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The Macroeconomic Impacts of E-Business on the Economy

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ABSTRACT

The growing use of information and communications technology (ICT) by business—e-business—profoundly affects the economy. This article covers some of the macroeconomic impacts of e-business. Evidence from empirical studies examining the impact that greater use of ICT by business has on productivity and national economic growth is presented, along with discussion of how e-business changes the volatility and complicates measurement of growth. E-business can bring down inflation, but also exacerbates some monetary and fiscal policy challenges, and raises new ones. While e-payments and e-money can complicate monetary policy and may alter its goals, little effect has been seen to date. Sales tax leakage due to e-commerce can affect the fiscal policy of states, although again the magnitude of lost revenue is not great. Suggested directions for future research close out the article.

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THE MACROECONOMIC IMPACTS OF E-BUSINESS ON THE ECONOMY

INTRODUCTION

The growing use of information and communications technology (ICT) by business—e-business—has a profound impact on the economy.¹ E-business lowers costs and increases the choices available to consumers and firms. These microeconomic changes work their way through the economy and ultimately influence macroeconomic conditions. Overall, e-business benefits the economy in many ways. Nevertheless, not all the effects of e-business on macroeconomic conditions are positive, and some aspects of e-commerce may limit the effectiveness of monetary policy.

E-business changes the macroeconomy in several beneficial ways. Some gains are static in nature, arising from the more efficient use of existing resources. For example, increases in productivity increase a nation's GDP. In addition, by lowering search and transaction costs, e-business unleashes deflationary pressures (Willis, 2004). Other gains are dynamic, altering the path national growth takes. By lowering

¹ In this article we use the term “e-business” in its most general sense: any use of ICT by a firm to conduct its business. E-business as we use the term includes e-commerce, which is buying and selling over the Internet, but also any use of ICT to service customers, receive their payments in non-cash form, procure inputs, or enhance the productivity of labor. Often e-business is defined more narrowly to mean the conduct of business over the Internet. One of the problems with such narrower definitions is that they unwarrantedly restrict the meaning of “electronic” (the “e” in e-business) to refer to the Internet. A narrower definition also excludes most B2B e-commerce, the majority of which is still performed via non-Internet based EDI systems. It is perhaps also worth noting that the term “electronic mail” (if not “e-mail”) predates the Internet.

the cost of transferring and employing knowledge, ICT enables greater R&D and innovation, which is crucial to long-run economic growth.

E-business exacerbates some macroeconomic policy challenges, and raises new ones. E-commerce crosses state borders seamlessly, resulting in lost sales tax revenue for state and local governments (Goolsbee, 2001). Consequently, e-business has potentially severe implications for fiscal policy and government financing, and policymakers continue to seek methods to tax e-business (Redpath, Redpath, & Ryan, 2007). The rise of electronic payments (e-payments) and the advent of e-money, an electronic medium of exchange separate from legal tender issued by a central bank, also complicate monetary policy and may alter its goals.

This article covers some of the impacts e-business has on the economy, emphasizing macroeconomic effects. Evidence from various empirical studies examining the impact greater use of ICT by business has on U.S. GDP is presented, followed by a review of the ways e-business affects monetary and fiscal policy. Suggested directions for future research and a discussion of issues that e-business presents policymakers close out the article.

BACKGROUND

At the microeconomic level, e-business increases the productivity of firms and enhances the economic welfare of consumers.² Use of ICT by business increases pro-

² We discuss the microeconomic aspects extensively in the companion article on the microeconomic impacts of e-business in this volume.

ductivity and profits by lowering search and transaction costs, enabling greater specialization, and broadening the market for trading goods (Wen, 2004). Through business-to-business (B2B) transactions, firms can connect their inventory systems with each other to quickly order additional product without using much labor in the process (Lucking-Reiley & Spulber, 2001). Business-to-consumer (B2C) e-business expands the marketplace, producing greater competition, lower prices, and broader consumer choice (Willis, 2004; Banham, 2005). Collectively, these reductions in cost and increases in productivity and consumer choice significantly benefit the economy.

