



Assessing How Brazil Would Benefit From Joining the ITA

BY STEPHEN J. EZELL AND CALEB FOOTE | MARCH 2019

With a number of ICT-goods producing enterprises looking for alternatives to China, Brazilian accession to the ITA could come at an opportune moment giving the current reordering of global supply chains for the production of ICT goods.

The Information Technology Agreement (ITA), a trade agreement that eliminates tariffs on hundreds of information and communications technology (ICT) products, has been one of the most successful trade agreements in the World Trade Organization's (WTO's) history.¹ As ITA accession commits countries to eliminating tariffs, it decreases the cost of these innovation- and productivity-enhancing ICT capital goods, which spurs their adoption and consumption among businesses and consumers alike. As ICT products have become the modern global economy's most powerful drivers of economic growth, ITA accession has played an important role in fostering economic growth across developing nations, both by integrating them into global value chains for the production of ICT goods and services and by ensuring lower-cost ICT goods. This report assesses the anticipated economic impact of Brazil joining the ITA and finds that doing so could add nearly a full percentage point to Brazil's gross domestic product (GDP) by the 10th year after its ITA accession, with that expanded growth producing new tax revenues that would fully offset tariff losses. In other words, ITA accession would help Brazilian consumers and businesses without hurting the Brazilian treasury.

This report proceeds by briefly examining Brazil's ICT economy, then summarizing how ICT products drive developing country economic growth and then describing how ITA

accession can benefit developing nations specifically. It concludes with an explanation of the methodology behind the report's economic analysis and by providing additional details relevant to the Brazilian analysis.

EXECUTIVE SUMMARY

In December 1996, 29 WTO member nations launched the ITA, a novel trade agreement in which participating nations completely removed tariffs on eight categories of ICT products, such as semiconductors, semiconductor manufacturing equipment, computers, and telecommunications equipment. In 2012, owing to the tremendous success of the ITA, member nations started negotiations toward expanding the ITA to add innovative ICT products commercialized since 1996 as well as some categories of ICT not included in the original agreement. ITA expansion negotiations concluded in December 2015, with parties agreeing to bring an additional 201 high-tech products under ITA coverage, such as new-generation multicomponent integrated circuits, touchscreens, GPS navigation equipment, and some medical equipment, such as pacemakers and ultrasonic scanners.² The expansion, which the WTO estimated will eliminate tariffs on an additional \$1.3 trillion in annual global trade of ICT parts and products—an amount equivalent to approximately 10 percent of world trade in goods—represented the first major tariff-cutting deal completed at the WTO in 19 years.³

Developing economies have benefitted tremendously from the ITA. In fact, developing economies' share of world exports of ITA products more than doubled from 26 percent in 1996 to 63 percent in 2015. This is higher than their share of total world exports, which grew from 27 percent to 43 percent over the same period.⁴

Brazilian ITA accession would produce many of the benefits other developing countries have enjoyed since signing on. Not only would it represent a boon for the Brazilian economy, it would likely have an animating effect in terms of encouraging additional Latin American nations to join the ITA, giving Brazil a leading role in spurring broader adoption of a policy tool that can catalyze economic growth across the region. More importantly, ITA accession would send a strong signal to global markets that Brazil is committed to slashing tariffs and red tape and providing a welcoming environment for investment in ICT goods-producing industries. With a number of ICT-goods producing enterprises looking for alternatives to China (and other nations that employ trade-distorting “innovation mercantilist” policies), Brazilian accession to the ITA could come at an opportune moment giving the current reordering of global supply chains for the production of ICT goods. At the same time, lowering the cost of ICT goods (such as computers, servers, and mobile devices) would only make Brazil's fast-growing ICT services industries more globally competitive.

The Information Technology and Innovation Foundation (ITIF) has analyzed the economic impact of potential ITA accession for a number of developing nations, including Argentina, Cambodia, Chile, Indonesia, Laos, Kenya, Pakistan, Sri Lanka, South Africa, and Vietnam.⁵ As is the case for each of these nations, ITIF finds that ITA accession would

considerably bolster Brazilian economic growth over a 10-year period (and beyond), with the economic impact for Brazil being among the strongest of countries studied.⁶

Specifically, as table 1 shows, ITIF’s report finds that Brazil would benefit significantly from ITA accession. Among the highlights:

- Brazil’s economy would immediately grow 0.08 percent in the first year post-ITA accession.
- These economic benefits compound considerably over time, such that in the 10th year post-ITA accession Brazil’s economy would be nearly a full percentage point (0.82 percent) larger than would otherwise be the case.
- Taxes generated from the increased economic growth would more than offset losses from reducing tariffs on ICT goods, with Brazil recouping 123 percent of the revenue level (from taxes) compared to the value of forgone tariffs over a 10-year period, and with tax receipts being 170 percent the level of forgone tariffs in the 10th year post-ITA accession.
- As soon as year four, the expanded economic growth ITA accession would engender would be sufficient to produce tax revenues in excess of tariffs forgone in that year.
- Brazil’s average (bound) tariff rate on ITA-covered-goods imports is 9.7 percent, but its effective applied rate is 3.4 percent.

