E-Commerce and Globalization
[WORKING TITLE]

Carla Carnaghan

Assistant Professor
University of Lethbridge
Carla.Carnaghan@uleth.ca

and

Kenneth J. Klassen

Associate Professor
University of Georgia
kklassen@uga.edu

Abstract

E-commerce is believed to reduce coordination costs across operations to produce more competitive international operations. This paper investigates whether e-commerce is associated with increased foreign sales, increased profitability of U.S. multinationals, and firms' tax planning activities. We specifically address whether greater use of e-commerce has lead to greater sales in total, greater foreign sales relative to total sales, and greater pre-tax profits both in total and for foreign operations. Our evidence is consistent with e-commerce being associated with increased sales, but not increased pre-tax profitability. In a second set of tests, we demonstrate that firms' e-commerce-related sales changes are sensitive to tax incentives, with more shifting occurring for companies with lower-tax foreign tax rates. Also consistent with tax planning flexibility, we show that foreign tax rates fall more for firms that employ technology to a greater degree.

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I. Introduction

The increase in internet-based technologies is cited anecdotally as a stimulus for recent globalization. For example, a recent article in the *Wall Street Journal* (Regalado 2007) describes the global outsourcing of many back-office activities. U.S. corporations such as The Gap and Whirlpool have outsourced corporate data functions to IBM, who performs these services in Brazil. Technology, including those used in electronic commerce facilitates communication of data, making it considerably less costly for companies like IBM to operate in distant locations.

E-commerce not only reduces communication costs, but also increases flexibility in locating activities. Data processing can occur equally well in the United States, Brazil, or one of many other countries. This flexibility permits web-based sales to both be customized to local customers and yet be located in a distant jurisdiction—increasing the reach of even small companies.

Research posits that internet technology has lead to an increase in international trade (Freund and Weinhold, 2002, 2004). Likewise, anecdotal evidence suggests profits from foreign operations have also increased in recent years (Hilsenrath, 2005). However, while technology use, foreign sales activities and foreign profits appear to be rising simultaneously, there is little evidence on the relation among these three trends. The purpose of this paper is to fill this gap. Specifically, we examine whether overall company sales growth, the growth in foreign sales relative to total sales, and changes in profitability are related to the use of e-commerce sales activity, a specific type of technology.

To address these questions, we collect data on 489 companies for three five-year periods: 1990–1994, 1995–1999, and 2000–2004. We compare company-specific changes in the average value of the variables of interest during the first period, 1990-1994, to those in the latter period,

2000-2004. This design has several benefits. Firstly, it uses company-level data rather than country-level data common to extant literature. Company-level data permits the design to control for many company-specific features. Secondly, by taking the mean value across a five-year period, annual fluctuations are removed, improving the power of the tests. Thirdly, by comparing the values for the latter period to the company's own values for the earlier period, many company-specific correlated omitted variables are avoided. While company-specific factors can be considered, company disclosures do not allow analysis of activities by specific foreign countries. Thus, using these data has both benefits and limitations and our results can corroborate extant evidence using macroeconomic data.

Our tests reveal that the growth of total sales is strongly related to using electronic commerce technologies. On average, a firm with median e-commerce-based sales of 4% would see an increase in total sales, holding other factors constant, of 78% between the two time periods under study. The tests also reveal that using e-commerce is related to increasing foreign sales. In our sample during this period, the average firm increased its foreign sales by 11% (i.e., increasing foreign sales from 30% to 41% of total sales). Being a firm with median e-commerce sales is associated with this value being 5.6% higher, on average (i.e., 16.6% rather than 11%).

A different picture emerges when we analyze profitability. Neither increases in overall company pre-tax return on sales nor the pre-tax return on sales of foreign operations is related to our proxy for technology use. Thus, foreign operations may be generating more profits, but we are unable to show that this trend is correlated with e-commerce. We re-visit this finding when we analyze the effects of tax incentives in the subsequent analyses.

E-commerce allows companies to increase their sales in domestic and foreign operations and the flexibility afforded by the technology also provides less costly opportunities to locate operations strategically. Determining the optimal location for foreign activities involves a

complex trade-off among many country-specific factors. Taxation is one such significant factor. Some costs and complexities, including taxes, can be avoided when costs of locating operations farther from the ultimate customer decrease.

Therefore, like the globalization phenomenon more generally, considerable attention has been focused on the use of technology to reduce global tax payments. Strategically locating technology, and the geographic flexibility that technology creates, both permit companies to expand globally in a tax-efficient manner.[1]

The threat of e-commerce to international tax collections has been the subject of much research (e.g., Bruce and Fox, 2001; Borkowski, 2002; Cockfield, 1999; Fleming, 2000; Jones and Basu, 2002; and Li 2003; Teltscher, 2002). Legal and economics researchers have focused on the challenges of applying extant tax treaties that focus on physical location to trigger taxation to the new technologically-enhanced business methods. New methods do not involve a physical location in many cases. Offsetting the opportunities to reduce foreign taxes by strategically locating activities are several challenges. These include potential operating inefficiencies and lower pre-tax profits, and increasing tax enforcement efforts.

While considerable attention by tax policy setters is devoted to low tax-rate foreign countries, so-called tax havens, many industrialized countries' tax rates exceed the U.S. rates. If companies, faced with high foreign tax rates due to the location of their activities, can employ technology to locate operations strategically, then the relations explored in the first section will be affected by company-specific foreign tax rates. E-commerce can be used in two ways. Firstly, relative to other companies, a company using e-commerce can shift operations between

[1] For example, entering the German market by opening a location in Germany directly, operations can be located in the lower-taxed Ireland using e-commerce technologies to reduce the distance. In addition, to avoid the high German taxes, the company may retain operations in the U.S. and use the technology to facilitate German sales.

domestic and foreign locations to benefit from the relative taxation of the two. Thus, lower foreign tax rates would be associated with more shifting of activities into foreign jurisdictions. Secondly, the companies with e-commerce sales methods can strategically locate foreign operations to reduce average foreign tax rates.

