consumers take into consideration a time cost of shopping in their time-budget constraint. We show that a representative consumer allocates her time among these three in constant proportions.

In order to consume, people need to do shopping. Before the introduction of the Internet technology consumers were required to appear physically in the market. However, after the introduction of the Internet technology consumers are given the opportunity to shop virtually and therefore not to appear physically on the market, which obviously saves shopping time. The next section shows how the representative household’s allocation problem changes when time cost of shopping drops, i.e., virtual shopping becomes fully operational.

3 Back to the Future: Virtual Shopping

> “You're about to pour the last ounce of milk into your late-night bowl of cereal. Oops — looks like there'll be none left for your morning coffee! All the stores are closed. What's a hungry night owl to do?
> Pour away! By 6 a.m., a new gallon will be on your doorstep, thanks to a microchip sensor embedded in the milk carton and transmitted to an Internet device on your kitchen counter.” (LaPlante, 1999)

One of the latest battles in the cyberspace is in refrigerator technology. Look at the "intelligent" refrigerator that Frigidaire Home Products debuted recently.[9] Equipped with a microprocessor, touch screen, bar-code scanner and communications port, the refrigerator allows consumers to automate their grocery shopping. Whenever someone is low on a given product, he can simply swipe the carton past the refrigerator's bar-code scanner, which adds that item to a list. When the consumer is ready, the list can be transmitted to the local grocer. The groceries will either be delivered to the consumer's door or packaged for pickup. The fridge can be connected to the Internet via a standard phone line or an Ethernet network.

The refrigerator example, which even eliminates the computer, represents perfectly what we mean by virtual shopping. The distance between the seller and the consumer disappears and in addition to this, the consumer does not worry about the delivery of the goods and services ordered. In other words, compared to real shopping, the time cost arising from the *distance* between the consumer and the seller disappears.[10] In one respect, we go *back to the future* and imagine a world such that shopping through the Internet is as easy as swiping a carton through a bar-code scanner or voicing the name of the product to the computer (or may be to any home appliance). We further imagine a (virtual) market that covers almost all products for virtual shopping. Now suppose that a representative agent purchases virtually and therefore shopping time drops out as a decision variable. Accordingly, utility function is defined as

$$U_v = \theta \log(c_v) + (1-\theta)\log(l_v) \tag{6}$$

where subscript v represents virtual shopping. A unit of time is allocated between working and leisure

$$n_v + l_v = 1 \tag{7}$$

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[9] Another example is a new venture between appliance maker Electrolux and L.M. Ericsson Telephone that aims to deliver wired appliances for use in networked homes.

However, in order to 'run' virtual shopping, the representative household has to incur some costs. These costs are of two types. First and foremost, the household has to incur variable costs that we call connection costs in this study.[11] Second, some fixed costs like buying a computer with an Internet connection are incurred. However, we exclude these costs in our analysis for two reasons. Firstly, consumers do not purchase a computer or a refrigerator to undertake solely Internet shopping, that is, their main functions are different. For example, most home computers are used for education, leisure (entertainment), and even for business. Secondly, adding fixed costs does not change the results qualitatively and we prefer to keep the model as simple as possible. Obviously, in case of virtual shopping, real income is spent on two items: consumption and variable costs. For simplicity, let us suppose that total variable costs are a linear function of total consumption:

$$Total\ costs = \alpha_1 c_v \qquad 0 < \alpha_1 < 1 \qquad (8)$$

where α_1 represents the cost incurred per unit of real consumption via the Internet.[12] According to equation (8), total connection costs rise as the amount of shopping, represented by consumption, increases. Accordingly, the maximization problem becomes

$$\begin{aligned} & Max U_v = \theta \log(c_v) + (1-\theta)\log(l_v) \\ s.t.\ \ & n_v + l_v = 1 \\ & c_v + \alpha_1 c_v = n_v x \end{aligned} \qquad (9)$$

[10] Evidently, the consumer spends some time on searching on the Internet for the products she looks for. But, relatively speaking, it drops to neglectable amounts. Rather, the income cost of this time becomes important.

[11] By connection cost we mean all types of variable costs. For example, in case of computer connection, the representative consumer uses some electricity and telephone. According to a survey by Nielsen NetRatings, most home surfers are still using slow modems to connect to the Net. Fully 47 percent of Web users have modems with speeds of 33.6Kbps or slower, and 93 percent connect at 56Kbps or less. It is worth to mention that a 56Kbps is 25 times slower than a high-speed T1 line.