Table 1: Summary Economic Growth and Tax Revenue Impact of Brazil’s ITA Accession

Category	Brazil
ITA-Attributable GDP Growth (Year One)	0.08%
ITA-Attributable GDP Growth (In Year 10)	0.82%
ITA-Attributable Increase in GDP Output (In Year 10, US\$ Millions)	\$19,587
Tax Revenue Gained as % Tariff Revenue Forgone (Year One)	59%
Total Tariff Revenue Forgone (Cumulatively Over 10 Years, US\$ Millions)	\$10,296
Total Tax Revenue Gained (Cumulatively Over 10 Years, US\$ Millions)	\$12,643
Tax Revenue Gained as % Tariff Revenue Forgone (Over 10 Years)	123%
Tax Revenue	170%

BRAZIL'S ICT ECONOMY

Brazil enjoys a robust ICT economy, in terms of both ICT goods and services, although both these could be further strengthened by ITA accession. Brazil's Ministry of Science, Technology, and Innovation estimates that the information technology and communications sectors contributed 8.8 percent to Brazil's GDP in 2013, with this level expected to increase to 10.7 percent by 2022.⁷ Moreover, according to the Brazilian Association of Software Companies, Brazil represents the sixth-largest ICT market in the world, with an estimated \$105 billion of total investment.⁸ Brazil's ICT sector employed 1.5 million workers in 2013, with this amount expected to increase to 3 million by 2022.⁹ The sector is booming, with 13,000 new information technology companies launched in 2017, a 17 percent increase from 2016.¹⁰

Despite these impressive statistics, there's opportunity for improvement in Brazil's ICT economy. For example, the International Telecommunications Union ranked Brazil 66th in its 2017 ICT Development Index, up only slightly from 67 in 2016.¹¹ Similarly, Huawei's 2018 Global Connectivity Index, which maps countries' transformation into digital economies, ranks Brazil 44th out of 79 countries assessed, classifying Brazil as an "adopter" with potential to grow more than other countries which are only "starters."¹² Likewise, Deloitte argues that "Brazil is underperforming in ICT," noting that in 2016, Brazil's broadband penetration rate (at 12.9 percent) remained below the global average (at 13.9 percent) and ranked 83rd in terms of fixed-broadband subscription rates per capita.¹³ ICT penetration in Brazil trails that of peer countries throughout the Americas. For instance, only 51 percent of Brazilian households have a computer (compared to the Americas' 64.9 percent average), only 52.4 percent of Brazilian households have Internet access (compared to the Americas' 63.3 percent average), and Brazil's percentage of individuals using the Internet trails the Americas' average 59.7 percent to 64 percent.¹⁴ Brazil ranks fifth in the world in terms of the share of citizens not connected with mobile devices—40.6 percent, which is substantially higher than China's rate, at 23.1 percent.¹⁵ One reason for these lower-than-average rates of adoption is that tariffs on ICT products raise costs, which in turn reduce demand.

Likewise, Brazil's levels of ICT goods exports have languished over the past two decades, with Brazilian ICT goods exports in 2012 barely one-quarter their levels of 2006, as figure 1 shows.¹⁶ A major explanation for why Brazilian ICT exports fell so severely over that period is that Brazil hasn't joined the ITA. In fact, far from protecting domestic producers by maintaining high tariff levels on imports of foreign ICT goods, because ICT goods are produced from a wide array of inputs and components (such as cables, printed circuit boards, memory devices, screens, etc.) which are sourced from suppliers from a broad range of countries throughout the world, maintaining high tariff levels on key ICT inputs instead of joining the ITA actually made Brazil's ICT goods exports more expensive and less globally competitive. It contributed to Brazilian ICT goods exports cratering in the prior decade. That's why ITA accession would actually help, not harm, Brazil's ICT goods-producing industries—by forcing them to become more globally competitive.