To explore empirically whether companies are able to use technology to engage in these forms of international tax planning, we first reexamine the relations between electronic commerce, and foreign sales growth and profitability. Using the same sample, we consider whether these relations are mitigated by higher foreign tax rates. Empirical evidence presented is consistent with higher foreign tax rates reducing the relation between e-commerce and the change in the foreign sales ratio. We also find that the coefficient on the interaction of the e-commerce variable and the foreign tax rate is negative in the regression of the change in foreign pre-tax return on sales. However the coefficient is only marginally statistically significant.

In an additional test, we explore whether e-commerce has allowed companies to manage their foreign tax burdens. We regress the change in average foreign tax rate between the early period, 1990-1994, to the later period, 2000-2004 on e-commerce sales and control variables. We also include an indicator variable for whether the firm had a binding foreign tax credit position in the earlier period.[2] Firms with a binding position have an even stronger incentive to lower their foreign tax rates because, upon repatriating these earnings to the U.S., these companies cannot fully offset the foreign taxes using U.S. foreign tax credits. Consistent with expectations, the regression results show that there is a negative relation between the change in foreign tax rate and the use of e-commerce. Furthermore, there is some evidence that this

[2] As explained more fully below, the U.S. provides a credit for foreign taxes paid when those earnings are taxed in the U.S. If the tax credit is insufficient to offset all foreign taxes paid because the foreign tax rate is higher than the U.S. rate, then the company is said to be in a binding foreign tax credit position.

relation is stronger for firms facing binding foreign tax credits (i.e., firms with high foreign tax rates).

Overall, this research makes several contributions. First, it provides company-level tests of the role of technology in international business expansion. Extant evidence uses macro economic data at the country level. The company-level evidence provides a useful triangulation with the extant evidence. Second, the paper explores empirically the role of the international tax environment on these international business developments. The Organization for Economic Cooperation and Development (OECD) and tax policy setters have given much attention to the effect of electronic commerce on international tax collections. We provide the first empirical evidence that technology has affected international activities to a measurable degree. The results are robust to a series of specification checks.

The next section develops the hypotheses of the role of technology in international business expansion and presents the research design. Section three provides the results of the empirical tests. Section four and five develop hypotheses, describe the research design and present results of the role of taxation in this setting. Section six concludes.

II. E-commerce and International Business Expansion

Hypothesis Development

International trade has increased over time, with one hypothesized cause being the use of technologies such as e-commerce. E-commerce is a nebulous term used to describe business sales transactions mediated by the Internet or other computer networks rather than through direct interaction between humans. E-commerce benefits internationalization in two ways. First, as noted in PricewaterhouseCoopers (1999), "…[there] is a direct substitution of e-business

technology and processes for physical locations, manual processes, or other expediting functions that...increase costs but do not add actual value." (p. 19). In particular, companies may use computer servers to substitute for sales personnel, and even whole offices. Unlike salespeople, the location of the server from the customer's perspective is irrelevant, avoiding the need to duplicate sales infrastructure throughout the world. Thus, the creation of some foreign subsidiaries may be avoided, with a commensurate reduction in costs. By way of example, take Dell Computers. While Dell has established numerous foreign operations, the geographic location of servers hosting the online store for foreign country web addresses (e.g., *www.dell.ca* or *www.dell.nl*) appear to be in the U.S.[3] The secure server authentication certificates for these sites are also registered to Dell Computer Corporation, rather than to the relevant foreign subsidiaries. One can infer, therefore, that international sales of Dell computers generally occur through its web site located on servers in the U.S., not elsewhere in the world.

Second, as noted in PricewaterhouseCoopers (1999), e-commerce reduces coordination costs, which can reduce the costs of working with those foreign subsidiaries still required because of the nature of the product or service or because of regulation or cultural issues.

The internet has also been shown to generally stimulate trade. Freund and Weinhold (2002, 2004) show that country pairing in which internet technology is more prolific, have greater increases in international trade during the late 1990s. Freund and Weinhold (2004) develop a model of the effect of technology on cross-border trade. Their model predicts that (1) world trade will increase as a result of the internet because the internet facilitates bilateral trade growth through reduced fixed costs of trade, (2) trade will increase between closer countries and decrease among countries further apart due to informational effects, and (3) the internet will

[3] This conclusion is based on the use of the Internet program traceroute, which shows the physical location of the server hosting a particular domain name.

increase aggregate trade. They present empirical evidence using aggregate trade data for country-pairings from 1997 to 1999. Their results are generally consistent with their model's predictions. While their paper focuses on the internet technologies specifically, the relations predicted would apply similarly to other technology-facilitated trade.

Applying the predictions of their model to the activities of U.S. multinationals, it is reasonable to assert that companies that use technology in their sales process will be able to increase overall sales. Technology allows companies to reduce the costs of coordination, allowing greater sales expansion.

> **HYPOTHESIS 1** *(in alternative form): The use of e-commerce sales techniques will be positively associated with companies' sales expansion.*

In addition to affecting overall sales levels, technology enhancements are predicted to influence international trade as well. Consistent with the model of Freund and Weinhold (2004) we predict that technology reduces the costs of coordinating activities across countries, making it possible for companies to enter foreign markets more effectively. Thus, U.S. companies with access to e-commerce sales technologies would be expected to increase sales in foreign jurisdictions at a greater rate.

> **HYPOTHESIS 2** *(in alternative form): The use of e-commerce sales techniques will be positively associated with the change in companies' ratio of foreign sales to total sales.*

Finally, the efficiency gains that allow sales expansion should also permit improved profitability.

> **HYPOTHESIS 3** *(in alternative form): The use of e-commerce sales techniques will be positively associated with the change in companies' total pre-tax return on sales and its foreign pre-tax return on sales.*

Research Design

To test the hypotheses, we perform a series of regressions. The key explanatory variable is the use of technology for sales activities. While the tests would benefit from a firm-specific measure of technology use, such a measure is not publicly disclosed. Instead, we rely on the U.S. Department of Commerce *E-stats* industry-level summaries. In particular, we use the value of e-commerce sales as a percentage of total revenues. The Department of Commerce defines e-commerce sales to include "the value of goods and services sold online whether over open networks such as the internet, or over proprietary networks running systems such as electronic data interchange (EDI)." While the values derived from this source are averaged across 3 or 4-digit NAICS codes, the fine level of industry detail should provide a reasonable proxy for the amount of a sales derived from technology-enhanced online methods. Control variables and specification checks are employed to rule out alternative industry-based explanations.

