

Technology, Trade in Services, and Economic Growth

by

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Introduction

Information and communications technologies (ICTs) are forging new links between globalization, services, and growth. First, ICTs increase international trade in services, but FDI is playing an increasingly important role. Second, ICTs implemented particularly in the services sectors enhance productivity growth, but the technology needs to be networked, and investment in technology is not enough: Changes in workplace practices and business processes are key. Third, ICTs play an increasingly important role in the global value chain of production of manufactured products, but services are an essential component of facilitating trade along that global value chain. This paper reviews research findings in each of these three areas. The research helps to inform policymakers of the challenges and benefits of investing in ICTs, engaging in global trade and investment in services, and in creating a climate conducive to uptake of ICT, use of services, and undertaking economic reforms by both business and labor.

ICTs and Services are ‘Special’

(Slide 1 in the accompanying presentation)

Before embarking on an analysis of how important ICT and services are for trade and growth, it is important to discuss key characteristics of these two sectors. The most important characteristics of ICT products and services activities are that they are both income and price elastic: In this way they are ‘superior’ or ‘special’ products. Income and price elasticity means that global engagement, which reduces prices and expands income, has an enhanced impact and role.

First, with regard to income elasticity. As a country grows, the demand for technology diffuses throughout more sectors in the economy, so the estimated income elasticity of demand for ICTs is greater than one. Looking at the data, countries experiencing rapid growth in income—regardless of the level of GDP per capita—expenditures on IT products increase even faster. For example, in Ireland, Singapore, Korea, Poland, Malaysia, China, and India (ranked here by the World Bank’s level of human development), real GDP growth over the 1990s was above 4 percent and the increase in IT spending (measured in nominal terms) was more than double that, and in several cases IT spending increased at more than 15 percent annual rate over the 1990s. Similarly, with respect to services, as a country’s income grows and as it moves through the stages of development, the demand for services grows too. Wealthy economies have a higher share of services in GDP and employment and the range of services demanded are quite diverse and some are specialized for local tastes and preferences.

The responsiveness to price changes (price elasticity) is a second important characteristics of both ICT and services. Econometric analysis using different countries, different demand variables, different time periods, and different regression methods find similar results that confirm that demand for ICT is particularly responsive to price changes. The price elasticity is at least -1.0 for IT hardware and often found to be more elastic for other components of the ICT package, such as software. (See discussion and additional references on research on ICT elasticities in Mann, 2006, pp 12-14.)

What with services and ICT both being characterized by elastic price and especially elastic demand, globalization plays out differently for producers, consumers, and workers than globalization-induced price declines of products that are not demanded elastically. Elastic demand ensures that globalization is not a zero-sum game. As trade takes place and reduces prices and increases GDP of the trading partners, elastic demand means that the overall market expands. Globalization creates new activities and new firms engaged in cross-border trade and investment.

Globalization and Services: Why Now?

Slide 2

Although international trade in transportation and travel services has always existed, in general high international *transactions costs* (measured in time, distance, or otherwise) and *functional integral* (to an organization's business activity or product) have tended to make many financial and business services 'non-traded'. As well, domestic regulations often protect these markets. But, technological change, as well as policy change and changes in customer and business attitudes over time, has eroded these attributes of financial and business services — transactions costs and functional integration — that heretofore made them 'non-tradable'. (This section draws on Mann, 2005)

Three types of technological change have been important: First, the raw technology of the Internet in conjunction with international telecommunications networks and IT hardware (such as personal computers) create the potential for linkages between countries and businesses that simply did not exist before. For example, the average price of an international call between the United States and India dropped in half between 1996 and 2001. The penetration of personal computers into the Chinese marketplace increased nearly seven fold over the same period.

Second, digitization of service functions further reduces transactions costs of trade. Information or software or advice need not be transported by a person or on a physical carrier medium in order to be traded. Consultants can provide advice via video and software can be downloaded, traded, and used internationally.

Third, 'codification' of information puts information into ordered formats that reduce the need for specific knowledge to perform skill — and information-intensive tasks. For example, the on-screen menu system in a customer-service center replicates complex expert knowledge so that people with less expertise can perform these tasks nearly as effectively. Spreadsheet software with embedded equations combined with the ability to download data means that people with modest financial training can prepare financial reports.

Cheaper Internet and information technology, digitization, and codification of information also allow many tasks to be separated from the main activity of a business, which creates the potential for both domestic and international outsourcing. These factors also create the cost-effective creation of new markets, new products, and new activities for businesses and consumers.