ICT products generate such powerful economic impact because they represent "super capital" that has a much larger impact on productivity than other forms of capital.

Figure 1: ICT Goods Exports from Brazil in Millions of U.S. Dollars¹⁷



HOW ICT DRIVES DEVELOPING COUNTRY ECONOMIC GROWTH

ICT products are the modern global economy's most significant drivers of economic growth, for developed and developing countries alike. For instance, the World Bank writes that "the accumulation of ICT capital accounted for almost 20 percent of global growth between 1995 and 2014."¹⁸ Similarly, Richard Heeks, professor of development informatics at the University of Manchester, estimates that "ICTs will have contributed something like one-quarter of GDP growth in many developing countries during the first decade of the 21st century."¹⁹ Consider Kenya, where ICT products were responsible for roughly one-quarter of the country's GDP growth during the 2000s.²⁰ Elsewhere, ICT adoption accounted for 38 percent of Chinese total factor productivity (TFP) growth and as much as 21 percent of Chinese gross domestic product growth from 1980 to 2001.²¹ Similarly, Ahmed and Ridzuan, in their report, "The Impact of ICT on East Asian Economic Growth," find "a positive contribution of ICT to economic growth" across eight East Asian countries: China, Japan, Korea, Indonesia, Malaysia, Philippines, Singapore, and Thailand.²²

ICT generates such powerful economic impact because it represents "super capital" that has a much larger impact on productivity than other forms of capital.²³ In fact, ICT capital has a three to seven times greater impact on firm productivity than non-ICT capital. Similarly, ICT workers contribute three to five times more productivity than non-ICT workers.²⁴ These effects explain why the World Bank finds that firms in developing countries such as Mexico, Turkey, and Vietnam are more productive if they have more computers per worker, conduct e-commerce, and have a higher share of workers using the Internet.²⁵ It explains why, in Vietnam, firms using e-commerce enjoy TFP growth 3.6 percentage points higher on average than firms that do not use e-commerce.²⁶ The World Bank identifies even greater effects in Africa, finding that African firms using the Internet enjoy 3.7 times higher labor productivity and 35 percent higher TFP than firms that do not.²⁷ Moreover, as the World Bank concludes, there's still much more scope for impact from

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ICT in developing nations, observing that, “Firms in developing countries have considerable room to adopt digital solutions that have led to growth in high-income countries, such as using the Internet for e-commerce or inventory management.”²⁸

These findings highlight an essential point: ICT consumption and application is far more important than ICT production. Indeed, the central way ICT drives a country’s economic growth is not through the production of ICT goods (e.g., manufacturing computers or mobile phones). Rather, the vast majority of the economic benefits from ICT in developing countries—more than 90 percent—stems from greater adoption of ICT products across an economy, while less than 10 percent of the benefits stem from ICT production.²⁹

So, while many countries have focused almost exclusively on attracting ICT goods production, the far greater impact of ICT on countries’ economic growth stems from encouraging its adoption and use across all sectors of an economy, from agriculture and manufacturing to services sectors like finance, education, government, and tourism. That’s why the McKinsey Global Institute estimates that about 75 percent of the value added by data flows on the Internet accrue to “traditional” industries, especially via increases in global growth, productivity, and employment.³⁰ This has been true for the United States as well, with studies showing that the bulk of U.S. productivity growth over the past 15 years originated in ICT-using, not-producing sectors.³¹ This is why developing country ICT policy should focus foremost on infrastructure deployment and ICT adoption, as opposed to ICT production.³²

The ITA has been instrumental in furthering consumption and adoption of ICT goods and services by lowering their prices through tariff elimination and thus facilitating ICT diffusion. It’s critical to note that these effects amplify, because ICT goods are highly price elastic, meaning that a 1 percentage point decrease in price leads to more than a 1 percentage point increase in ICT adoption. In fact, economists estimate that a 1 percent decrease in the price of ICT products on average lead to a 1.3 percent increase in demand for those products.³³ Moreover, as a country’s capital stock of ICT goods grows, this larger base of capital goods engenders downstream economic growth, explaining why a review of econometric literature by Cardona, Kretschmer, and Strobel finds that, on average, an increase in ICT capital stock of 1 percent leads to a 0.06 percent increase in a country’s GDP.³⁴ As subsequently explained, ITIF’s report leverages these mechanics to estimate the economic growth impact of Brazil joining the ITA in full.