To control for a variety of firm-specific variables that may be correlated with the technology variable of interest, we use the firm's own historical value as a basis. Thus, our empirical analysis regresses the difference between the values since technology practices have become prevalent to the values before the wide-spread use of e-commerce techniques. We eliminate the intervening period, 1995 to 1999, because technology adoption during this period are difficult to determine in the absence of data (the Department of Commerce only began to disclose the e-commerce data in 1999). A second feature of our design is the use of average values across five-year periods. All variables are available annually, but we believe that the relations predicted are broad trends and annual fluctuations in the observed values are not relevant to assessing the hypotheses.[4]

[4] While it is possible to run the regressions using annual recent data as a change from the historical average, this approach will introduce potentially serious econometric problems including serial correlation within the errors.

Using this e-commerce measure, we estimate four regressions to test the three hypotheses. These regressions are as follows:

$$Growth = \alpha_0 + \alpha_1\, Ecomm + \alpha_2\, 1/Sales_1 + \alpha_3\, R\&D_1 + \alpha_4\, PTROS_1 + \varepsilon \quad (1)$$

$$\Delta FSales\ Ratio = \beta_0 + \beta_1\, Ecomm + \beta_2\, 1/Sales_1 + \beta_3\, Growth + \beta_4\, R\&D_1 + \beta_5\, PTROS_1 + \varepsilon \quad (2)$$

$$\Delta PTROS = \delta_0 + \delta_1\, Ecomm + \delta_2\, 1/Sales_1 + \delta_3\, Growth + \delta_4\, R\&D_1 + \varepsilon \quad (3)$$

$$\Delta FPTROS = \gamma_0 + \gamma_1\, Ecomm + \gamma_2\, 1/Sales_1 + \gamma_3\, Growth + \gamma_4\, R\&D_1 + \gamma_5\, \Delta PTROS + \gamma_6\, FSales\ Ratio_1 + \varepsilon \quad (4)$$

where the variables are defined as follows.

Growth	is change in total sales from period 1 (average value over 1990 to 1994, inclusive) to period 3 (average value over 2000 o 2004, inclusive) deflated by period 1 total sales.
FSales Ratio	is total foreign sales, the sum of reported exports and foreign subsidiary sales, as disclosed in the segments disclosures, divided by total sales, averaged over the five year period.
PTROS	is pre-tax income deflated by total sales, averaged over the five year period.
FPTROS	is foreign pre-tax income deflated by total foreign sales, averaged over the five year period.
Ecomm	is the percentage of sales that are made through E-commerce for the NAICS industry in which the company is a member, averaged over the period 2000 to 2004.
1/Sales	is the inverse of total sales.
R&D	is research and development expense deflated by total sales, averaged over the five year period.

In the equations, Δ denotes a difference in the variable from period 1, 1990 to 1994, to period 3, 2000-2004. Subscripts denote the period for variables that are not differences.

Our hypotheses predict that the coefficient on the *Ecomm* variable will be positive in each regression. A positive coefficient is consistent with the level of online sales being correlated with increasing sales growth, proportion of sales generated in foreign jurisdictions, total company profitability, and foreign profitability.

Beyond using the differences, control variables are included to capture exogenous reasons for the observed increases. All equations include a control for 1/Sales and R&D. The inverse of sales is used because all variables are deflated by sales. R&D is included because firms that invest greater amounts in product and process development are likely to enjoy greater growth in sales and profits. Industry fixed effects are also included. To create the industry classification variable, companies are initially classified by their primary 4-digit SIC code and categorized into the 48 "logical" industry groups defined by Fama and French (1997). Where insufficient firms were found in a single industry (i.e., less than 1% of the sample), closely related industries were combined, resulting in 25 industries described below. Since the *Ecomm* measure uses finer industry partitions and ones based on NAICS codes, the use of industry fixed effects does not present an econometric problem.

In addition to these controls found in all the equations, regressions also control variables that relate to other dependent measures. For example, period 1 pre-tax return on sales ($PTROS_1$) is included in the two sales equations (equations 1 and 2). It may be the case that more profitable firms are in a relatively stronger position to increase sales both domestically and elsewhere. Given that the value is computed in the first historical period, no simultaneity should exist. On the other hand, *growth* and $\Delta PTROS$ are also included as explanatory variables in other equations to control for overall trends within the firm and focus attention on the unique changes in the foreign operations. This approach is in the spirit of Collins et al. (1997). However, inclusion of such variables suggests that these equations may be simultaneously determined. In the main

tests we use OLS in spite of this potential recursive nature to the equations. In supplemental tests, we use the instrumental variables approach to ensure our results are not driven by this choice.

We are unable to predict the coefficients on the *1/Sales* variable or on the $FSales\ Ratio_1$ in equation (4). Otherwise, we expect the relation between the variables to be positive.

Sample

We collected data on U.S. multinational companies from *Compustat*. To be included in our sample, each firm is required to have data on all the variables of our regression equations for at least three years during the period 1990 to 1994 and the period 2000 to 2004. We also required the firm to have positive total profits and positive foreign profits.