The next section explains how e-business affects GDP, national growth, and monetary and fiscal policy. A country's GDP, a measure of total economic output, is a function of its physical and human capital, other resources, and the production processes used to turn inputs into output. The use of ICT by business increases GDP and economic growth by affecting all of these elements. To begin with, the information industry is itself a category in the GDP accounts, making up nearly four percent of US national income in 2008. More important is the way ICT makes other industries more productive. By 2001 already, over two-fifths of UK companies from all sectors reported that e-business was having a "real impact on all aspects of the organization", and nearly all companies expected some impact in the next few years (Wadhvani, 2001). Investment in ICT increases the amount of physical capital, resulting in increased domestic output across the economy. E-business also makes labor and the

production process itself more efficient, which will result in long run economic growth.

Monetary policy refers to how a central bank uses the money supply to influence interest rates, with the purpose of promoting sustainable economic growth. A key goal of monetary policy in most nations is price stability. E-business can produce significant cost reductions that lead to deflationary pressures. E-payments and e-money also affect monetary policy by creating “inside money”, which is money produced by the private sector instead of by the central bank. While mainstream monetary economics takes the passive view of inside money (i.e., that it has no role in the transmission of monetary policy; Stracca, 2007), some commentators argue that inside money should change the *goal* of policy.³

Fiscal policy refers to actions of the government involving spending or taxation undertaken with the goal of economic growth or stability. E-commerce creates new avenues for avoidance of states sales taxes, and thus may limit a state government’s power to raise revenue and fund its spending.

THE MACROECONOMIC IMPACTS OF E-BUSINESS

Impact on National Growth

The theoretical implications of e-business on the macroeconomy are far reaching, because ICT increases productivity, enhances competition, and broadens consumer choice. However, quantifying how e-business affects the economy is difficult,

³ Green (2001) describes but does not espouse the latter view.

because the impacts are largely intangible (Lee, Gholami, & Tong, 2005). For example, ICT is not merely an addition to the physical capital stock of a firm, but can transform the nature of the entire production, sales, and distribution process. Early attempts at measurement led to the “productivity paradox”: ICT could be found everywhere but in the productivity statistics.⁴

However, many recent empirical efforts overcome the problem of intangibility and find that ICT adoption has a sizeable affect on national wealth and productivity. As one review states, “the academic evidence in the US is growingly supportive of the notion that ICT investment has played an important role in increasing labor productivity growth in a variety of sectors...” (Wadhvani, 2001, p.18). Some of these studies are examined here. In addition to changing the level of the growth rate, the ICT revolution may also have changed the variation in growth over time as well. Ultimately, discussions of national growth and its volatility rest on the statistics used for growth accounting, and the section concludes by reviewing some ways that e-business has made accurate measurement more difficult.

Productivity and the level of GDP

In the short term, investment in ICT increases economic growth by adding to the capital stock of a nation, which makes labor more productive. Investment in ICT capital accounted for 0.7 percentage points of growth in G7 countries during 1995-

⁴ This statement of the productivity paradox is from an oft-quoted *bon mot* of Robert Solow (“We’d better watch out,” *New York Times Book Review*, July 12, 1987, 36).

2003 (Jorgenson & Vu, 2005), which was about half of the contribution of capital to growth and about one quarter of total growth.⁵ In the US, investment in ICT capital accounted for 0.8 percentage points of growth during 1995-2004, almost two-thirds of the growth attributed to capital deepening (Jorgenson, Ho, & Stiroh, 2006). Jorgenson, Ho, and Stiroh (2006) state that “a consensus has emerged” that much of the US growth acceleration during 1995-2000 is due to sectors that produce or intensively use ICT.