[12] It is hard to imagine that connection cost of unit online shopping is higher than the cost of unit consumption.

Then, the optimal values of variables become $n_v^* = \theta$, $l_v^* = 1 - \theta$, and $c_v^* = \theta \cdot x / (1 + \alpha_1)$, $y_v^* = \theta \cdot x$, respectively. The representative consumer allocates her time between working and leisure in the constant proportions θ and $1 - \theta$, respectively. These values should be interpreted with caution. The results are sensitive to the type of utility function. Normally, we expect the household to allocate extra time in such a way that both leisure and working time rise.[13] However, the basic interpretation does not change: though in the virtual shopping case the consumer incurs some (variable) costs from her income, the time cost of shopping disappears, and the representative household uses this extra time to work more (n_v is larger than n_r) and to earn more (y_v is larger than y_r). Which shopping technology makes the representative consumer better off? The next section investigates this issue.

4 Welfare Analysis

In this section, we investigate the circumstances under which it may be optimal for a representative consumer to shift to virtual shopping given the model above. We derive the *necessary and sufficient* condition for shifting to virtual shopping. We begin by evaluating economic welfare under real shopping. Suppose that the representative consumer chooses to remain with real shopping technology. The representative agent's real income, which is equal to real consumption c_r is given by real wage, x, times the amount of time worked. The representative agent allocates her time between working, leisure and shopping in the constant proportions $\theta / (1 + \delta x)$, $1 - \theta$, and $\theta \delta x / (1 + \delta x)$, respectively. Hence, from equation (3), the representative consumer's utility may be expressed as

$$U_r = \theta \log\left(\frac{\theta x}{1 + \delta x}\right) + (1 - \theta) \log(1 - \theta). \qquad (10)$$

[13] See Annex A for results of CES-type utility function.

Consider now the alternative 'regime', namely virtual shopping. The representative consumer allocates her time between work and leisure in constant proportions θ and $1-\theta$, respectively. The representative agent's real consumption is lower than her real income due to the fact that she incurs some (variable) costs linear to the amount of shopping via the Internet. From equation (6), the representative consumer's utility is

$$U_v = \theta \log\left(\frac{\theta x}{1+\alpha_1}\right) + (1-\theta)\log(1-\theta) \qquad (11)$$

Internet shopping will improve welfare relative to real shopping if and only if $1+\alpha_1 < 1+\delta x$, which implies

$$\alpha_1 < \delta x. \qquad (12)$$

What is δ? It is the opportunity cost of one unit of real income in terms of time, that is, how much time the representative consumer is ready to give up in order to save one more unit of real income (by doing shopping via physically appearing in the market). Remember that real wage is equal to the productivity parameter, x. Thus, the right hand side of equation (12) is the loss of real income due to incurring costs in terms of time. The left-hand side, on the other hand, is income loss per unit consumption due to shopping via the Internet. Thus, the consumer is better off by shopping via the Internet if and only if the cost of virtual shopping is lower than the opportunity cost of real shopping.

The opportunity cost of real income in terms of time δ is a function of many variables like real wage, average distance to the market, skill and education levels, and consumer attitude, etc. Most of these factors are 'internal' in the sense that they are specific to individuals. An interesting result appears for a specific value of δ. Suppose for the moment that the representative consumer takes into consideration her real wages alone in forming the value of δ, and suppose specifically the representative consumer takes $\delta = 1/x$. Then, the right hand side of equation (12) becomes unity. In this case the consumer is always better off by shifting to virtual shopping due to the fact that $\alpha_1 < 1$ by definition. The loss of income due to shopping via the Internet is also function of many variables like Internet infrastructure, unit cost of electricity, the power of computer and/or the modem, etc., which are ‘external’ to the representative consumer, by and large. In all, the switching condition reflects that people with higher income value their time higher. Subsequently, they are more willing to implement the new type of shopping. Our argument is also supported empirically. For example, the Forrester Report (1998) states that while households earning more than $50,000 a year make up only 36% of the total U.S. population, they account for 47% of total consumer spending and 74% of spending on-line.[14]