We place three significant constraints on our data. Firstly, companies must have data both in the early 1990s and the early 2000s, which may introduce a survivorship bias. However, the long-period changes specification allows the tests to implicitly control for many firm-specific factors that may be correlated with the variables of interest. This choice allows the tests to eliminate other potential explanations for our results; however, it may limit the generalizability of the results. Secondly, we require firms to publicly disclose pre-tax income and tax expense within domestic and foreign operations. These values are necessary to explore the tax planning in the second set of tests presented below. To allow comparability across the tests, we impose the same constraints on the data throughout the regression analyses.[5] Finally, we require all firms to be profitable. This requirement allows us to assume that all firms in the sample will find

[5] Using all possible observations that satisfy the other constraints, a total of 698 firms, in the main tests of hypotheses 1 to 3 does not alter inferences presented below. In all cases, the coefficients are quite similar and the *t*-statistics increase modestly.

expanding globally to be rewarding. Furthermore, in the later tests, it allows us to have clear predictions on the roll of taxation in incentives to shift income to foreign operations.[6]

Table 1 presents the data classified according to industry. The table includes the number and percentage of firms in each industry as well as the average value of the *Ecomm* variable within the industry. The most significant industries represented in the sample are machinery, electronic equipment, and business services, with 11.0% , 9.8% and 8.6% respectively of the observations. In terms of industries engaged in sales online (the *Ecomm* measure as defined by the Department of Commerce), during the period 2000-2004, firms classified in the aircraft, shipbuilding and defense industry have a mean value of 9.9%; automobiles and trucks industry have a mean value of 8.4%; metal mining, coal and petroleum industry have a mean value of 5.1%; and electrical equipment have a mean value of 5.0%.

Table 2 presents summary statistics for the variable used in the regressions. The mean and median value of sales is $1,163 million and $5,142 million, respectively. This represents a mean growth in sales from the historical period of 2.3 times. Median value of growth is 1.1 times. The mean and median values of total foreign sales are $2,607 million and $465 million, which represents 41% of total sales (both as a mean and median value). The ratio of foreign sales to total sales increased by about 11%. The average pre-tax return on sales is 9.5% with the foreign operations providing a slightly lower value of 8.7%. Both of these values have increased relative to the historical period, with total return increasing by 2.7%, on average, and foreign returns increasing by 5.3%, on average. The mean value of the e-commerce intensity is 3.4% with a median value of 4.0%.

[6] Removing only this constraint yields a sample of 729 firms. Estimating the regressions with this sample leads to similar inferences as those presented below, except in the test of the change in overall profitability. Using the larger sample, the coefficient on e-commerce in this regression is 0.01 with a *t*-statistic of 1.73, statistically significant at the 5% level. While this provides some evidence that company profitability may be correlated with e-commerce sales techniques, we continue to present the results using the reduced sample to provide consistency across tests.

III. Results of Internationalization Hypothesis Tests

Table 3 present results of estimating equations (1) and (2) using these data. The regression of sales growth on e-commerce intensity and control variables yields a coefficient on the e-commerce variable of 0.19 that is statistically significant at the 5% level. Using the median value of the variable, 4.0, suggests that a firm with median technological use, relative to one with no online sales, sales grew by 77% more over the decade under analysis.

The control variables are also statistically significant at the 5% level. Sales inverse (*1/Sales*) has a positive correlation with sales growth, suggesting that smaller firms grew more, on average. Historical R&D and profitability also contribute positively to sales growth, consistent with expectations.

In the second set of regression estimates, the change in the foreign sales ratio is regressed on e-commerce intensity and control variables. Again, the coefficient on e-commerce is positive and statistically significant, now at the 1% level. The coefficient is 0.014, which for the median e-commerce value of 4.0% suggests that the shift to foreign sales is 5.6% more for such a firm than for a firm that did not use on line sales. Compared to the median ratio of 41% for the latter period, the implied increase represents an economically significant change.

In this regression, the sales inverse is negatively correlated with the change in the foreign sales ratio, suggesting that larger firms increased their foreign sales more than smaller firms. Sales growth is also significantly related to a shift to foreign sales. R&D and profitability are not related to the dependent measure.

As noted earlier, sales growth appears as a regressor in equation (2) and has also been shown to be correlated with other independent variables. To explore the possibility that this recursive structure affects inferences, we employ a two-stage least squares estimation technique

to the system. We exclude the return on sales from equation (2) to identify the system. Results of this approach are presented in the last column of Table 3. By modeling explicitly the endogeneity of sales growth, the coefficient on this variable is no longer statistically significant. Other coefficients in the regression, and in particular the coefficient on the e-commerce variable, are not substantially affected by this alternative empirical technique.

In summary, Table 3 provides evidence that rejects the null forms of hypotheses 1 and 2: the use of technology is positively related to increasing sales and increasing the proportion of sales that are derived from foreign customers.

To test hypothesis 3, we estimate equations (3) and (4). The results are presented in Table 4. The first regression examines the change in company pre-tax return on sales. The coefficient on the e-commerce intensity variable is not statistically significant. Sales growth and R&D are correlated with the change in returns, however. In the second regression, the change in foreign pre-tax return on sales is regressed on the same set of variables plus the change in total return on sales and on the historical foreign sales ratio. Only coefficients for these latter two variables are statistically significant at conventional levels.[7] Overall, the results from Table 4 are unable to reject the null form of hypothesis 3, and we provide no evidence that technology use affects profitability, either in total or for foreign operations.

A potential concern with the industry-based e-commerce proxy is that it may be correlated with other industry characteristics that may also influence international trade in a manner similar to our hypotheses. It is possible that our measure is simply a proxy for the average value-to-weight of the companies' products. To explore this possibility, we collect

[7] Using the two-stage least squares to estimate these two equations has a similar effect as reported with respect to equation (2): the coefficients on sales growth, and on the change in pre-tax return on sales in equation (4), are no longer statistically significant, but conclusions drawn from the other coefficients are not affected.

average value-to-weight statistic for U.S. exports by 4 digit NAICS codes. This variable has a high correlation with our e-commerce measure of 0.4. When we include the value-to-weight measure in our tests, the results reported are substantively similar and the coefficient on the value-to-weight variable being statistically significant in the regression of equations (2) only. We do not include the variable in our primary analyses for two reasons. Firstly, the measure is not available for retail or service firms, resulting in a loss of over 10% of our sample. Secondly, the variable is infrequently statistically significant and does not alter inferences on the coefficient on the e-commerce variable.