Newly Tradable Services: Fast Growing Trade and FDI Linkages

(Slide 3, 4, 5)

To a great degree, the forces promoting tradability and hence globalization of services — reduced transactions costs, and fragmentation and separability of business functions — are the same forces that have underpinned the globalization of goods. So, what's new?

First, the pace of change in the globalization of 'newly tradable' services is more rapid than globalization of goods and has greater potential to accelerate. Global international trade in services doubled over the last 12 years (although it still accounts only for about 20 per cent of global international trade) (WTO data). Growth in business services trade (the 'newly globalized' services increased 36 percent between 1996 and 2002, as compared to only 14 percent growth in traditional globalized services (transportation and passenger fares), and 20 percent growth in goods trade. Global foreign direct investment (FDI) in services accelerated over 1990-2002, increasing fourfold to account for about 60 per cent of the global stock of FDI in 2002, up from 50 per cent in 1990 (UNCTAD data). Decomposing the FDI in services, and increasing share of FDI is into business activities, rising from a 14 percent share to 28 percent share between 1990 and 2002.

Data for the United States show that cross border trade in 'newly-tradable' services (so-called 'Other Private Services') has increased as a share of total trade in goods and services to 13 percent of exports and to 5 percent of imports. As a share of total trade in services, the 'newly-tradable' services account for about 30 percent of exports of all services and about 16 percent of imports of all services.

US data also reveal how important FDI is in terms of bringing services into the host market. Data on trade flows and international sales can be decomposed into 'arms-length' trade between firms that are independent buyers and sellers (\$109 billion in exports and \$60 billion in imports), 'intra-firm' trade that takes place within a multi-national corporate structure (\$30 billion in exports and \$22 in imports), and 'affiliate-sales' that represent sales by the office of a multinational in the host country to local consumers (\$242 billion). Although cross border trade in services is important, sales by the affiliated offices in the host market are almost twice the value of cross-border exports from the US to foreign countries. Moreover, the host country affiliates play an important role in serving third country markets as exports from the host country into third market (\$54 billion).

In sum, ICTs both globalize and localize services by fragmenting and codifying some services, but also allow the creation of new customized services to meet local needs. Going forward, trade and investment in services worldwide likely will accelerate because, as discussed in the previous section, the share of services in consumption tends to rise with the level of income and development.

ICTs, Services, and Productivity Growth (Slides 6, 7, 8)

Previous research leaves no doubt that economies can experience significant macroeconomic gains from production and, more importantly, diffusion and use of information technology by many sectors throughout the economy. For the United States more than half of the gain in productivity growth from the mid 1990s to the recent 2000s, has come from the use of ICT. (See citations in Mann, 2006, page 77).

Enhanced productivity growth comes through four channels: First, ICT investment leads to capital deepening and faster labor productivity growth. Second, network effects and transactions spillovers between enterprises that both use ICT raise the productivity of these enterprises. Third, information technology and changing workplace practices within firms together enhance total factor productivity growth. (For further discussion and research references on ICT and changes in workplace practices, see Mann 2006, especially chapter 5.) Fourth, international technology transfer and global engagement raise productivity growth by weeding out lagging firms.

If ICT is such an important economic driver of productivity, would not global sourcing of some technology products undermine macroeconomic performance? In fact, the globalization of ICT, as measured by investment in new production facilities at home and abroad as well as international trade in technology products, leads to lower prices of these products. My research suggests that prices of some key IT hardware products are 10-30 percent lower price than they would have been if no globalization of these products had taken place.

Recalling the price-elastic nature of technology products, the lower prices from globalization yields more than proportional investment in the economy, and overall greater productivity and GDP growth than would have been the case in the absence of globalization of the sector. Adding up the gain to the US economy of the globalization of ICT, US GDP was some \$250 higher billion over the 1995 to 2000 period than it would have been had there been no globalization of IT hardware.¹

The macroeconomic analysis masks significant disparity in ICT use by different sectors of an economy. For example, large sectors of the US economy have not yet integrated ICT fully into their business operations, even as other sectors have led the way in investing in ICT. The figure shows the relationship between IT intensity (IT capital per

