Cyberconsumption Taxes and Electronic Collection Systems: A Canonical Consumer-Delivered Sales Tax

Jae Kyu Lee and Yeoul Hwangbo

ABSTRACT: This study analyzes existing consumption tax systems and proposes a new cyberconsumption tax policy called the Consumer-Delivered Sales Tax (CDS tax) for use in the electronic commerce environment. The CDS tax has the characteristics of a sales tax, but is remitted directly by the consumer without the intervention of the supplier. Seven criteria are laid out for use in designing an acceptable cybertax system: The system should be equitable and simple, ensure user confidence, prevent tax evasion and economic distortion, maintain a fair balance among countries, and not introduce a new form of taxation. All of these goals are satisfied by a version of the CDS tax termed the Canonical CDS tax. The taxation agency in the supplier’s country imposes the Canonical CDS tax on consumers in a manner that is consistent in both physical- and cyberspace. The merchant’s software issues a tax bill to the consumer’s personal computer (PC) together with the bill for the consumer’s purchase. The consumer pays the total amount, and the tax portion of the payment is transferred to the account of the consumer’s tax agency in a consumer-designated bank. The study shows that the Canonical CDS tax system can be implemented using ordinary electronic payment systems, such as electronic fund transfers, electronic credit cards, and electronic cash. It also demonstrates that the Canonical CDS tax system can coexist with traditional consumption tax systems, such as the sales tax and the value-added tax.

KEY WORDS AND PHRASES: Cyberconsumption tax, cybertaxation, electronic commerce taxes, electronic payment systems, sales tax.

The Internet offers new opportunities for global electronic commerce [3, 4, 17, 20, 25], but at the same time it poses new challenges in the area of consumption taxes [6, 11, 15, 16]. As the name implies, a consumption tax is levied on the consumer and collected by the taxation agency in the consumer’s country. However, when a consumer makes a purchase in cyberspace from an electronic mall (e-mall), the consumption tax charged under current sales tax and value-added tax (VAT) systems is collected by the mall operator and paid to the taxation agency in the mall operator’s country, which may not be the same as the consumer’s country.

As a means of dealing with the many contradictions of this kind that occur in cross-border cybertrading, a cyberconsumption tax system called the Consumer-Delivered Sales Tax (CDS tax) is proposed. Under the CDS tax system, the consumption tax is paid by the consumer to the taxation agency in the consumer’s country. In order to function properly, the CDS tax system requires precise definitions of who is required to pay what, when the tax is imposed, and how it is collected and remitted to the government.

In an effort to design the best-possible CDS tax system, hereinafter referred to as the Canonical CDS tax, this paper delineates and compares several alternative CDS tax systems. The comparisons are based upon seven evaluation
criteria (e.g., transaction cost, clearance cost, auditing cost, risk of tax evasion). The CDS tax system for electronic commerce is integrated with traditional sales tax and VAT systems, and should be designed to utilize such electronic payment systems as electronic fund transfers, electronic credit cards, and electronic cash.

The Controversy over Taxing Internet-Based Commerce

Challenges Posed by the Internet

As shown in Figure 1, the implementation of a cybertaxation system faces several challenges. Among these are the problems of identifying taxpayers, certifying documents, detecting tax points, and preventing the use of tax havens and offshore banking facilities [6, 10, 16, 21].

According to the Committee on Fiscal Affairs (CFA) of the Organization for Economic Cooperation and Development (OECD), taxation practices in global electronic commerce should satisfy the following seven criteria [17]:

1. The system should be equitable. Taxpayers in similar situations should be taxed in the same way.
2. The system should be simple. Transaction and auditing costs should be kept down.
3. The rules should engender taxpayer confidence.
4. The system should be effective so as to minimize tax evasion and avoidance. This can be accomplished by appropriate auditing.
5. The system should avoid economic distortions that might induce consumers to seek tax havens.
6. The Internet tax base should be fairly shared between countries so as to keep clearance costs down.
7. The system should adapt current tax arrangements to the Internet rather than introduce new forms of taxation. The sales tax and VAT are the preferred systems for cybertrading rather than a new one like the bit tax.

Although it is very difficult to design a tax system that can satisfy all of the above conditions, these seven criteria are good guidelines for an ideal cybertax system. The Canonical CDS Tax System designed in this paper satisfies most of the criteria.