In the longer term, use of ICT by business also spurs growth in total factor productivity (TFP)(Brynjolfsson & Hitt, 2002). TFP refers to the part of output not directly explained by measurable input usage.⁶ ICT enhances productivity by improving the efficiency of capital and labor and enabling greater technological innovation in the production process (UNCTAD, 2008).⁷ Furthermore, e-business promotes greater economies of specialization within firms (or nations, in the case of international trade) by lowering transactions costs with other firms or nations (Wen, 2004). Inputs and services formerly produced within the firm or nation can be more easily provided from without via e-business. Economies of specialization in production can then lead to higher productivity.

⁵ For the 15 non-G7 industrialized economies Jorgenson and Vu (2005) also studied, investment in ICT also played a significant (but lesser) role.

⁶ Growth in TFP “reflects the labor productivity growth not attributable to capital deepening or labor quality gains. This is often associated with improvements in technology, but also includes changes in utilization rates, reallocations of resources among sectors, increasing returns to scale, and measurement error.” (Jorgensen, Ho, & Stiroh, 2006)

⁷ E-business and ICT use also greatly improves the process of R&D, innovation, and diffusion (see ch. 4 of UNCTAD (2007)).

Lee, Gholami, and Tong (2005) measure the effect of ICT investments on TFP. They find that investments in ICT contribute to the productivity of developed and newly industrialized nations, but not to that of developing nations. Oliner and Sichel (2000) find the increased use of ICT accounts for two-thirds of the one percentage point increase in productivity growth in the latter half of the 1990s in the United States. In a later study, they conclude that 80 percent of TFP growth in the US during the productivity acceleration of 1996-2001 was due to the IT-producing sector (Oliner & Sichel, 2002). These estimates are higher than those of Jorgenson, Ho, and Stiroh (2006), who find that ICT contributed 0.4 points to output growth through TFP, or about two-fifths of all TFP growth. Belorgey, Lecat, and Maury (2006) find that ICT adoption improves the growth rates of labor productivity and partially explains the higher productivity growth in the US in the 1990s, compared to Europe. Similarly, the OECD (2004) found that ICT was responsible for all of the growth in labor productivity over 1996-2002 in OECD countries.

Empirical efforts to measure changes in GDP caused directly by specific forms of e-business are scarce. Brookes and Wahhaj (2001) estimate that B2B e-commerce increases economic growth by 0.25 percentage points per year in industrialized countries. Greenstein and McDevitt (2008), following careful national income accounting methodology, find that broadband diffusion generally (not just as part of e-business) has added a relatively modest \$8-11 billion to GDP (and another \$5-7 billion to ag-

gregate consumer surplus, which is not measured in GDP). Their finding contrasts with other estimates that are an order of magnitude higher (Crandall & Jackson, 2003).

Volatility and changes in GDP

The volatility of GDP growth in the US fell markedly in the late 1980's and 1990's. While many explanations have been proposed (Trehan, 2005), McConnell and Perez-Quiros (2000) document that the decline in growth volatility came in large part from the decline in the volatility of durable goods production and in the share of durable goods held in inventories. The latter, they suggest, may derive from adoption of just-in-time inventory management techniques, which are enabled by B2B e-commerce (McConnell & Perez-Quiros, 2000; Kahn, McConnell, & Perez-Quiros, 2002). While discussion of declining volatility in GDP growth may appear quaint in the midst of the precipitous fall in growth worldwide in the current recession, it is probably nonetheless true that e-business helped smooth the business cycle. E-business techniques and ICT alone, however, obviously cannot prevent a downturn stemming from deep and wide-ranging structural problems with the economy.

Measurement of growth accounting data

Assessments of causes of national growth can only be as good as the underlying data. Some commentators assert that e-business and the "new economy" increase the difficulty of assessing productivity growth and the non-accelerating inflation rate of unemployment (NAIRU) (Wadhvani, 2001). Briefly covered here is the argument

that e-business has complicated the measurement of inflation and therefore real GDP, making it harder to quantify growth in the economy.