¹ For calculations, see Mann (2003). Bivens (2005) calls into question this calculation. But, his reassessment assumes that the rate of return to ICT investment is the same as for all other investment in the economy. Research shows that the rate of return to ICT investment is about 5 times that for other types of capital in the economy. For more discussion of the rate of return to ICT investment and additional references see the discussion in Mann (2006) pages 8-9.

worker) and contributions to aggregate productivity growth in the United States by sector, along with the size of the sectors in terms of GDP.²

The upward slope of the trend line is consistent with the relationship as derived from macroeconomic time series data—that investment in ICT is positively related to productivity growth and macroeconomic performance. But there is substantial diversity underlying this macroeconomic performance. Understanding common factors why some sectors have led in the investment and use of ICT while other sectors have lagged may point to the future role for deeper globalization of IT, particularly IT software and services, with implications going forward for the US economy.

The first observation is that services sectors are both leaders and laggards in the use of ICT and in the contribution to productivity acceleration in the United States. The leading services activities account for 31 percent of GDP. Therefore, the rapid acceleration of US productivity growth has come more from productivity-enhancing IT use in the services arena rather than from manufacturing. (Mun and Nadiri (2002) confirm this finding.)

Which sectors lead in terms of IT investment and contribution to productivity growth? Wholesale trade, securities and commodity brokers, depository institutions, and communications are all sectors where networked IT have played a particularly important role in linking together customers and suppliers to the industry. Retailing is the only notable example of a large service sector that did not use ICT particularly intensively across the board but experienced above-average productivity growth. This may reflect the diverse nature of retail establishments—both Wal-Mart and mom-and-pop stores are included in this sector. (See also Foster, Haltiwanger, and Krizan (2002) for a further discussion of the retail sector.)

And the laggards? Two specific sectors stand out for being large in GDP terms, have low intensity of ICT capital per worker, and are below average in terms of contributing to productivity growth: health services and construction. In addition, there is the highly heterogeneous group of “other services,” which among other activities includes engineering, accounting, research, and management services.

Exactly why some service activities have led in the use of ICT and others have lagged remains a fertile area for research. There are several nonexclusive hypotheses, including those related to the information content of the activities of the sector; the degree to which firms in the sector were already organized in or around networks; the population of small and medium-sized enterprises in the sector; the extent of sector-specific regulation; and exposure to international market forces.

With regard to the nature of the sector’s activities, research by Frank Levy and Richard Murnane finds that industries intensive in business processes and jobs characterized by routines and explicit rules have invested the most in ICT, thus changing the mix of tasks

² Analysis by the Economics and Statistics Administration (2002) for the *Digital Economy 2002* report for the US Department of Commerce developed sector-level measures of IT investment, productivity contributions to US growth, inflation, and other important indicators.

between those done by people and those done by technology. ICT-intensive industries then increase their demand for labor with skills such as judgment, problem-solving, and communications, and reduce their demand for workers who performed the routine tasks that follow explicit rules.

With regard to the second hypothesis on the role of pre-Internet networks, it may be that the sectors that have led in ICT intensity and contribution to GDP growth already exchanged information over telecommunications networks before the Internet and information technology made this interchange even more integral to the activity of the sectors. For example, in the financial system, inter-bank payment systems and automated teller machine networks created both forward and backward linkages within and among firms and customers well before the advent of Internet technology.

Similarly, telecommunications firms were well positioned with networks in place to add new services based on ICT investments. Lower-cost supply-chain logistics and improved management of supply-chain information were at the heart of just-in-time inventory management systems and rapid package delivery systems that contributed to improvements in productivity in some manufacturing sectors and wholesale trade (Gereffi 2001).

With regard to the third hypothesis, the two large lagging sectors: health services and construction are also those with a high population of small and medium-sized enterprises (SMEs) and where culture and regulatory constraints may affect the uptake of ICT. SMEs have tended to not invest in ICT to the same extent as larger firms and their ICT intensity per worker is substantially lower. Whether the technology is too expensive or too hard to use remains an area for consideration. With regard to other issues, privacy and regulatory issues are quite important for health services, professional licensure may be important for construction and for engineering services.

Finally, legacy issues of existing training, information management systems, and technology equipment complicate integration and the type of business transformation and networks that are the hallmark of productivity growth in the leading sectors.