HOW ITA PARTICIPATION BENEFITS DEVELOPING COUNTRIES

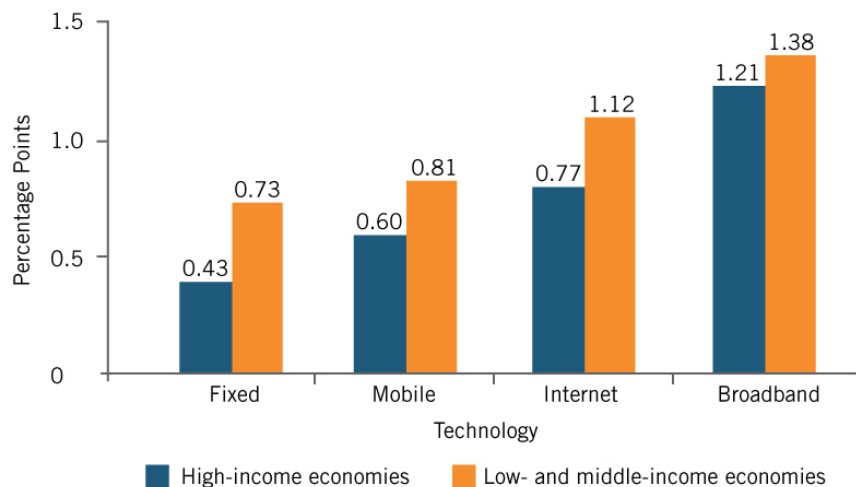
ITA participation benefits developing countries in at least five principal ways, by: 1) spurring ICT adoption and diffusion, thus boosting economy-wide productivity and innovation; 2) supporting ICT services and exports; 3) facilitating countries’ participation in ICT global value chains; 4) enhancing the competitiveness of countries’ domestic manufacturers; and 5) supporting social, health, and sustainability goals.

Facilitating ICT Adoption and Boosting Productivity and Innovation

First, and most fundamentally, ITA accession lowers prices by eliminating tariffs on a broad range of foundational ICT goods—such as mobile phones, personal computers, and mobile devices—which facilitates their adoption, consumption, and diffusion across developing economies. This effect is magnified by the high elasticity of demand for ICT goods, especially in developing countries, whereby there's at least a 1.3 percent increase in demand for every 1 percent drop in price in ICT products (with the effect likely even higher in developing nations). Moreover, it's not just that the demand for ICT products is price elastic, it's also income elastic, meaning that a 1 percent increase in income leads to an increase greater than 1 percent in the demand for ICT products.³⁵ In other words, demand for ICT products grows disproportionately when an economy grows and when prices for ICT goods fall. Thus, as an economy grows, it engenders a virtuous cycle whereby the prices of ICT products fall and ICT becomes more easily available, including for additional sectors of the economy eager to realize the productivity gains associated with its use.³⁶

Moreover, extensive research has found that greater penetration of ICT among consumers and businesses directly boosts economic growth in developing countries. For instance, a seminal World Bank report found that a 10 percent increase in high-speed broadband Internet penetration adds 1.38 percent to annual per-capita GDP growth in developing countries. Likewise, a 10 percent increase in mobile phone penetration adds 0.81 percent to annual per-capita GDP growth in developing countries, as figure 2 shows.³⁷ And according to a study of 131 developing countries, increasing mobile and Internet penetration impacted economic growth more than any other variable tested, short of primary school education.³⁸ Put simply, by joining the ITA and lowering tariffs on the productivity and innovation-enhancing capital ICT goods foundational to the modern digital economy, ITA accession can play a key role in catalyzing developing countries' broader levels of economic growth.

Figure 2: Impact of a 10 Percent Increase in Penetration of Key ICTs on Annual Percent GDP Growth³⁹