Key to the measurement of inflation (whether for the CPI or the GDP deflator) is the change in price of a like basket of goods. When the quality of goods in the basket increases, adjustments are required to avoid overstating true inflation (i.e., the increase in price of gaining the same amount of utility from consuming the goods). ICT, namely computers and software, are prime examples of goods whose quality rises dramatically over time. Central also to ICT and e-business is the creation of new goods and services, which also raises difficulties for the “pure price” approach to measuring inflation. Hausman (2003) asserts that quality bias and new good bias stemming from ICT lead to persistent overestimates of inflation in the US, notwithstanding official attempts to correct for the increasing quality of computers.⁸ The problem may be even worse in Europe (Wadhvani, 2001).

When overstated inflation rates are used, converting nominal to real GDP unavoidably results in lower growth rates and underestimates of productivity.

Wadhvani (2001) cites research calculating that if the UK GDP figures had been computed with quality-adjusted price series for computers and software, then GDP growth would have been pegged at 0.4 percentage points higher than official estimates were over 1994-1998. When the entire capital stock is adjusted for quality dif-

⁸ More specifically, Hausman (2003) argues that hedonic price adjustments for certain products such as computers in the calculation of the CPI do not fully correct for the overstatement of inflation caused by the increasing quality of these goods.

ferences, Sakellaris and Vijselaar (2005) find that GDP in Europe was 0.7 percentage points higher than officially reported over 1994-2000. Cummins and Violante (2002) find that adjusting US figures for the improving quality of goods in which businesses invest (largely driven by ICT) increases real GDP by 0.6 percentage points during the 1990's.

Impact on Monetary Policy

Inflation

Monetary policy in many countries aims to control inflation. E-business' potential for dramatic cost savings and greater competition can have considerable influence on the aggregate price level. The lower costs and prices associated with the growth of e-business have lowered inflation, at least in the short-term. In addition, e-business allows firms to adjust prices more quickly to respond to economic shocks. Reductions in such "menu costs" can produce ongoing reductions in the welfare harms from inflation. E-payments may also have disciplined central banks in recent years, keeping inflation low.

ICT lowers the cost of transferring, storing, and processing information. Accordingly, firms have embraced B2B e-commerce to lower procurement costs (Lucking-Reiley & Spulber, 2001). Cost reductions can be significant. Varian, *et al.* (2002) report cost savings over 1998-2001 of \$164 billion to US firms from adoption of e-business, and Brookes and Wahhaj (2001) estimate that B2B e-commerce reduces input costs by 4-5 percent across all industry categories. Lower costs for firms result in

lower prices for final goods and services. E-commerce also widens markets by removing geographical boundaries, bringing greater numbers of firms into competition with each other and lowering prices. The broadening of markets and the lowering of search costs for consumers forces both online and “brick and mortar” stores to lower prices (Willis, 2004; Banham, 2005).⁹

There is consensus among empirical studies that the growth in e-business lowers price levels. Brookes and Wahhaj (2000) find that B2B transactions reduce the overall price level by 3.4 percent, although they revise the estimated long-term impact to 0.5 percent in a later study (Brookes & Wahhaj, 2001).¹⁰ Similarly, Basu and Siems (2004) attribute a portion of the decline in the price of core commodities and services in last twenty years to the adoption of e-business technologies.¹¹ Even if the effects of e-business on the overall price level are permanent, the main impact on the rate of inflation may last only while the cost reductions work their way through the economy. In the long term, however, inflation may not be much affected by e-business unless costs continue to fall at similar rates. Also, firms and consumers will adjust their behavior to account for the presence of e-business (when it becomes just

⁹ However, there is potential for online firms to limit competition, exercise market power, and price discriminate by raising switching costs for consumers (Bakos, 2001). See our companion article on the microeconomic impacts of e-business.

¹⁰ Interestingly, Brookes and Wahhaj (2001) find that B2B e-commerce is mildly inflationary over the first two years after adoption, because the expectation of greater future productivity gains inflates asset values in the present. The holders of the affected equities experience wealth effects boost their demand for goods, which creates inflationary pressure.

¹¹ See our companion article for evidence that e-commerce lowers prices in specific industries.