The important role of the uptake of ICT in services is further emphasized by comparing the productivity performance of key services in Europe with the US data. (van Ark, Inklaar, and McGuckin 2003; van Ark, 2005, among others) A key reason for the superior productivity performance of the United States in the 1995 to 2002 period as compared to the 1979 to 1995 period is productivity in the ICT-using services sectors, particularly wholesale trade, retail trade, and financial services. Further work is needed to determine the foundations of the differences in productivity performance. But, some evidence indicates that labor market regulations that slow changes in business process and workplace practices can undermine the incentives to effectively use ICT. (Marquez and Gust, 2000).

Technology and the Global Value Chain

Slides 9, 10

The fragmentation and globalized production of both goods and services means that technology is playing an increasingly important role in the global value chain of international trade in goods and services. But, not all industries use technology in the global value chain in the same intensity. Some industries use ICTs intensively, and others less so. Because countries also differ in what they trade, it is increasingly important for countries to understand the interaction between technology and the global value chain of international trade.³

Industries differ in the intensity of ICT use in the global value chain for several reasons. Cost savings differ when used with some sectors gaining more cost reductions through networked information technology. Some products are more amenable to fragmentation into a global supply chain where information technology plays a role. Industries differ in the degree to which they have embraced information technology and use of the internet (e.g. not at all, only a static website, an interactive website, financial exchange over the internet, integrated supplier information exchange, fully integrated multi-firm operations).

Although there is no comprehensive assessment across all industry sectors of how extensively ICTs are being used, nor the impact of these technologies when they are used, analysis of multiple sources can yield an indicator of “intensity of technology use.” This indicator will point out which industry sectors are likely to be the first to respond to the opportunity (or feel the pressure) to use information technology. Analyses are distilled and summarized in the table. The lower the indicator of technology use, the less intensively an industry sector is using and being transformed by the internet and ICTs.

Although there are no services sectors in the table, we will see in subsequent sections of this paper/presentation that services play a key role in both enabling firms to use ICTs and in facilitating trade. The point of this section is to show how differences in industry intensity of technology use affects countries through the products that they trade.

Data on the industry-sector trade patterns of a country can be mapped onto the indicator of technology use to show how exposed an economy might be to the opportunities and pressures of technology use coming through the trade channel. Two economies are shown in the figure: China and Chile. The center-point of the bubble measures the share of the industry in exports (on the vertical axis). The diameter of the bubble is the indicator of technology intensity in the global value chain (from the table). Thus larger bubbles indicate industry sectors that are using ICTs in the global value chain more intensively.

Comparing China and Chile, it appears that China’s trade is more heavily-weighted towards industries where the global value chain is being transformed by ICTs. Consumer goods and textiles represent nearly 50 percent of exports and have a technology intensity indicator of 4 and electronic products are another 20 percent of exports and have a

³ This section draws on Mann, 2002.

technology intensity indicator of 5. In comparison, Chile's exports of processed agriculture products, while having a technology intensity indicator of 4, represent only about 30 percent of exports.

Comparing China and Chile, then, China is an economy that is much more exposed to the opportunities and pressures of ICTs in the global value chain. It is particularly important for firms in this economy to be able to use ICTs effectively. In contrast, Chile's trade patterns are more insulated from ICT use in the global value chain. This does not mean that Chile cannot take advantage of using ICTs, it just means that China has to, or else its firms could lose their position on the global value chain to another country whose firms better use ICTs in their international operations.

Trade in Manufactures and Services Infrastructures: Trade Facilitation (Slide 11)

Understanding the relationships between trade, trade costs, and services infrastructure come under the umbrella of understanding 'trade facilitation'. What is 'trade facilitation'? In a narrow sense, trade facilitation simply addresses the logistics of moving goods through ports or more efficiently moving customs documentation associated with cross-border trade. In recent years, the definition has been broadened to include the overall environment that support trade transactions, including the telecommunications and financial infrastructure to support the fragmentation of the global value chain of production.

How important are the services infrastructures to support trade in manufactures as compared with traditional ways to reduce trade costs by improving transportation and ports, or even by reducing tariffs? Wilson, Mann, Otsuki in two papers use several methods to create indicators of trade facilitation and implement these in a gravity model of trade flows. One innovation in this work is to consider both importer and exporter effects and to examine overall trade flows as well as trade flows from 'south' (developing countries) to 'north' (developed countries) and 'south' to 'south' for the differential impact of the different types of trade facilitation.