We state above that the condition given in equation (12) is function of many ‘internal’ and ‘external’ variables. We argue that our results can be extrapolated into long run by adding a ‘time-dimension’ to the switching condition in equation (12). By this, we mean that, practically, the condition found in (12) will be satisfied at different times for each consumer in an economy. The intuition is as follows: since there are many internal and external factors, we may intuitively argue that each person will evaluate the condition given in equation (12) and decide accordingly where to shop. In that sense, those who ‘pass’ the condition will shift to Internet shopping. Obviously, the current trend is in favor of Internet shopping, that is, many variables ranging from computer technology to Internet education support the shift to virtual shopping. Here we discuss some of them in detail to confirm our intuition. First, computer skills have been continuously increasing. Computers (and Internet) have already become part of the education in many countries and especially in developed economies.[15] In the new millennium, especially in developed economies, major part of the economically active labor force will not need to extend any additional effort (in terms of education) to learn how to use the Internet. Second, technological changes, which are very rapid in the computer industry, ease Internet

[14] On the contrary, households that earn less than $25,000 per year (constituting 34% of the population) account only for 6% of on-line retail sales.

[15] For example, in the UK, Internet access is highest among 18-24 year-olds. Of these, 37% are regular users, accessing the Internet at least once a week. This figure is expected to increase to close to 100% when the Internet becomes fully available in schools. Trends in the access to Internet at schools support this. In France, for example, by the end of 1998, the number of schools connected to the Internet has increased remarkably, for ordinary secondary schools from less than 40% to 85%; from

shopping in many ways. Third, governments see the Internet as a tool that serves to accelerate and diffuse more widely changes that are already under way in an economy, such as deregulation or the establishment of links between businesses. Furthermore, trade via Internet, by definition, is the main tool of further globalization and integration of economies and therefore receives big support from governments. A good example is US government, which takes a leading role in promoting e-commerce.[16] Obviously, these three reasons are comprehensive but not exhaustive. In conclusion, we believe that it is intuitive to argue that the current trends will give rise to more and more consumers to prefer Internet shopping to real shopping *through time*. Based on this premise, we shall reinterpret our results to hold in the *long run* though our model is framed in a static world.

5 Macroeconomic Implications of Virtual Shopping

In this section we investigate the macroeconomic implications of the shift to virtual shopping. As the necessary and sufficient condition is a function of internal and external variables, each consumer will shift to virtual shopping as soon as *her* condition is satisfied. In that context, we postulate that aggregate consumption will follow the path illustrated by Figure 1 (not necessarily in linear shape).

1% to over 10% for primary schools. And free Internet access is to be available from schools, cultural centers, national employment agencies, and libraries.

[16] For example, the Telecommunication Act of 1996 encourages the rapid deployment of advanced telecommunications capabilities for all Americans. The New Millenium Classrooms Act, introduced in 1999, gives tax credits to those that donate computers to schools and disadvantaged communities. There are several examples of government support of the Internet in other countries as well. In May 1999, the Canadian Radio- television and Telecommunications Commission (CRTC) announced its decision to leave new media services and the Internet unregulated. The Performance and Management Unit of the British Cabinet Office released a report in September, 1999, that sets out the Government's strategy for enhancing the UK as a favorable environment for the development of Internet shopping. See the OECD report (2000) for further examples.