Ambiguous Place of Supply in Cyberspace

What to regard as the permanent establishment of the vendor is one of the key issues in the field of cybertaxation [19]. Since consumer, e-mail server, and warehouse may all be located in different countries, it is necessary to decide which location should be viewed as the fixed place of business.

An example is provided in Figure 2. The consumer is in country C, the e-
mall server operates in country M, and products are stored in country W. In this situation, there is no consensus on where the business is located. Is it in country C, where the consumer is located, in country M, where the e-mail server is located, or in country W, where the warehouse is located?

At present, jurisdiction for consumption taxes is mainly based on the place of supply, because the supplying merchant collects the tax and remits it to the taxation agency to which both the merchant and consumer belong [11, 17]. However, as shown above, transactions involving goods and services on the Internet dilute the importance of physical boundaries. If this situation tempts servers to move to a tax-haven country, it may break down the mutually beneficial structure of global electronic commerce.

There are two broad positions in the controversy over international taxation. As represented in Figure 2, country M, where a cybershopping mall is situated, and country C, where the consumer resides, may have different views on international trade. That is, when a consumer from country C purchases something from the mall, country M may maintain for tax purposes that the consumer is a visitor from country C. On the other hand, country C may hold that the consumer has imported a product from a foreign country. The warehouse has nothing to do with the consumption tax if the price of the merchandise is paid to the e-mail operator. If it is paid to the warehouse, however, the positions of the warehouse and the e-mail operator are the same from the taxation point of view.

The different consumption tax systems currently in use are another source of conflict. The United States uses the sales tax, while the European Union (EU), Korea, and several other countries have VAT systems. International trade on the Internet under different national tax systems may result in dual taxation or even tax evasion [12, 22].
Figure 2. Electronic Commerce Among Different Countries

**Internet Round**

In July 1997, President William J. Clinton of the United States raised the customs and taxation issues in a government document titled "A Framework for Global Electronic Commerce" [2]. Several days later, economic, trade, and technology ministers from some forty nations around the world met in Bonn, Germany, to discuss the growth of free trade and electronic commerce on the Internet [8]. They acknowledged the U.S. position of not imposing any new tax, such as a new bit tax [24], as suggested by the European Union (EU). The EU did not take a concrete position on taxing electronic commerce because of concern that doing so might affect the revenues of its member governments, all of which use the value-added tax (VAT) [8]. The electronic commerce tax issue was raised again at a conference of the Organization for Economic Cooperation and Development (OECD) in Turku, Finland, in November 1997. The participating countries all apparently wanted to establish their own tax jurisdiction over electronic commerce because of the revenues they would presumably accrue. The controversy focused on whether jurisdiction belongs to the country where the e-mail's server has a fixed installation or the country where the consumer resides. The EU supports the principle of taxing according to the place of the consumer, vesting jurisdiction in the country where the consumer is located. At the OECD conference held in Ottawa, Canada, in October 1998, it was finally agreed that the consumer's country has jurisdiction over cyberconsumption taxes [18]. However, the definition of a consumer's location is not that straightforward, as will be seen below. The question is how to implement the principle of consumer jurisdiction.

**Jurisdictional Models for the Cyberconsumption Tax**

There are two possible models of tax jurisdiction for a cyberconsumption tax system: the Supplier's E-Mail Server-Based Model and the Consumer-Based Model.
**Server-Based Jurisdiction Model**

The server-based jurisdictional model is a direct mapping in cybertrading of the traditional procedure for collecting consumption taxes. As shown in Figure 3, the tax goes to the country where the server is installed. In this concept, the consumer pays the tax to the supplier along with the purchase price, and the supplier remits the payment to the taxation agency of the country where it is located. This model sees the consumer as a visitor to the supplier’s country. In practice, the tax, together with the purchase price, may be transferred from the consumer’s bank account to the supplier’s bank account. The supplier or the supplier’s bank may be responsible for collecting the tax and remitting it to the appropriate taxation agency.

**Consumer-Based Jurisdiction Model**

Under the consumer-based jurisdictional model, the tax revenue goes to the country in which the consumer resides, as depicted in Figure 4. According to this model, the supplier is an importer bringing merchandise to the consumer’s country. The consumer pays the purchase price to the supplier and the tax to the country’s taxation agency.