Before considering the impact of trade facilitation, consider the effect of tariffs. Higher tariffs have a significant and the expected negative effect (with -1.55 coefficient) on trade—a 1 percentage point reduction in ad valorem tariff from the global average (from 8.5% to 7.5%) would be associated with an increase in global trade of 1.55 percent. This figure is a useful benchmark against which to compare the coefficients on the trade facilitation indicators.

Port efficiency is a traditional sort of trade facilitation issue. Improved ports of both importer and exporter is positively associated with trade; that is, an improvement in the port-efficiency indicator toward global best practice is associated with an increase in trade flows. Comparing the effect of port efficiency on imports vs. exports, the coefficient is higher for exporters than importer (0.92 vs. 0.31), which implies that global trade flows get a bigger boost when the exporters' port efficiency improves.

Improving indicators of service sector infrastructure (called ‘e-services infrastructure’ in the table) are positive and significantly associated with increased trade among the studied countries. E-service infrastructures have a more significant positive relationship with exporter trade than for imports. The coefficient of the exporters e-service sector infrastructure is the highest among all trade facilitation measures (1.94). This high coefficient reflects the important role that services play in all types of trade.

We re-estimated the model on South-to-North trade and on South-to-South trade. Comparing across the three groups, several points emerge. First, the lack of significance on tariffs suggests that tariffs are not the major impediment to South-to-North trade. Second, the e-services infrastructure indicator has a higher coefficient in both sub-samples than in the full sample suggesting that the potential trade gains from improved e-services infrastructures are greatest for the ‘south’ countries.

In sum, e-services infrastructures such as telecommunications and financial services play a key role in supporting trade in manufactured goods.

International Trade in Business Services

(Slide 12)

The first section of this paper showed how technology was enabling a rapid growth of international trade in business services. What should developing countries do to make the most of this expanding opportunity to trade in business services? First, it must be clear by now that the export of these services should not be the final goal. Just as domestic use of information technology enhances domestic productivity (as discussed earlier), domestic services infrastructures are integral to international trade generally, as well as to broad-based economic and human development.

Preliminary research on the factors underpinning imports of US business services integrates an internet-connectivity variable into a gravity model of trade. The results suggest that internet connectivity is positively associated with US imports of ‘other private services’. The relationship is stronger for higher GDP countries than for lower GDP.

Other observations from this very preliminary work include that ‘distance’ still matters for trade in services, just as it does for trade in goods. (So much for the internet leading to the ‘death of distance’.) Imports from lower income countries appear to benefit from having signed a bilateral trade treaty with the United States, from having FDI in the tertiary sector, and from a better developed domestic services sector.

Conclusion

(Slide 13)

The interplay between services, information technology, and trade is complex. Services and ICTs work together to increase domestic productivity growth. They build on each

other to enhanced trade in manufactures, with, on the one hand, ICTs being important in the global value chain of production, and, on the other, E-services infrastructures being important for trade in manufactures. Finally, internet connectivity is important to take advantage of the growing market for trade in business services, which is being enabled by ICTs.

Therefore, policies toward e-service infrastructures, including telecommunications services and financial services, are essential. (See a more complete discussion in Mann, Cleeland, and Knight, 2000.) These infrastructures, along with distribution/logistics infrastructures, play a key role in creating an environment conducive to productivity growth, successful participation in the global value chain, and enhanced trade in business services.

Telecommunications policies directly affect internet costs and uptake by businesses and citizens. Competition among communications providers improves access and significantly lowers the price of local and international telephone calls. Although obviously critical for international trade in business services, internet use broadly and by business outside the services sectors is key to create new business opportunities both at home and abroad. Metered phone charges and high international connectivity charges have the undeniable effect of reducing the time spent investigating, exploiting, and creating information and business opportunities. These new businesses, focused not only on external markets but also on internal markets, contribute to broad-based GDP growth and human development.

The performance of financial intermediaries affects the benefits of and the global linkages offered by the internet and ICTs. Investment and transformation of business activities foster new ideas that create new employment opportunities, products, and wealth. Hence, the financial system is particularly critical as it allocates and disciplines financial capital to these new business activities. More immediately, a financial sector that can swiftly and securely process transactions electronically will significantly enhance the global reach of local firms, not just in international trade in business services but in goods trade as well.

Technology and e-services infrastructures alone are not the whole story of course. The overall climate of human capital, good governance, and a positive business climate are also key. Moreover, because of the key role for services in productivity growth, global value chain competitiveness, and international trade in services, trade negotiations in the services area are now more crucial – but this takes us to another line of research!

References

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