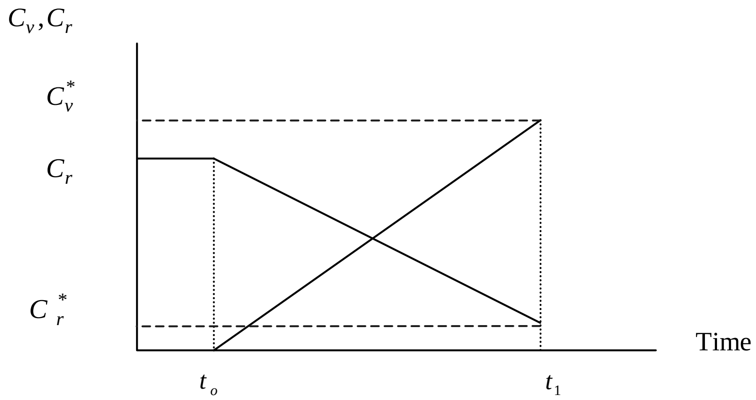

Figure 1: The 'dynamics' of real and virtual consumption

The economy can be considered to be on its long-run path C_r (the aggregate real consumption until t_o) before the introduction of the Internet technology. After the introduction of virtual shopping the consumers whose switching condition, given in equation (12), is satisfied shift to virtual shopping. Thus, aggregate consumption begins to rise. At some point like t_1, real shopping is expected to approach its lowest 'stable' level C_r^*, and the virtual shopping its highest level C_v^*. Analogous to dynamic analysis, we may call these values the respective 'steady-state' values, where virtual and real shopping levels remain unchanged. At time t_1, C_r^* may stay positive because some consumers may prefer to continue real shopping. We have to note here that C_v^* is not necessarily above C_r. To see this, let us suppose that N_v is the number of 'virtual' consumers/workers and N_r is the number of 'real' shoppers. At time t_o aggregate consumption is $C_r = N \cdot c_r$, where N is the total number of consumers. At time t_1 aggregate virtual consumption will be $C_v^* = N_v \cdot c_v^*$. Obviously, we cannot compare C_r and C_v^* because $N > N_v$ and $c_r < c_v^*$. Yet, it is easy to see that $0 < C_r < C_v^* + C_r^*$ due to the fact that virtual consumption is always higher than real consumption for those who shifted to virtual shopping.

When Internet shopping becomes fully operational, two other important results appear. The aggregate real income and output, $Q^* = Q_v^* + Q_r^*$, and the aggregate labor supply, $N_v n_v^* + N_r n_r^*$, increase given the Cobb-Douglas utility function. Workers allocate the extra time they generate due to switching to Internet shopping between work and leisure (in the Cobb-Douglas-type utility function leisure stays intact, which is a case-specific result), which increases aggregate output and income proportional to the change in the amount of time worked. Thus, the effects of virtual shopping exceed the current premature business-to-consumer trade realization and contribute significantly to the emergence and performance of the new economy in the (near) future. We argue that future will witness more lively discussions on the virtual shopping issue in the field of economics (at the theoretical level), of government (policy level), and of business (at practical level). The next section makes an introduction at the policy level.

6 Some Policy Analyses

The nice feature of our model is that it is extendable in many aspects due to the fact that it is set up in a theoretical framework. In section five we show that the permeation of Internet shopping leads to higher aggregate income, as well as to higher aggregate consumption inducing growth in the economy during transition. The report of the U.S. Department of Commerce (1999) argues that without sufficient investment into network technologies, nations may find themselves behind in an increasingly wired (and may be wireless) world. In the US, the country with the highest permeation of the Internet, the government is taking a leading role in infrastructure investment besides promoting Internet shopping in other ways. Several private sector organizations are linked to government projects supporting the Internet infrastructure, such as electronic Commerce Committee, CommerceNet, and the Electronic Messaging Association. In fact, in 1995-97 expenditures on Internet-related infrastructure reached 40 billion dollars.

In section 4 we argue that the condition to switch to Internet shopping from real shopping will be satisfied for each individual according to certain internal and external variables. Naturally, one major external variable is the quality of the Internet infrastructure, which directly determines the cost of connection to the Internet. We believe that the success of Internet shopping depends on consumers' access to Internet shopping without network delays (for example, due to congestion) and without other restrictions on access as well as (lower) connection costs. In essence, the former highly determines the latter. The efficiency of underlying infrastructure (by all means) is important in this respect.

The infrastructure requirements for online shopping are changing rapidly with new technological developments and widening of Internet shopping. As the demand for virtual shopping grows, it stimulates higher demand for better infrastructure. Slowness in meeting demand for 'better' network infrastructure may create reluctance of potential online shoppers to shift to virtual shopping and thus retards the growth of Internet shopping (and Internet economy).[17] Hence, policy makers have to ensure continuous improvement of infrastructure to support virtual shopping and Internet economy. Given the current fashion of balanced budget policy among policy-makers, the most obvious way of funding these infrastructure investments is to collect some taxes from the online shoppers (in our framework). We call these taxes online-investment taxes in this study.

Are online consumers in favor of online-investment tax or not? Answer is obvious and intuitive: if online-investment taxes improve network infrastructure sufficiently, then the consumer may end up better off at the end. In order to show this result, we need to modify our model. Let us introduce a government into our model, collecting taxes and investing tax revenues in improving network infrastructure. Assume that an investment tax is imposed on the representative online consumer in the form of

$$t = \tau c_v \tag{13}$$

where t is per capita investment tax and τ is investment tax per consumption unit and taken as given. According to equation (13), investment taxes are proportional to shopping via the Internet. Let us suppose that all tax revenues are used for improvement in network infrastructure. In our model, the efficiency of infrastructure is hidden in the connection costs, α_1 real units per unit of online shopping.