**Discussion of Tax Jurisdiction Models**

The server-based jurisdictional model might tempt servers to move to tax haven countries, and thus could adversely affect the global electronic commerce environment. Moreover, it is not in keeping with the spirit of a consumption tax borne by the consumer. In contrast, the consumer-based jurisdictional principle satisfies the fifth of the criteria outlined earlier. For this reason, consumer-based jurisdiction is adopted as a principle of the CDS tax system.
Sales Tax and VAT as Cyberconsumption Taxes

The principle of the consumer-based jurisdictional model implies that the VAT cannot be adopted because it cannot be calculated without merchant involvement. The consumer-delivered consumption tax also implies that tax collection should be implemented without the involvement of merchants. At this point, then, it can be inferred that a cyberconsumption tax should follow the consumer-based jurisdictional model, and thus should be a kind of sales tax charged only to consumers and excluding businesses. This tax, accordingly, can be called a Consumer-Delivered Sales Tax (CDS tax).

Location of Consumers: Six Principles

As summarized in Table 1, six principles must be considered in implementing the notion of the customer’s location. In addition, the theoretical possibility of identifying the customer’s nationality and the effort needed to do so are also matters of concern.

Each of the six principles has its pros and cons. Since actual consumption is almost impossible to trace, and location of delivery may result in taxing gift recipients, these two principles should be avoided. The third and fourth principles are also ineffective. The location of a residence is not easily confirmed, and this will continue to be the case unless suppliers in the field of electronic commerce uniformly adopt the use of certificates that include residential addresses of consumers. In any case, a person may have more than one residence. The location of payment is not easily defined and may differ from the location of consumption. Thus, none of these four alternatives is selected.

The location of the order can be confirmed by identifying the IP address, but consumers may use foreign IP addresses in order to avoid taxation. On the other hand, location of order would be a feasible method if the tax rate was consistent across countries. The last principle, nationality of the payer’s
<table>
<thead>
<tr>
<th>Principle of consumer's location</th>
<th>Effort necessary to identify jurisdictional country</th>
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</thead>
</table>
| Location of consumer’s residence | • Consumer has to report residence address to merchant so that merchant’s software can trigger jurisdictional country to consumer’s software.  
• Merchant needs consumer’s certificate for authentication. |
| Location of order                | • Consumer has to report ordering location so that merchant can identify consumer’s country.  
• Confirmation of ordering location based on IP address requires extra work on merchant’s side. |
| Location of delivery             | • Since consumer has to report delivery location anyway, this process does not take any extra effort.  
• However, delivery point may not be tax point if customer sends gifts to friends. |
| Location of actual consumption   | • Hard to confirm actual location of consumption.  
• Almost impossible to implement. |
| Location of payment              | • It is ambiguous to define the location of payment in cyberspace.  
• Consumer and electronic account may be in different locations. |
| Location of consumer’s bank      | • Bank’s nationality is easy to identify.  
• However, foreign banks may be used for payment. |

Table 1. Principle of Consumer’s Location.

bank, is very easy to confirm, but foreign banks may be used for making payments. At this point, the selection of a consumer’s location is put off for the time being. The criterion of “who remits the tax” will resolve this conflict in the next section. The method of tax delivery should be specified to make the CDS tax system realistic.

**Types of Consumer-Delivered Sales Taxes**

The CDS tax delivery method is determined by the tax deliverer, the consumer’s location, the tax billing agent, the tax billing time, the tax collection time, the jurisdictional basis, the number of taxing stages, the tax rate determinants, and the taxation agency’s frontier account. Possible alternatives for each of these factors are listed in Table 2.

**VAT, Sales Tax, and CDS Tax Compared**

Table 2 shows the characteristics of the VAT, sales tax, and CDS tax. Compared to the VAT and the sales tax, the CDS tax offered several alternatives. Selecting the best combination of alternatives is of the utmost concern.