IV. The Role of Taxes

Extant Literature

Beyond the relations among e-commerce and international sales and profitability, we are also interested in the effect of foreign tax incentives on these relations. Existing taxation theory is used to structure our understanding of the potential effects of tax planning in this setting. Scholes et al. (2005) suggest that tax planning involves trade-offs between opportunities to reduce taxes and the costs of engaging in such tax planning behaviors. For example, operating a manufacturing facility in a tax haven may reduce the taxes on profits generated; however, the cost of labour and transportation may be significantly higher in this jurisdiction. In effect, the profits before taxes in such a location may be so low that the savings from tax do not offset the higher costs. Thus, just minimizing taxes will often not lead to the most profitable outcome. There is substantial evidence (see Scholes et al., 2005; and Shackelford and Shevlin, 2002) that supports this theory.

Prior research has already established that income shifting across jurisdictions is a viable tax planning technique. This includes studies at both the multinational (e.g., Klassen et al., 1993;

Jacob, 1996; and Collins et al. 1997) and subnational levels (e.g., Klassen and Shackelford, 1998; and Goolsbee and Maydew, 2000). Recent work also explores specific techniques used, such as strategic issuance of debt by subsidiaries in high-tax rate countries to reduce tax payments in those countries (Dhaliwal and Newberry, 2001). In this section we explore whether such tax planning techniques affects the relation between e-commerce and globalization found in the previous section.

It is e-commerce's ability to enable a more efficient means of selling from a remote location through the use of computer servers that gives rise to concerns by policy bodies such as the OECD, and expressed the business press, about the impact of e-commerce on income taxes. While few claim that e-commerce is being deployed by any firm primarily as a means to reduce taxes, its ability to facilitate remote sales enables it to be used to reduce the costs of income shifting as a secondary effect. For example, an article in *The Economist* (Bishop 2000,Special Section p. 5) on globalization and tax states, "The Internet has the potential to increase tax competition, not least by making it much easier for multinationals to shift their activities to low-tax regimes, such as Caribbean tax havens, that are physically a long way from their customers, but virtually are only a mouse-click away." A study by the IRS (IRS, 2000, 50) states that "The Internet has reduced the marginal costs for businesses to engage in international regulatory arbitrage." International and national taskforces such as that of the OECD (OECD, 2003) and the U.S. (Department of the Treasury, 1996) have investigated how e-commerce might be used to reduce income taxes and what if anything could be done to revise tax legislation to address this.

The opportunity for companies engaged in international trade to shift income existed prior to e-commerce. The overarching concern is that while e-commerce technologies facilitate international trade, they also permit a more strategic locating of sales and profits. Part of the policy discussion concerning the impact of e-commerce focuses on the permanent establishment

(PE) concept's applicability to e-commerce. The OECD model tax treaty prior to 2000 indicated that a PE exists in a particular country if the company (a) has a fixed place of business in that country, such as a store or place of management, with some degree of permanence, or (b) conducts a business through employees or dependent agents who have authority to conclude contracts on behalf of the company. In general, companies are only taxed in a country if they have operations sufficient to trigger a PE there.

To clarify the PE concept with respect to e-commerce, the OECD made changes to the PE commentary in its model tax treaty in 2000. In a significant change from previous treaty provisions, the OECD stated that it feels that no human interaction is necessary for the server to be a PE, but only that the server performs a core function of the business. Examples of core functions include soliciting orders, doing credit checks and processing orders (Ossi, 2001). Thus, when properly-structured, an e-commerce site can either create a PE or not create one, depending on the tax planning desire of the company. This flexibility reduces the costs of tax planning. When combined with Kemsley's (1998) finding that taxes affect the location of earnings, e-commerce technology could further increase the sensitivity of multinational companies to tax incentives.

U.S. corporate tax rates are moderate when compared to those in many U.S. trading partners.[8] Thus, it is expected that U.S companies producing goods and services in the U.S. find making sales to many foreign jurisdictions using a domestic computer server more attractive than deploying a sales force, or a server, in a high tax-rate foreign jurisdiction, all else equal.[9] This perspective suggests that U.S. companies can use e-commerce to more easily to shift income for

[8] Analyzing tax rates for 42 trading partner countries reveal that twenty countries have a tax rate of at least 35%, which is the U.S. statutory tax rate. Similarly, company data used for the our tests show 56% of firm years with an average foreign tax rate greater than the U.S. statutory rates (i.e., in a binding foreign tax credit position).
[9] This, of course, assumes the sales force is a sufficient presence to trigger tax in that foreign location.

tax purposes by lowering the cost of export sales (by using domestic servers to service foreign markets). Similarly, companies would find it preferable to retain profits in the U.S. when foreign tax rates are higher.

This gives rise to our fourth and fifth hypotheses.

> **HYPOTHESIS 4** *(in alternative form): The positive relation between the use of e-commerce sales techniques and the change in companies' ratio of foreign sales to total sales will be mitigated by increasing foreign tax rates.*

> **HYPOTHESIS 5** *(in alternative form): The positive relation between the use of e-commerce sales techniques and the change in companies' foreign pre-tax return on sales will be mitigated by increasing foreign tax rates.*

The preceding discussion suggests that companies use the increased flexibility technology affords to either strategically locate operations or profits in lower tax-rate foreign countries or to shift income among foreign jurisdictions. If this is the case, not only will technology enable these firms to have higher foreign sales when the foreign tax rate is lower, but their overall foreign tax rate should also be lower than companies that do not have the flexibility.

An important feature of U.S. multinational taxation is the deferral of U.S. taxation of foreign earnings and the foreign tax credit granted when those earnings are eventually taxed in the U.S. upon repatriation. Because the U.S. tax system gives credit only up to the amount of U.S. taxes, if foreign tax rates exceed the U.S. rate, the credit will not fully offset foreign taxes paid. For these companies, reducing foreign tax payments represents a permanent reduction in worldwide taxes. For firms with foreign tax rates below the U.S. rate, the foreign tax credit offsets all foreign taxes paid and the company will pay the incremental U.S. taxes. For these

companies, reducing foreign tax rates represents an increase in the amount of taxes deferred until repatriation, the present value of which can still be dramatic.

With the data used to estimate the other regressions, it is possible to specify another test with change in foreign tax rate as the dependent measure as described in the last hypothesis.