Improvements in infrastructure via new investments must appear as a reduction in connection costs.[18] We assume that the relationship between tax revenues and connection costs can be represented by:

$$\alpha_0 = \alpha_1 - \xi\tau \qquad (14)$$

where α_0 is the connection cost and ξ is the infrastructure technology parameter. The second part of equation (14) on the right hand side represents the improvement in infrastructure, which leads to a reduction in connection costs. The crucial property of equation (14) is that the infrastructure is assumed to be a private good rather than a public good.[19] Investment taxes paid per head produce a linear improvement in infrastructure, which leads to a decline in connection costs according to our formulation. It may be argued that a linear infrastructure improvement is not realistic. We agree that an efficiency production function with decreasing returns to scale is preferable. Nevertheless the public good character of infrastructure investments is also obvious and therefore we approximated these investments in a linear fashion.

The solution of the model yields the optimum consumption level $c_v^* = \dfrac{\theta \cdot x}{(1+\alpha_1) + \tau(1-\xi)}$ while optimum values of other variables remain same due to the special utility function we use. Is the representative agent better off? The answer lies in the value of infrastructure technology parameter. If one real unit of tax produces more than one real unit of decrease in connection costs, than the consumer is better of by paying online-investment taxes. Thus, we conclude that consumers

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[17] Roberts (2000) states that to keep place with the Internet's expansion, for example, the maximum speed of core rooters and switchers must increase at the same rate, which means that performance improvements are required at a rate faster than 18-month doubling of semiconductor performance.

[18] For example, tax revenues can be used to replace coaxial cables for ones that have higher capacity or to increase the maximum speed of core rooters and switchers.

[19] We assumed away public good property of government investment for three reasons. First, connection costs are partly consumer-specific and therefore results might have been biased had we included openly public character of these investments. Second, the linearity in the infrastructure efficiency improvement part of equation (14) partly captures the public good character of government investments. Third, we prefer to keep the model as simple as possible. Note that Equation (14) would be $\alpha_0 = \alpha_1 - \xi\tau N$ had we assigned public good character to the government investment.

may be more ready to pay online taxes than some people think given that governments will use these tax revenues for the benefits of online consumers.

Another issue concerning policy makers is the bit tax. The bit tax issue is about whether local or federal governments should impose tax on Internet traffic (online sales in our case) owing to the fact that borderless trade causes some governments or states to lose part of their tax revenues. The counter argument is that Internet trade is still fragile and therefore, to tax it now may seriously damage its growth.[20] Bit tax is welfare reducing, given our framework. Nonetheless, our model shows that per capita consumption as well as per capita income will increase when online shopping becomes the major way of shopping. This fact implies that some of the tax revenue losses incurred by governments and states may be compensated due to increases in consumption and income. However, it is obvious that there will be reallocation of tax revenues among state and federal governments within a country. Governments and states located in areas that are centers of Internet trade will realize a rise in tax revenues while governments located in regions that specialize in real shopping will loose their tax bases. The same trend may be observed across countries, and especially in those regions that formed regional blocks like European Union (EU) or North American Free Trade Agreement (NAFTA). Within each region, centers of Internet economy will gain and others will loose. We believe that the increase in Internet trade across borders necessitates greater need for mutual cooperation and international tax enforcement, namely countries need to develop a tax framework together that protects the tax base but avoids hindering the development of virtual shopping.[21] This part of our analysis also shows that online consumption (as part of trade via the Internet) has far-reaching implications for policy-makers, too.

[20] Goolsbee (1998) provides an empirical study about the potential effects of local taxes on Internet commerce. He finds that tax differences are significant stimuli for people to switch to online shopping. He states that applying existing sales tax to the commerce via the Internet will reduce the number of online buyers by us much as 24 percent. See also Goolsbee and Zittrain (1999) and Goolsbee (1999).