“business”), at which point one would not expect further cost-savings from competition (Willis, 2004).

Lower costs are only one way e-business may lower the aggregate price level. Since e-firms have lower menu costs (the costs of changing prices) than offline stores, their prices should be less rigid and they should adjust prices more often. Thus B2C and B2B e-commerce lessens price rigidity, causing unexpected, temporary cost shocks to not have as great or as long lasting an effect on price levels (Willis 2004). Brynjolfsson and Smith (2000) confirm that online bookstores have more flexible pricing than offline establishments. Other, more recent economic studies find that considerable price rigidity still exists among e-firms, however (Kaufmann & Lee, 2004; Chakrabarti & Scholnick, 2007). Unlike one-time cost savings from adopting e-business, decreased menu costs can continue to alter the way adverse cost shocks are promulgated to prices on an ongoing basis, setting up persistent deflationary pressures.

The final way e-business affects inflation is by providing cash substitutes such as e-payments. Marimon, Nicolini, and Teles (2003) suggest that one reason world-wide inflation was low in the 1990s was that the widespread use of interest-bearing cash substitutes required central banks to exercise more monetary discipline. In their theoretical model, competition between the central bank and the suppliers of inside money reduces the temptation to depreciate the currency. When consumers can switch to the alternative money (inside money such as e-payments, e-money, etc.),

the government knows it will lose future seigniorage revenue¹² and the incentive to inflate is lessened.

E-payments and e-money

In the US, about two-thirds of non-cash settlements make use of e-payment instruments such as credit and debit cards (CPSS, 2008). One estimate holds that moving from paper checks to e-payments for non-cash transactions can save an economy 0.6 percent of GDP (Humphrey, Kim, & Vale, 2001). E-money products, which store value purchased by a consumer on an electronic device and reduce the funds when purchases are made, are also intended to serve as a general means of payment.¹³ However, e-money has not yet diffused widely in the US (perhaps because of issues of security and trust), and still constitutes a negligible fraction of the settlement media market (CPSS, 2008).¹⁴

Despite slow adoption in the US of e-money specifically, e-payments in general raise issues for monetary policy. Two key questions prompted by the rise of e-payments are whether traditional policy instruments will continue to work as in the past and whether the growing prevalence of inside money should change the goals of

¹² Seigniorage is the revenue to the issuer of outside currency (the central bank or the government) from expanding the money supply.

¹³ Newer forms of e-money require removing the requirement in older definitions that the value be stored on an electronic device in the consumer's possession. Some new e-money systems are server-based, where funds are not stored on a local device but are kept at the issuer's central server. Users access funds based on their e-mail address, mobile phone number, or an access number (Hartmann, 2006).

¹⁴ Compare this with Singapore, where 84 percent of non-cash transactions make use of e-money (CPSS, 2008).

monetary policy. In addition to issuing currency, central banks undertake open market operations and set banks' reserve requirements and the discount rate to accomplish their objectives. The effectiveness of these instruments depends on the public's demand for bank reserves and on the central bank's capacity to supply these reserves. If e-payments and e-money alter the demand for reservable deposits (perhaps because e-money offers greater liquidity or convenience), a central bank would need to adjust its operating techniques (BIS, 1996). While use of e-money directly reduces demand for cash and reservable deposits, e-payments have a smaller, more indirect effect on demand for money. On the side of businesses, e-payments reduce the need for working capital caused by the delay in processing checks, so that more economic activity can be associated with the same money supply (Humphrey, Kim, & Vale, 2001). On the side of consumers, replacing numerous point of sale cash transactions with a single monthly payment from a checking account to a credit card issuer is a more efficient cash management strategy and reduces the precautionary demand for cash. Credit card ownership has indeed been associated with lower demand for checking and money balances (Duca & Whitesell, 1995).