**Tax Deliverer**

Who is more reliable as the tax deliverer: the consumer or the consumer’s bank (assuming that most electronic payments will be made via a bank)?
<table>
<thead>
<tr>
<th>Factors</th>
<th>VAT</th>
<th>Sales tax</th>
<th>CDS tax</th>
</tr>
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<tbody>
<tr>
<td>Tax deliverer</td>
<td>Supplier</td>
<td>Supplier</td>
<td>Consumer's bank</td>
</tr>
<tr>
<td>Principle of consumer's location</td>
<td>Supplier’s nationality</td>
<td>Supplier’s nationality</td>
<td>Consumer’s residence, ordering location, delivery location, actual consumption location, payment location, nationality of consumer’s bank</td>
</tr>
<tr>
<td>Tax billing agent</td>
<td>Merchant</td>
<td>Merchant</td>
<td>Merchant</td>
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<tr>
<td>Tax billing time</td>
<td>Price billing time</td>
<td>Price billing time</td>
<td>Price billing time</td>
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<tr>
<td>Tax collection time</td>
<td>Periodic</td>
<td>Periodic</td>
<td>Ordering time, delivery time, consumption time, payment time</td>
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<tr>
<td>Tax stages</td>
<td>Multiple</td>
<td>Single</td>
<td>Single</td>
</tr>
<tr>
<td>Tax rate determinant</td>
<td>Supplier’s country</td>
<td>Supplier’s country</td>
<td>Consumer country, supplier country</td>
</tr>
<tr>
<td>Taxation agency’s frontier account</td>
<td>Taxation agency or designated bank</td>
<td>Taxation agency or designated bank</td>
<td>Consumer’s bank, taxation agency</td>
</tr>
</tbody>
</table>

**Table 2. Characteristics of VAT, Sales Tax, and CDS Tax.**

Obviously, the consumer’s bank is much more reliable than the consumer. So it is selected as the tax deliverer.

**Principle of Consumer’s Location**

If the consumer’s bank delivers the tax, it is necessary to confirm the nationality of the consumer’s bank rather than the nationality of the consumer. Thus the nationality of the consumer’s bank is chosen as the identification of the consumer’s location. This resolves the issue of selecting the consumer’s location mentioned in the previous section.

**Tax Billing Agent**

The merchant computes and bills the tax and charges it to the consumer in both physical- and cyberspace by applying the tax policy of the country to which the merchant belongs. The merchant validates the certificate of business to waive the consumption tax for business customers. This process is basically the same as with the regular sales tax and the VAT.

**Tax Billing Time**

Merchants will issue tax bills to the consumers with their invoices. The timing is the same as for the regular sales tax and the VAT.
**Tax Collection Time**

The bank can collect the tax from the consumer’s account simply by transferring it to the taxation agency’s account in the same bank. This step will not involve heavy computation. The tax transfer can be executed at payment time either on-line or periodically—for instance, once a week or month.

**Tax Stages**

Since a sales tax is charged to consumers (not to manufacturers or merchants), there is only one tax stage. Thus the single-stage principle is automatically selected.

**Tax Rate Determinant**

Can the consumer’s country determine the tax rate? If so, how much effort should be made to identify the consumer’s nationality? This again brings up the issue of the consumer’s location. If the consumer’s PC has the tax rate installed in its software, the consumer’s country’s tax rate could be implemented. Since this would be very difficult to audit, however, consumers might be tempted to use a tax-free country’s software. Thus the possibility of imposing a tax rate based on the consumer’s country is eliminated. The only alternative is for the tax rate to be imposed by the supplier’s country. This policy is consistent with the tax rate charged to cybercustomers and traditional customers from the supplier’s point of view. If a globally common cybertax rate can be applied, conflicts caused by different tax rates among countries can be completely resolved. However, it may be very difficult to implement a single global tax policy (e.g., a tax waiver for a certain group of people for a certain period of time may be necessary depending upon the country’s situation). The tax rate gap may tempt dishonest consumers to seek a tax haven.

**Taxation Agency’s Frontier Account**

The taxation agency may reside in another building, but the money collected has to be deposited in the same bank. Keeping the taxation agency’s account in the consumer’s bank can be the frontier storage method for taxes collected. The taxes accumulated in such accounts can periodically be transferred to a central taxation agency account.

The selected alternatives for each factor are shown in boldface in Table 2. The CDS tax system with the selected alternatives is designated as the Canonical CDS Tax System.

**Canonical CDS Tax System**

The Canonical CDS tax is a sales tax imposed on the consumer by the taxation agency of the supplier’s country in a manner that is consistent in both physical- and cyberspace. The tax bill is issued by the merchant’s software to the
consumer's PC at invoice billing time, and charged when the consumer makes the payment by transferring the tax amount to the taxation agency's account in the consumer's bank if the bank is authorized to handle the tax collection. The details of the tax collection procedure may vary depending upon the method of electronic payment (this issue will be dealt with below). The taxation agency of the bank's country has jurisdiction over the tax payment. The Canonical CDS tax system is depicted in Figure 5.