[21] Recognizing this, governments have in fact begun the task of analysis and policy formulation. In November 1996, the United States Treasury Department initiated a discussion. Later, the Australian Taxation Office and The Japanese Ministry of International Trade and Industry have contributed besides others. In response to the need for international consensus, the OECD has started to issue

7 Conclusion and Future Research

The 1990s witnessed the breakthrough of Internet technology. The net has quickly spread over all aspects of life ranging from entertainment to education. Recently, it brought an alternative to conventional retail technology. In this paper we compare the old and new ways of shopping. We base our analysis on consumer theory. Comparing the results of conventional and internet shopping we obtain the switching condition for a representative consumer to shift from the former to the latter: when the real cost of virtual shopping becomes lower than the respective cost of real shopping, the representative consumer shifts to virtual shopping. Then, we project our results to the aggregate. We indicate that consumption, income, and labor supply rise when the majority of the consumers shifts to Internet shopping. Thus, we show that the economic implications of Internet shopping will exceed current expectations in business-to-consumer trade in specific and Internet trade in general. This result points to the efficiency gains that the new way of trade provides for consumers (and other traders). It worth noting that this efficiency-gain arises if the time of the consumer is valuable. This may explain why consumers living in the most developed economies were the first users of the new economy.

There are many other issues not discussed in this study. First and foremost, we do not analyze the supply side. Second, we build our model in a closed-economy framework. One of the implications of the Internet technology is its contribution to globalization. Perhaps extension of the model to a two-country framework will highlight other sources of efficiency gains, such as specialization. Third, we construct our model in a static framework. Its extension to a dynamic model can better emphasize the transitional dynamics of the shift from real shopping to virtual shopping on the one hand, and growth effects of virtual shopping on the other hand. All these issues and probably many others are possible areas of future study.

international guidelines for the taxation of electronic commerce. For further details see Katsushima (1998).

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Appendix A: The Solution for CES-type Utility Function

Let us suppose that the utility function is CES-type:

$$U = \left(c^{1-\sigma} + l^{1-\sigma}\right)^{\frac{1}{1-\sigma}} \tag{A.1}$$

where the elasticity of substitution is $1/\sigma$. In case of real shopping, the representative agent's maximization problem is

$$\begin{aligned} &Max \quad U_r = \left(c_r^{1-\sigma} + l_r^{1-\sigma}\right)^{\frac{1}{1-\sigma}} \\ &s.t. \quad n_r + n_1 + l_r = 1 \\ &\qquad\ n_1 = \delta c_r \\ &\qquad\ c_r = x n_r \end{aligned} \quad . \tag{A.2}$$

After necessary substitutions and after taking logarithmic transformation of the utility, we end up with the following 'reduced form' of maximization problem:

$$Max \ln[U_r] = \frac{1}{1-\sigma} \ln\left[c_r^{1-\sigma} + \left(\frac{x-(1+\delta x)c_r}{x}\right)^{1-\sigma}\right] \tag{A.3}$$

First order condition with respect to real consumption yields

$$c_r = \frac{x^{\frac{1}{\sigma}}}{(1+\delta x)^{\frac{1}{\sigma}} + (1+\delta x)x^{\frac{1}{\sigma}-1}} . \tag{A.4}$$

Equilibrium values of other unknowns are given in Table A.1 below.

In case of virtual shopping, the representative agent's maximization problem is

$$\begin{aligned} Max \quad & U_v = \left(c_v^{1-\sigma} + l_v^{1-\sigma}\right)^{\frac{1}{1-\sigma}} \\ s.t \quad & n_v + l_v = 1 \\ & c_v = x n_v - \alpha_1 \cdot c_v \end{aligned} \tag{A.5}$$

which is reduced to:

$$Max \ln[U_v] = \frac{1}{1-\sigma} \ln\left[c_v^{1-\sigma} + \left(\frac{x-(1+\alpha_1)c_v}{x} \right)^{1-\sigma} \right] \tag{A.6}$$

First order condition with respect to virtual consumption yields

$$c_v = \frac{x^{\frac{1}{\sigma}}}{(1+\alpha_1)^{\frac{1}{\sigma}} + (1+\alpha_1) x^{\frac{1}{\sigma}-1}} \tag{A.7}$$

Table A.1 also presents equilibrium values in case of virtual shopping technology.