> **HYPOTHESIS 6** *(in alternative form): The use of e-commerce sales techniques will be negatively associated with the change in companies' foreign tax rate and more so for companies facing binding foreign tax credit positions.*

Research Design

To test hypotheses 4 and 5, we re-estimate equations (2) and (4), respectively, and include a common measure of the foreign tax rate, computed as foreign tax expense divided by foreign pre-tax income. While this measure aggregates foreign operations and thereby obscures potential tax planning opportunities that may arise when some operations are in a tax haven, extant research has found this to be a reliable proxy for the foreign tax incentives faced by multinational firms. Unlike extant research and consistent with the prior tests, we compute the average value of this tax rate across the five year periods. Using an average value is particularly useful in this context because annual fluctuations in tax rates can be quite significant but the efforts to locate income respond only to longer-term incentives.[10] In addition to including the foreign tax rate variable, we also include its interaction with the e-commerce intensity variable to determine the effect that tax rate has on the effect of technology.

To test the sixth hypothesis, we estimate the following regression

[10] In addition, companies are permitted to carry over excess foreign tax credits. Thus, even absent timing repatriation to avoid excess foreign tax rates in a particular year, company's status as either binding or excess foreign tax credit position does not tend to vary from year to year.

$$\Delta FTB = \varphi_0 + \varphi_1 Ecomm + \varphi_2 BindFTC_1 + \varphi_3 BindFTC_1 \bullet Ecomm + \varphi_4 1/Sales_1$$
$$+ \varphi_5 Growth + \varphi_6 R\&D_1 + \varphi_7 \Delta TB + \varphi_8 FSales\ Ratio_1 + \varepsilon \quad (5)$$

where the variables are defined as in the previous regressions or as follows.

ΔFTB	is change in the foreign tax rate; foreign tax rate is computed as the foreign tax expense divided by foreign pre-tax income.
BindFTC	is an indicator variable to denote firms in a binding foreign tax credit position, and equals 1 if the firm's foreign tax rate is greater than 36% and 0 if the firm's foreign tax rate is less than 34%.
ΔTB	is change in total tax rate for the firm, computed as tax expense divided by pre-tax income.

In the definition of *BindFTC*, firms whose foreign tax rate exceeds the U.S. statutory rate by more than 1% are considered to be in a binding position. That is, their foreign tax payments cannot be fully offset by U.S. foreign tax credits upon repatriation. Firms with a foreign tax rate of less than 34% are considered to be in a non-binding, or excess, foreign tax credit position. While these firms benefit currently from reducing foreign taxes, the reduction of foreign tax payments is offset by higher taxes upon repatriation, should such repatriation occur.[11] The overall change in tax rate for the firm, ΔTB is included in the regression to focus attention on the reduction of foreign taxes relative to overall tax reductions.

Summary statistics for the new variables are found in Table 5. The average foreign tax rate is 35%, which exceeds slightly the equivalent statistic for overall tax rate. Both the foreign and overall tax rates are declining, on average, during the time period under study, suggesting the importance of controlling for overall firm changes to isolate the effects of e-commerce on foreign tax rates.

[11] Firms would rationally undertake actions to reduce current tax payments even when in an excess foreign tax credit position because they benefit from the deferral of U.S. taxes on repatriation, which may be deferred for an extended period of time, and changes in U.S. law, such as the recent significant reduction in repatriation taxes, might further lower future U.S. taxes on repatriation.

V. Results of Regressions with Tax Variables

The results of estimating equations (2) and (4) with foreign tax rates included are found in Table 6. In the regression of the change in foreign sales ratio, the effect of the tax rate is consistent with hypothesis 4. The interaction of the e-commerce intensity variable and the foreign tax rate variable has a negative coefficient that is statistically significant at the 5% level. The main effect of e-commerce intensity continues to be positive and statistically significant at the 1% level. The coefficients imply an economically significant effect as well. For a firm whose foreign tax rate is one standard deviation above the mean in the early 1990s, 51.4%, the implied relation between e-commerce intensity and the change in foreign sales ratio is 0.010. Thus, a median level of e-commerce activity would lead to an increase in foreign sales ratio of only 4%. However, for a firm with a historical foreign tax rate of one standard deviation below the mean, 17.8%, the implied coefficient on e-commerce intensity is 0.018. Thus, a median level of e-commerce activity would lead to an increase in the foreign sales ratio of over 7%. The main effect of the foreign tax rate is not statistically significant at conventional levels.

The second regression in Table 6 estimates equation (4) with the tax variables included. Like the previous estimates, only two of the control variables are statistically significant. The interaction of e-commerce and foreign tax rates has a negative coefficient, but it is only marginally significant and we are reluctant to draw strong inferences from this result.

Table 7 provides the regression of the change in foreign tax rate on e-commerce intensity and the indicator variable for firms with binding foreign tax credit positions. Results of this estimation demonstrate that e-commerce activity is associated with a reduction in foreign tax rates, significant at the 5% level. Further, the reduction is possibly greater for firms with binding foreign tax credit positions. The interaction of the two variables has a negative coefficient that is statistically significant at the 10% level. The coefficient for the non-binding firms is 0.022. For

a firms with a median level of e-commerce activity, the reduction in foreign tax rate during this time period is almost 9% on average, after controlling for the change in overall tax rate. If the coefficient on the interaction is reliable, it would imply that the relation between e-commerce intensity and the change in foreign tax rates is -0.037, suggesting a decline of almost 15% for the median e-commerce user. These are very large changes in foreign tax rates.

VI. Conclusions

E-commerce, and technology in general, have created significant changes in the operating environments of U.S. multinationals. While there have been studies of the macroeconomic effects on trade, we are unaware of any studies on the cross-sectional differences in globalization that has resulted from such technology adoption. Furthermore, we are unaware of any study that uses firm-level data in this context. Our research provides evidence consistent with e-commerce sales practices being related to increasing total sales and also to increasing emphasis in foreign markets. We are not able to show that pre-tax profits have been affected by using these technologies.