In order to discuss the possible variations in the CDS tax system, it is necessary to define some relevant terms. The variables in the CDS tax system are the tax deliverer, the principle of the consumer's location, the tax billing agent, the tax billing time, the tax collection time, the tax stages, the tax rate determinant, and the taxation agency's frontier account.

Thus the Canonical CDS tax system can be represented as follows:

\[
\text{Tax Deliverer} = \text{consumer's bank}
\]

\[
\text{Principle of Consumer's Location} = \text{nationality of consumer's bank}
\]

\[
\text{Tax Billing Agent} = \text{merchant}
\]

\[
\text{Tax Billing Time} = \text{billing time}
\]

\[
\text{Tax Collection Time} = \text{payment time}
\]

\[
\text{Tax Stages} = \text{single}
\]

\[
\text{Tax Rate Determinant} = \text{taxation agency of merchant's country}
\]

\[
\text{Taxation Agency's Frontier Account} = \text{kept in the consumer's bank}
\]
Evaluation of Canonical CDS Tax

Four typical criteria have been selected to evaluate the validity of the Canonical CDS tax system as compared to the possible variations.

- **Transaction cost** is the cost of tax billing and collection (Criterion 2).
- **Auditing cost** is the cost of software and manpower to supervise the information systems of consumers, suppliers, and associated banks in order to prevent tax evasion (Criterion 4).
- **Clearance cost** is the discrepancy between reality and the goal of the consumer-based jurisdictional model. If two countries have to clear the taxes each has collected to ameliorate an imbalance, this results in a clearance procedure. The costs associated with the clearance procedure constitute the clearance cost.
- **Risk of tax evasion** may result from intentional omission of a tax levy (Criteria 4 and 5).

The present study is intended to find a tax system that can minimize both the costs associated with transaction processing, auditing, and clearance and the risk of tax evasion. Since Criteria 1, 3, and 7 are satisfied because of the inherent nature of the CDS tax, the best CDS tax system is the one that can also satisfy the remaining four criteria, thereby satisfying all seven. Let us now evaluate the Canonical CDS tax system on the basis of the criteria outlined above.

Transaction Cost

The transaction cost factors for the Canonical CDS tax system are considered in accordance with the seven steps in Figure 5.

1. **Impose the tax rate and tax policy on merchants**: The Canonical CDS tax system is no more expensive than the sales tax and VAT systems for this step. But the taxation agency has to audit the merchants' software to ensure that the tax policy is being properly implemented.

2. **Authenticate whether the customer is an individual or a business**: A globally agreed upon certification standard is necessary to distinguish businesses from individual consumers across countries. Similar authentication is necessary for electronic commerce.

3. **Bill tax to the consumer along with the price of goods and services**: This does not entail an extra cost as long as the first step is assured.

4. **Let the consumer's software automatically ask the consumer's designated bank to pay the purchase price and tax**: The consumer's digital wallet should initiate the tax bill transfer automatically and without modification.

5. **Transfer the price payment to the merchant's bank account**: This step is necessary for electronic commerce anyway, but is indifferent to the tax payment per se.
6. **Transfer the tax to the taxation agency's account**: A transfer within the same bank is usually free of charge. The bank may wish to open an account for the taxation agency because of the increase in deposits.

7. **Let the taxation agency transfer the stored taxes in the bank account to the central taxation agency**: This process is very simple to execute.

Software that can perform the above steps will be needed at the merchant, consumer, and bank sites. Since merchants and banks do not require any significant extra development, the transaction costs may be negligible, but it is not easy to trace and audit a consumer's software. This problem can be overcome by requiring that the consumer's electronic wallet conform to the protocol for generating tax-payment messages. This implies what the standard of merchant and wallet software should be in the future, and what the protocol should be for the Canonical CDS tax system. The auditing costs of the Canonical CDS tax system will apparently be higher than the transaction costs.

**Auditing Cost**

The auditing cost factors for the Canonical CDS tax system steps are as follows:

1. **Impose the tax rate and tax policy on merchants**: A merchant may try to evade the regular (nonelectronic) sales tax by falsely claiming that goods and services have been sold electronically. The sales record tracking software for both electronic and regular sales should be auditable. Software packages like ERP and the merchant's proprietary software need certification that they conform to the CDS tax system protocol and are technically nonmodifiable without the permission of the taxation agency.