Table A.1. Equilibrium values of variables in the case of CES utility function

	REAL SHOPPING	VIRTUAL SHOPPING
n^*	$n_r = \frac{x^{\frac{1}{\sigma}-1}}{(1+\delta x)^{\frac{1}{\sigma}} + (1+\delta x) x^{\frac{1}{\sigma}-1}}$	$n_v = \frac{x^{\frac{1}{\sigma}-1}}{(1+\alpha_1)^{\frac{1}{\sigma}-1} + x^{\frac{1}{\sigma}-1}}$
n_1^*	$n_1 = \frac{\delta x^{\frac{1}{\sigma}}}{(1+\delta x)^{\frac{1}{\sigma}} + (1+\delta x) x^{\frac{1}{\sigma}-1}}$	N/A.
l^*	$l_r = \frac{(1+\delta x)^{\frac{1}{\sigma}}}{(1+\delta x)^{\frac{1}{\sigma}} + (1+\delta x) x^{\frac{1}{\sigma}-1}}$	$l_v = \frac{(1+\alpha_1)^{\frac{1}{\sigma}-1}}{(1+\alpha_1)^{\frac{1}{\sigma}-1} + x^{\frac{1}{\sigma}-1}}$
y^*	$y_r = \frac{x^{\frac{1}{\sigma}}}{(1+\delta x)^{\frac{1}{\sigma}} + (1+\delta x) x^{\frac{1}{\sigma}-1}}$	$y_v = \frac{x^{\frac{1}{\sigma}}}{(1+\alpha_1)^{\frac{1}{\sigma}-1} + x^{\frac{1}{\sigma}-1}}$

The critical element in analysis is to compare the welfare of the representative agent in both cases. To this aim, first, calculate welfare (take equation (A.1)) in case of virtual shopping. After necessary substitutions, the utility function becomes

$$U_v = \left[c_v^{1-\sigma} \left(1 + \left(\frac{1}{c_v} - \frac{(1+\alpha_1)}{x} \right)^{1-\sigma} \right) \right]^{\frac{1}{1-\sigma}} \tag{A.8}$$

Note that c_v can be written as

$$c_v = \frac{x}{(1+\alpha_1)^{\frac{1}{\sigma}} x^{1-\frac{1}{\sigma}} + (1+\alpha_1)} \tag{A.9}$$

and thus U_v becomes

$$U_v = \left[c_v^{1-\sigma} \left(1 + \left(\frac{(1+\alpha_1)^{\frac{1}{\sigma}} x^{1-\frac{1}{\sigma}} + (1+\alpha_1)}{x} - \frac{(1+\alpha_1)}{x} \right)^{1-\sigma} \right) \right]^{\frac{1}{1-\sigma}} \Rightarrow$$

$$U_v = \left[c_v^{1-\sigma} \left(1 + (1+\alpha_1)^{\frac{1-\sigma}{\sigma}} x^{-\frac{1-\sigma}{\sigma}} \right) \right]^{\frac{1}{1-\sigma}} \tag{A.10}$$

Note that

$$1 + (1+\alpha_1)^{\frac{1-\sigma}{\sigma}} x^{-\frac{1-\sigma}{\sigma}} = \frac{x}{(1+\alpha_1) c_v} \tag{A.11}$$

from (A.9). Then, substituting (A.11) into (A.10) gives

$$U_v = (c_v)^{-\sigma/(1-\sigma)} \left(\frac{x}{(1+\alpha_1)} \right)^{\frac{1}{1-\sigma}} \tag{A.12}$$

Similarly, we get

$$U_r = (c_r)^{\frac{-\sigma}{1-\sigma}} \left(\frac{x}{(1+\delta x)} \right)^{\frac{1}{1-\sigma}} \tag{A.13}$$

in case of real shopping. It is easy to see that the consumer is better off by shifting to Internet shopping if and only if

$$-\frac{\sigma}{1-\sigma} \ln[c_v] - \frac{1}{1-\sigma} \ln[1+\alpha_1] > -\frac{\sigma}{1-\sigma} \ln[c_r] - \frac{1}{1-\sigma} \ln[1+\delta x] \tag{A.14}$$

This condition implies that

$$\ln[\frac{c_v}{c_r}] > \frac{1}{\sigma} \ln[\frac{1+\delta x}{1+\alpha_1}] \tag{A.15}$$

Substituting back respective values of c_v and c_r and some simple algebra yields that

$$\alpha_1 < \delta x\,. \tag{A.16}$$

This is the condition we get also for Cobb-Douglas type utility function.