Beyond the use of technology to improve or alter sales activities, we explore the role of foreign tax rates in the incentives to strategically locate sales and profits in the U.S. versus in foreign countries. When we introduce the tax dimension into our analysis, we find that high foreign tax rates mitigates the effects of e-commerce on the shift of sales to foreign countries. Examining the average foreign tax rate directly, we find that e-commerce use is correlated with reductions in the foreign tax rate, and the correlation is stronger for firms with binding foreign tax credit positions.

In sum, these results suggest that technology is being used by U.S. multinationals to improve their competitiveness in foreign countries. In addition, certain multinational

corporations have improved their overall performance by being able to respond to tax incentives to a greater degree than multinationals that do not have the opportunity to employ e-commerce sales techniques.

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Table 1
Industry classification of sample firms

Industry	Number	Percent	Mean E-comm Intensity
Food, candy, alcohol, and tobacco	18	3.7	3.7
Recreational products	12	2.5	2.7
Entertainment, and publishing	6	1.2	0.7
Consumer goods	19	3.9	4.0
Apparel, and textiles	15	3.1	3.9
Healthcare, and medical equipment	26	5.3	3.2
Pharmaceutical products	28	5.7	3.7
Chemicals	28	5.7	3.9
Rubber and plastic products	4	0.8	2.9
Construction, and construction materials	24	4.9	2.1
Steel works	12	2.5	3.6
Fabricated products, and shipping containers	7	1.4	2.6
Machinery	54	11.0	3.7
Electrical equipment	17	3.5	5.0
Automobiles and trucks	13	2.7	8.4
Aircraft, shipbuilding and defense	9	1.8	9.9
Metal mining, coal, and petroleum	7	1.4	5.1
Business services	42	8.6	0.6
Computers	24	4.9	2.9
Electronic equipment	48	9.8	4.1
Measuring and control devices	29	5.9	4.2
Business supplies	19	3.9	3.6
Wholesale, transportation, and trading	11	2.3	0.4
Retail	10	2.0	0.0
Restaurants and hotels, real estate, and misc.	7	1.4	1.2
Total	489	100.0	3.4

Notes:
This table displays distributional characteristics of the sample across industries. The sample is firms with sufficient data to estimate the regression model. Firms are classified by their primary SIC code and categorized into the 48 "logical" industry groups defined by Fama and French (1997). Where insufficient firms were found in a single industry (i.e., less than 1% of the sample), industries were combined. Mean e-comm intensity is the mean value of e-commerce intensity across firms in the industry. E-commerce intensity is the percentage of total sales made through E-commerce for the NAICS industry in which the company is a member, as reported by the Department of Commerce.

Table 2
Company summary statistics

Variable	N	Mean	Std Dev	5th %	Median	95th %
Total $sales_3$	489	5,142	13,461	74	1163	24,637
Total foreign $sales_3$	489	2,607	11,167	18	465	10,118
Foreign sales $ratio_3$	489	0.414	0.203	0.088	0.407	0.754
Pre-tax return on $sales_3$	489	0.095	0.074	0.012	0.079	0.250
Foreign pre-tax return on $sales_3$	489	0.087	0.096	0.000	0.066	0.223
Δ (Foreign sales ratio)	489	0.113	0.160	-0.111	0.094	0.396
E-comm $intensity_3$	489	3.411	2.252	0.082	3.986	5.388
1 / Total $sales_1$	489	0.008	0.018	0.000	0.002	0.040
Sales growth	489	2.312	4.166	-0.285	1.136	8.109
R&D / $Sales_1$	489	0.043	0.056	0.000	0.021	0.152
Δ (Pre-tax return on sales)	489	0.027	0.151	-0.155	0.031	0.275
Δ (Foreign pre-tax return on sales)	487	0.053	0.263	-0.145	0.016	0.471

Notes:
This table displays summary statistics for the sample of multinational companies: those with total foreign sales of at least $1 million and positive pre-tax income (both total and foreign) in 2000 through 2004, inclusive.
Variables are defined as follows. *Total sales* is consolidated reported numbers. *Total foreign sales* is the sum of reported exports and reported foreign subsidiary sales, as disclosed in the segments disclosures. *Foreign sales ratio* is *total foreign sales* divided by *total sales*. *Pre-tax return on sales* is pre-tax income deflated by total sales. *Foreign pre-tax return on sales* is foreign pre-tax income deflated by total foreign sales. *E-comm intensity* is the percentage of total sales made through E-commerce for the NAICS industry in which the company is a member, as reported by the Department of Commerce. *Sales growth* is change in *total sales* from period 1 to period 3 deflated by period 1 *total sales*. *R&D / sales* is research and development expense deflated by *total sales*. Values are determined using the average across the period and subscripts denote the period, where appropriate. Period 1 is 1990 to 1994, inclusive; period 2 is 1995 to 1999, inclusive; and period 3 is 2000 to 2004, inclusive. $\Delta(\bullet)$ denotes value is computed as the change from period 1 to period 3.

Table 3
Regression of the sales growth and change in the foreign sales ratio on e-commerce

Variable	Predicted Sign	Sales Growth	Δ Foreign Sales Ratio (OLS)	Δ Foreign SalesRatio (IV)
E-comm intensity	+	0.194 (2.13)**	0.014 (2.74)***	0.014 (2.36)***
1 / Total sales$_1$	?	42.894 (2.02)**	-1.224 (-2.51)**	-1.304 (-1.99)**
Sales growth	+		0.004 (2.47)***	0.006 (0.49)
R&D / sales$_1$	+	20.509 (3.93)***	-0.069 (-0.30)	-0.107 (-0.32)
Pretax return on sales$_1$	+	7.835 (1.77)**	0.015 (0.14)	
Industry controls		Yes***	Yes***	Yes***
R^2		15%	13%	13%

Notes:
Regressions are estimated using 489 firms. The dependent variables are *Sales growth* and Δ *(Foreign sales ratio)*. Variables, defined in Table 2, are estimated over the period 1990 to 2004 with period 1 (denoted by subscript) consisting of 1990–1994 and changes variables computed as the difference between the period 2000–2004 and period 1. The industry indicator variables are defined as presented in Table 1. In parentheses, regression *t*-statistics are displayed; they are computed using Huber-White robust standard errors. Ordinary least squares (OLS) and instrumental variables (IV) are used to estimate the second equation to account for the possibility that *sales growth* is endogenously determined.