2. **Authenticate whether the customer is an individual or a business**: An individual consumer may try to evade the tax by falsely claiming to be a business. The certifying authority should take care, when issuing a certificate, to determine whether the recipient is an individual or business.

3. **Bill tax to consumers along with the price of goods and services**: A merchant may be tempted not to bill the tax in order to attract customers who do not want to pay taxes. The taxation agency will have to audit the merchant's software from this perspective, as mentioned in step 1.

4. **Allow the consumer to ask his or her designated bank to pay the purchase price and tax**: To prevent consumers from falsifying their tax bills, the digital wallet should be designed to prevent illegal modifications, and commercial digital wallets should be certified to this effect. Adopting a government-regulated encryption scheme should technically, as well as legally, prevent the proliferation of compatible freeware. The audit trail of software modification may be adopted to detect unauthorized modifications.
5. **Transfer the price payment to the merchant's bank account:** Records of price payments may be stored, so that the tax can periodically be recomputed and compared with the actual tax payment amount in step 6.

6. **Transfer the tax to the taxation agency's account:** This process can be secured by auditing the bank's software. It is relatively inexpensive to implement because the number of banks is small and banks are usually trustworthy.

7. **Let the taxation agency transfer the stored taxes in the bank account to the central taxation agency:** This process seems basically safe, but the bank may periodically report the amount transferred as a cross-check with the actually transferred amount.

Since auditing the entire trail of tax collection will be very expensive, attention must be given to auditing the software's functionality for taxation and protection against illegal software modification. There is a close relationship between transaction costs and auditing costs. Strict auditing requires careful transaction logging. However, a good software audit can save the effort of transaction logging. In this sense, auditing costs are higher than transaction costs under the Canonical CDS tax system. However, the cost of auditing can be reduced with improvements in the security technology that prevents illegal modification of software.

### Clearance Costs

Clearance costs may be incurred if the balance of tax payments between countries is unequal. Under current sales tax and VAT systems, the supplier's country must pay a tax rebate to the consumer's country. This is implemented by giving a tax rebate to the consumers, who then pay the tax to their own country. Under the Canonical CDS tax system, clearance between countries is optional. As long as there is no significant imbalance between countries, clearance is of no great importance, but it becomes necessary if there is a large imbalance. For instance, when offshore banks are used, a transaction cost would have to be cleared between countries. This implies that the amount passing through offshore banks should be traced, which seems very difficult and costly. To trace the record of using a foreign bank for domestic consumption, it is necessary to keep up with the following points for clearance.

1. **Impose the tax rate and tax policy on merchants:** This process is indifferent to clearance.

2. Authenticate whether the customer is an individual or a business: This process is indifferent to clearance.

3. **Bill tax to the consumer along with the price of goods and services:** This process is indifferent to clearance.

4. **Allow the consumer to ask a designated bank to pay the purchase price and**
tax: The bank will need to know whether the customer is a resident or a nonresident. For this purpose, the customer’s certificate should specify nationality. However, if a customer has more than one legitimate certificate, a bank cannot distinguish a resident from a nonresident. Confirming the mailing address is an additional instrument for residence identification, but this entails extra computations and is not perfect. In practice, tracing and storing the records of all nonresident customers’ payments would be very costly.

5. Transfer the price payment to the merchant’s bank account: This process is indifferent to clearance.

6. Transfer the tax to the taxation agency’s account: The taxation agency needs to keep a record of tax rebates made to the foreign customer’s home country.

7. Let the taxation agency transfer the stored taxes in the bank account to the central taxation agency: The taxation agency has to count the total amount of tax rebates for each relevant country. Since the taxation agency cannot trace the amount to claim, it should honor rebate records from foreign banks.

As shown above, clearance requires effort on the part of banks and taxation agencies. In the beginning stage of the CDS tax system, if the imbalances resulting from the use of foreign banks are not substantial, they need not be cleared. In such cases, the bank’s competitiveness will attract nonresident customers, and then the need for clearance will be unavoidable [1, 9]. But if countries legally prohibit the use of foreign banks as major payment banks in electronic commerce, this loophole can be closed administratively to some extent. If it is essential to clear between countries, though, banks will have to trace the records of foreign customers. This may lead to infringements of personal privacy.

**Risk of Tax Evasion**

The risk of tax evasion will depend upon personal motivation, technical ease of illegally modifying tax software, level of audits, and legal prohibitions. The auditing process discussed earlier has great bearing on the technical ease of illegally modifying consumer, merchant, and bank software, as well as on the level of audits.