On the supply side, if enough demand for money leaks away from cash toward e-payments, then central bank balance sheets (on which cash is a major component) may be too small to undertake desired daily open market operations.¹⁵ While some

¹⁵ The federal funds rate is the interest rate banks charge each other for overnight loans of balances held at the Federal Reserve Banks. In the US, the Federal Reserve (Fed) seeks to accomplish its mone-

commentators argue that e-money is liable to weaken or destroy the leverage central banks have over the money supply (Solomon, 1997; Quaden, 2001), the consensus among central banks is that inside money—at least at its scale seen to date—does not fundamentally change the implementation of monetary policy (BIS, 1996; Green, 2001; Hartmann, 2006; Stracca, 2007).

On the other hand, inside money can prompt monetary authorities to re-evaluate their priorities. As buyers use less and less cash to transact, the smaller is the harm done by increases in inflation, because inside money typically bears interest and is relatively immune to the “inflation tax” (Aiyagari, Braun, & Eckstein, 1998). If so, then as e-payments become ubiquitous, perhaps central banks should shift their attention away from price stability toward other objectives, such as managing unemployment or attenuating business cycles.¹⁶

Growing substitution toward non-cash forms of payment may contribute to the recent decline in seigniorage, which is the primary source of revenue to fund the operations of central banks in many countries (Ize, 2007). The US Federal Reserve

tary policy goals by setting a target for the federal funds rate. If the amount of currency demanded falls over time, the assets on the Fed’s balance sheet would grow relative to the liabilities, of which cash is the largest component. Unless the Fed offset the expansion in balances by selling assets (US Treasury securities), the federal funds rate would fall from its targeted level. However, the Fed needs to hold enough securities to facilitate its daily open market operations in support of the federal funds rate. At some point, if the demand for cash has fallen so low that the Fed holds few securities, it is possible that the central bank could find itself without sufficient assets to (for example) absorb enough reserves to sterilize the effects of large purchases in the foreign exchange markets (BIS, 1996). To date, changes in demand for cash appear to have had no actual impact on the ability of the Fed to undertake its open market operations.

¹⁶ Green (2001) holds a contrary view, arguing that in a properly specified model, innovations in payments (such as e-payment and e-money) should have no effect other than to change the price level, so that the welfare impacts of monetary policy do not change.

earns seigniorage (which it pays to the US Treasury Department) through the interest it earns on the securities it holds to cover its liability for issued reserve notes (i.e., cash). As discussed above, as non-cash forms of payment such as e-money become more popular, demand for cash will fall and the Federal Reserve balance sheet will shrink. If the central banks' interest-bearing assets decline too much, seigniorage revenue may not be sufficient to cover the operating expenses of the monetary authorities, and alternative funding sources would be required. At least in the US, usage of e-money has grown slowly enough that it will likely not affect revenue from seigniorage much in the near future (Ferguson, 1998).¹⁷

Impact on Fiscal Policy

E-business as currently practiced reduces sales tax revenue for state and local governments. E-commerce in the US often operates across state borders, and the US Supreme Court has ruled that states cannot force out-of-state merchants to collect sales taxes if the merchant has no physical presence in the state.¹⁸ Instead, in most states the consumer is required to pay a "use tax" on goods that would have been taxed if purchased within the state (Redpath, Redpath, & Ryan, 2007). Use taxes are self reported and thus, with exception of large purchases like automobiles, go largely

¹⁷ Per CPSS (2008), e-money usage in the US is still "negligible". Notwithstanding, former Federal Reserve Chairman Alan Greenspan (1996) stated with regard to e-money that "a diversion of seigniorage may be an inevitable byproduct of creating a more efficient retail payment system in the long run."

¹⁸ *Quill Corp. v. North Dakota* (91-0194), 504 U.S. 298 (1992). New York State recently legislated that advertising on web sites run by New York residents constitutes a nexus within New York for purposes of sales tax collection. The New York Supreme Court had ruled the law (chiefly aimed at Amazon.com) to be constitutional at the time of writing, but the ruling likely will be appealed

unreported (Varian, 2000). The loss of sales tax revenue from B2C transactions receives the most attention from policymakers because these transactions are the most likely to be taxable. However, attempts to tax B2B transactions have occurred as well, despite the economic inefficiency of taxing intermediate goods (Diamond & Mirrlees, 1971).