*** Significant at the 1% level; one-sided test except 1/*Total sales*, which is a two-sided test.
** Significant at the 5% level; one-sided test except 1/*Total sales*, which is a two-sided test

Table 4
Regression of the change in the total and foreign pre-tax return on sales on e-commerce

Variable	Predicted Sign	Δ (Total Pre-tax Return on Sales)	Δ (Foreign Pre-tax Return on Sales)
Δ (Pre-tax return on sales)	+		1.298 (14.86)***
E-comm intensity	+	0.002 (0.70)	0.004 (0.61)
1 / Total sales$_1$	?	0.557 (1.25)	-0.221 (-0.49)
Sales growth	+	0.003 (2.53)***	0.000 (0.03)
R&D / sales$_1$	+	0.574 (3.81)***	0.058 (0.30)
Foreign sales ratio$_1$	?		-0.101 (-2.37)***
Industry controls		Yes***	Yes***
R^2		13%	58%

Notes:
Regressions are estimated using 489 firms. The dependent variable is Δ (Pre-tax return on sales). Variables, defined in Table 2, are estimated over the period 1990 to 2004. The industry indicator variables are defined as presented in Table 1. In parentheses, regression *t*-statistics are displayed; they are computed using Huber-White robust standard errors.

*** Significant at the 1% level; one-sided test for directionally-predicted coefficients; two-sided test otherwise
** Significant at the 5% level; one-sided test for directionally-predicted coefficients; two-sided test otherwise
* Significant at the 10% level; one-sided test for directionally-predicted coefficients; two-sided test otherwise

Table 5
Company summary statistics—tax variables

Variable	N	Mean	Std Dev	5th %	Median	95th %
Overall tax rate$_1$	489	0.337	0.259	0.000	0.324	0.977
Foreign tax rate$_1$	489	0.346	0.168	0.000	0.363	0.537
Binding foreign tax position$_1$	465	0.561	0.497	0.000	1.000	1.000
Δ (Overall tax rate)	489	-0.009	0.223	-0.318	-0.027	0.390
Δ (Foreign tax rate)	481	-0.017	0.288	-0.544	-0.015	0.477

Notes:
This table displays summary statistics for the sample of multinational companies: those with total foreign sales of at least $1 million and positive pre-tax income (both total and foreign) in 2000 through 2004, inclusive.
Variables are defined as follows. *Overall tax rate* is total tax expense divided by pre-tax income. *Foreign tax rate* is foreign tax expense divided by foreign pre-tax income. *Binding foreign tax position* has a value of one if the *foreign tax rate* is less than 34%, 0 if the *foreign tax rate* is greater than 36% and missing otherwise. Values are determined using the average across the period and subscripts denote the period, where appropriate. Period 1 is 1990 to 1994, inclusive; period 2 is 1995 to 1999, inclusive; and period 3 is 2000 to 2004, inclusive. $\Delta(\bullet)$ denotes value is computed as the change from period 1 to period 3.

Table 6
Regression of the change in the foreign pre-tax return on sales on e-commerce and foreign tax rates

Variable	Predicted Sign	Δ (Foreign Sales Ratio)	Δ (Foreign Pre-tax Return on Sales)
Δ (Pre-tax return on sales)	+		1.311 (14.77)***
E-comm intensity	+	0.023 (3.13)***	0.011 (1.16)
Foreign tax rate$_1$	–	0.069 (1.30)	-0.009 (-0.17)
E-comm intensity • foreign tax rate$_1$	–	-0.024 (-1.81)**	-0.018 (-1.28)*
1 / Total sales$_1$	?	-1.324 (-2.77)***	-0.368 (-0.81)
Sales growth	+	0.005 (2.69)***	0.000 (-0.16)
R&D / sales$_1$	+	-0.066 (-0.29)	0.074 (0.36)
Foreign sales ratio$_1$	?		-0.098 (-2.28)**
Industry controls		Yes***	Yes***
R^2		4%	55%

Notes:
Regressions are estimated using 489 firms. The dependent variables are Δ *(Foreign sales ratio)* and Δ *(Pre-tax return on sales)*. Variables, defined in Table 2, are estimated over the period 1990 to 2004. The industry indicator variables are defined as presented in Table 1. In parentheses, regression *t*-statistics are displayed; they are computed using Huber-White robust standard errors.

*** Significant at the 1% level; one-sided test for directionally-predicted coefficients; two-sided test otherwise
** Significant at the 5% level; one-sided test for directionally-predicted coefficients; two-sided test otherwise
* Significant at the 10% level; one-sided test for directionally-predicted coefficients; two-sided test otherwise

Table 7
Regression of the change in the foreign tax rate on sales on e-commerce and binding foreign tax position

Variable	Predicted Sign	
Δ (Overall tax rate)	+	0.238 (4.34)***
E-comm intensity	–	-0.022 (-2.23)**
Binding foreign tax position$_1$	+	0.359 (7.84)***
E-comm intensity • binding foreign tax position$_1$	–	-0.015 (-1.50)*
1 / Total sales$_1$	–	1.023 (1.31)
Sales growth	+	-0.000 (-0.04)
R&D / sales$_1$	+	-0.359 (-1.11)
Foreign sales ratio$_1$	?	-0.122 (-1.76)*
Industry controls		Yes***
R^2		36%

Notes:

Regressions are estimated using 457 firms. The dependent variable is Δ (Foreign tax rate). Variables, defined in Table 2, are estimated over the period 1990 to 2004. The industry indicator variables are defined as presented in Table 1. In parentheses, regression *t*-statistics are displayed; they are computed using Huber-White robust standard errors.

*** Significant at the 1% level; one-sided test for directionally-predicted coefficients; two-sided test otherwise

** Significant at the 5% level; one-sided test for directionally-predicted coefficients; two-sided test otherwise

* Significant at the 10% level; one-sided test for directionally-predicted coefficients; two-sided test otherwise