**Technical Requirements for Implementing the CDS Tax System**

The key entities involved in the system have somewhat different needs and requirements for the implementation of the Canonical CDS tax.

**Customer**

1. The customer’s digital wallet should be compatible with the
certification protocol for identifying nationality and determining whether the customer is an individual or business.

2. The customer’s digital wallet should store the tax bill and automatically initiate the tax transfer to the bank at the time of payment. Demon (an automatically initiating program) may be necessary to trigger the automatic initiation.

3. The tax-related part should not be technically modifiable without the assistance of the taxation agency’s secret software.

4. The customer’s digital wallet should be certified by the taxation agency as conforming to the CDS tax protocol and should be nonmodifiable.

**Merchant**

1. The merchant’s software should be able to authenticate whether the customer is an individual or a business.

2. The merchant’s software should be able to automatically initiate computations of the tax amount and billing.

3. The merchant’s software should store the transaction records of both electronic and regular transactions.

4. The merchant’s software should be certified by the taxation agency as conforming to the CDS tax protocol and should be nonmodifiable.

**Banks**

1. The bank’s software should be able to automatically transfer the price payment and tax, respectively, to the bank accounts of the supplier and the taxation agency.

2. If clearance is assumed between countries, the customer’s nationality should be identified and the tax amount paid by foreign customers should be identified for rebate.

3. Banks should be registered as tax collectors.

4. The bank should periodically report the amount of collected tax to the taxation agency.

**Certifying Authority**

1. The certificates issued by the certifying authority should include a specification of whether the customer is an individual or a business.

2. If clearance is assumed, the customer’s nationality should be included on the certificate.

3. A global standard for certification should be established and adhered to.
Software Tool Providers

Before they are distributed commercially, software products should be certified as conforming to the CDS protocol and nonmodifiable.

Taxation Agency

1. The world association of taxation agencies should establish a global standard protocol for the CDS tax system.

2. Taxation agencies should be able to access their accounts in banks to transfer the tax collected at each bank to the central taxation account. This can be accomplished through standard banking practices without any additional development.

3. If clearance is assumed, the taxation agency should collect reports from banks concerning tax rebates.

4. The taxation agency should audit customer, merchant, and bank software in order to certify its conformity with the CDS protocol and its nonmodifiable.

5. The taxation agency should have the legal power to prohibit the distribution of uncertified software.

6. The taxation agency should periodically compare reports on tax collection amounts from banks with the actually collected tax amount.

Implementation of the CDS Tax System Using Electronic Payment Systems

To put the CDS tax system into practice, it should be applied to typical electronic payment systems, such as Electronic Fund Transfer (EFT), electronic credit cards [28], and electronic cash systems [5, 7].

Electronic Fund Transfers

When the protocol of the Canonical CDS tax system was designed, it was assumed that EFT would be the default payment method. The protocol compatible with EFT is basically the same as the procedure shown in Figure 5. An issue is whether cyberbanks using EFT should be on the Internet or not.

Electronic Credit Cards

Electronic credit cards are credit cards used on the Internet. The tax delivery method with credit cards is similar to that for EFT, except that the payment and settlement times are not the same (see Figure 6).

Steps 1, 2, and 3 in Figure 6 are the same as those with EFT in Figure 5. The remaining steps are discussed below.
Step 4) Unlike the case of EFT, the consumer needs to get authorization for payments from the credit card issuer (e.g., Visa, MasterCard).

Step 5) The price payment to the merchant will be initiated when the merchant requests payment to the acquirer bank, which may be the merchant’s bank. This step is called the capturing process.

Step 6) The acquirer bank requests settlement to the credit card issuer (which may be the consumer’s bank, but not necessarily).

Step 7) The credit card issuer requests that the price and tax payment be made to the consumer’s bank on a predetermined day of the month.

Step 8) The consumer’s bank settles the requested price with the credit card issuer.

Step 9) The consumer’s bank transfers the tax to the taxation agency’s account in the bank.

Step 10) The process of collecting from the taxation agency’s bank account to the central taxation agency is the same as that for EFT.

Since credit cards are the most popular payment method for cybershopping, taxation in accordance with credit card payments is important. The key credit card issuers have global networks and have already developed a common secure standard protocol (Secure Electronic Transaction, or SET). The Canonical CDS taxation protocol should be implemented on top of the SET protocol [18].