Policymakers have expressed concern over the potential loss in sales tax revenue due to e-commerce. However, for various reasons, the actual amount of lost revenue is likely not substantial. Many e-firms are in industries that do not sell taxable products, such as the travel industry and event ticket industry. Further, e-commerce often replaces similarly tax-exempt mail order purchases. Also, for many online purchases, the merchant has a nexus in the consumer's state, and accordingly pays sales tax (Goolsbee, 2001). Nevertheless, since sales taxing states receive about one-third of total tax revenue from their sales and use taxes, policymakers there are keenly interested in reducing leakage.

How much tax revenue is actually lost to e-commerce? Goolsbee (2001) finds that online sales evaporate \$612 million dollars of sales tax revenue—only 0.3 percent of total sales tax—for all state and local governments in 1999. Other estimates find the loss of sales tax revenue at the turn of the millennium to be closer to one billion dollars per year (Jossi, 2003). The estimate of Bruce and Fox (2004), however, is \$15.5 billion lost to e-commerce in 2003 and a projected \$21.5 billion lost in 2008. Jossi (2003) argues that such large projections overestimate growth in the future Internet

economy and neglect voluntary payments of use taxes by businesses. In addition, the larger projections neglect the dynamic impacts of taxing online purchases as consumers adapt their purchasing behavior to the new taxes (Goolsbee, 2001).

State and local policymakers, noting the potential to add to state revenue in difficult economic times, are exploring methods to increase sales tax revenue from online sales (Victor & Jih 2006). Nevertheless, the burden on e-firms would likely be substantial, as there are thousands of taxing jurisdictions in the US with divergent rates (Redpath, Redpath, & Ryan, 2001).

FUTURE RESEARCH DIRECTIONS

More empirical research is needed to quantify the effects of e-business on the macroeconomy. While productivity enhancements from the use of ICT by business are now widely documented, isolating the effect on productivity of specific forms of e-business such as B2B e-commerce remains a difficult feat. This reality partially follows from the relatively nascent nature of e-commerce. As online markets continue to grow, and statistics on e-business activity improve, one should expect more detailed analyses of the impact e-business has on aggregate productivity levels to be possible.

In the future, monetary policy will need to adapt to the continued evolution of the payment and banking systems. As e-banking becomes more prevalent and as inside money hits the road with mobile commerce and banking (m-commerce and m-

banking), it remains to be seen whether the traditional control authorities exercise over the money supply will remain intact. Future research should explore the theoretical and actual impacts of e-banking (national and cross-border), increased competition among forms of money, and other innovations spawned by e-business on the effectiveness of traditional instruments of monetary policy. Research must also suggest new instruments.

Finally, sales tax leakage also merits future research. Most of the e-commerce studies on the subject were completed before the dot-com bubble burst. Consequently, the trends and projections in these articles rely on overly optimistic estimates regarding the growth of e-commerce. In addition, these studies should more carefully distinguish the effects of B2B from B2C transactions. Sales taxes on B2B transactions are inefficient, since a firm's final output is likely already taxed (Goolsbee, 2001). Accordingly, future research may want to compare the lost economic surplus from taxing B2B e-commerce with the benefits of meeting the revenue needs of the state and local governments.

CONCLUSION

E-business will have a growing impact on the macroeconomy. B2B and B2C transactions will continue to expand into existing and future industries. The growth in e-business will further increase productivity, reduce cost, and enhance competition. Consequently, e-business will continue to stimulate aggregate economic activity

across the world. Similarly, cost reductions and the disciplining of monetary authorities will continue to exert deflationary pressures in the near future. While the economic gains from e-business are certainly welcome, policymakers will face challenges in managing the monetary and fiscal impacts of e-business. Meeting these challenges as they evolve will require deepening our understanding of the theoretical and empirical effects e-business has on the overall economy.

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