**Electronic Cash**

Electronic cash (e-cash) is a money value in a digital wallet that may be stored in a PC or an IC (Integrated Circuit) card [7, 13]. The most popular form of e-cash is the one found in the IC card, which can be used for micropayments not only on the Internet, but also in off-line environments like subways, buses, and pay telephones. Since e-cash, like Mondex [14, 22], may be used without the intervention of banks, it is very difficult to collect tax at the time of use. When e-cash is paid off-line, it is almost impossible to remit the tax to the bank.

An efficient way, probably the only way, of collecting tax for IC Card-based e-cash payments is to transfer the collected tax to the tax section of the IC card at the time the price is paid. When to deliver the collected tax on the IC card to the taxation agency remains a question. The best time would be the time when the card is re-filled with cash from the bank account. Tax collected on an IC card cannot be used for other purposes, so there is no temptation for consumers not to remit it to the taxation agency’s account in the bank. To implement this system, as with other payment methods, security is a must. The tax collected on the IC card should be neither accessible nor transferable by unauthorized software.
Figure 6. The Canonical CDS Tax System Procedure Using the Electronic Credit Card

As shown in Figure 7, steps 1, 2, and 3 are the same as those for EFT (see Figure 5).

There are two price payment options when using e-cash with an IC card.

(Step 4-1: Open System) The e-cash on the IC card can be transferred to another IC card without intervention by the bank.

(Step 4-2: Closed System) The e-cash can only be transferred only to the payee’s bank account.

Step 5) The tax amount is stored in the tax section of the IC card simultaneously with step 4. This accumulated tax will be stored in the IC card until the consumer attempts to refill the e-cash from the bank.

Step 6) The e-cash in the IC card is refilled from the consumer’s bank account.

Step 7) The tax in the tax section of the IC card is automatically transferred to the taxation agency’s account when the refill in step 6 is triggered.

Step 8) The process of collecting from the taxation agency’s bank accounts to the central taxation agency is the same as with EFT.

As the foregoing discussion makes clear, the Canonical CDS tax system can be implemented successfully with all three typical payment systems. In
fact, without the introduction of electronic payment methods, the CDS tax system would be impossible.

**Simultaneous Development of CDS Tax System with Traditional Consumption Tax Systems**

Finally, there is concern about how to implement the CDS tax system for cybertrading in harmony with traditional (also called regular) consumption tax systems—for instance, the sales tax in the United States and the value-added tax (VAT) in the European Union and Korea. Can the current tax system be maintained for traditional transactions? Based on the authors' observations, the answer is yes. This is so because of the adoption of the principle that the supplier country's taxation agency enforces the same tax rate on both the CDS and the regular consumption tax.

The integrated deployment of the Canonical CDS tax system and the traditional consumption tax system is depicted in Figure 8. As is evident, the two systems can coexist without any loss of tax equitability, thereby satisfying Criterion 1, as set forth at the beginning of this paper.

**Conclusion**

The Canonical CDS tax is the best possible approach to a cyberconsumption taxation system, and, as shown above, meets the seven guidelines for the level development of global electronic commerce. The seven criteria listed at the
beginning of this paper—equitability, simplicity, taxpayer confidence, prevention of tax evasion, avoidance of economic distortion, fair balance between countries, and no new form of taxation—are all satisfied by the Canonical CDS tax system.

The paper demonstrates how the Canonical CDS tax system can be implemented using typical electronic payment systems, such as electronic fund transfers, electronic credit cards, and electronic cash. Finally, it also shows that the Canonical CDS tax system can coexist with traditional consumption-tax systems (sales tax and VAT) without causing conflict in taxation principles. To implement the Canonical CDS tax system in the real world, a globally acceptable protocol will have to be developed, and software will have to be implemented according to the protocol. Developing audit technology likewise presents a major challenge and opportunity.

REFERENCES

For biographical information on Jae Kyu Lee, see the Guest Editor's Introduction.

YEOUN HWANGBO (hby@phenix.dyu.ac.kr) is a professor in the School of Administrative Information Management at Dong Yang University, Korea. He received his Ph.D. in management information system from the Korea Advanced Institute of Science and Technology in 1998. His research areas include public management information systems, taxation of electronic commerce, and R&D management information systems. Before joining Dong Yang University, he worked for the Korea Science and Technology Policy Institute.