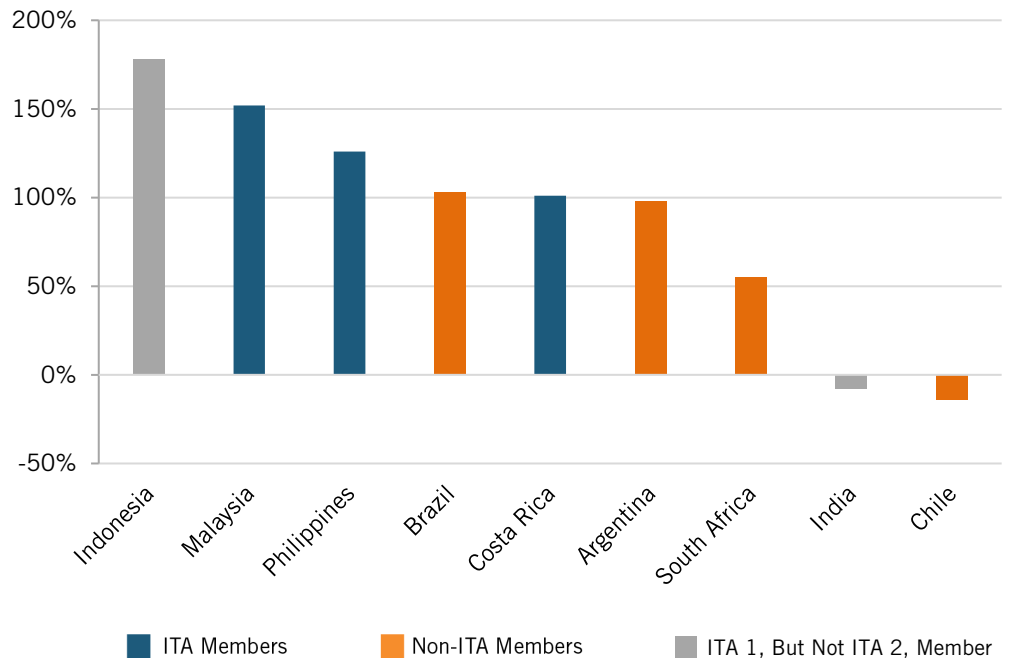


Supporting Countries' ICT Services Sectors

In order for countries to field globally competitive ICT services sectors, their ICT services enterprises need access to best-of-breed ICT hardware at the best possible prices. That's especially true because the ITA supports the ICT hardware on which the global digital economy now runs. ITA accession can thus bolster the competitiveness of countries' ICT services sectors and enterprises therein by eliminating tariffs and thus reducing costs on the ICT goods on which ICT services firms fundamentally rely. Indeed, for many developing countries, ITA membership has helped to lower prices for key ICT hardware inputs that their ICT services enterprises depend upon, helping them to innovate and become more globally competitive. For instance, the Philippines' ICT/BPO (business process outsourcing) sector accounts for fully 5 percent of the country's GDP, with the sector supporting over 1.15 million Filipino jobs.⁴⁰

As figure 3 shows, countries that have acceded to the ITA have generally experienced stronger growth in ICT services exports as a percentage of their total services exports from 2001 to 2017. Indonesia's ICT services exports as a percentage of total services exports increased 178 percent over this period, Malaysia's 152 percent, and the Philippines's 126 percent. The Philippines' ICT services exports account for over 16 percent of the country's total services exports, while for Costa Rica this figure is 14.6 percent. Brazil and Argentina matched Costa Rica in ICT services exports as a share of total services exports growth over this period; however, ICT services exports as a percentage of total services exports in Brazil was just 6.3 percent in 2017, less than half Costa Rica's level.

Figure 3: Change in ICT Services Exports as a Percentage of Countries' Total Services Exports, 2001-2017⁴¹

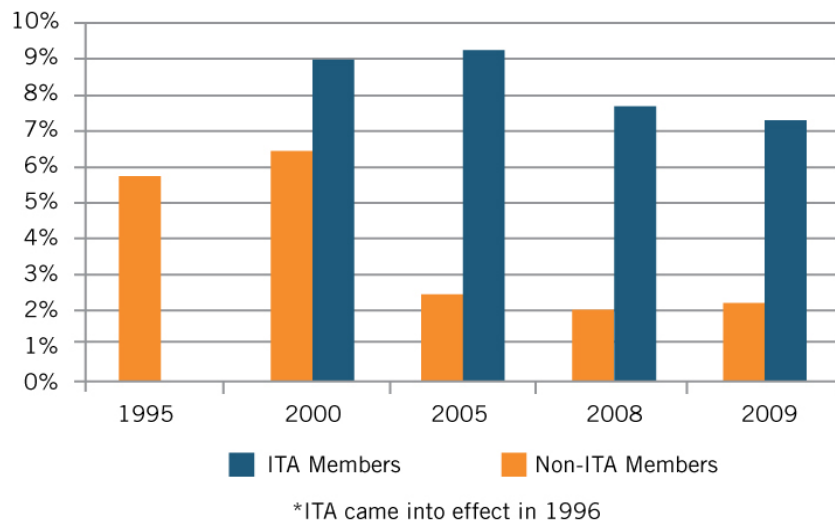


Deepening Developing Countries' Participation in ICT Global Value Chains

Keeping ICT prices low is paramount if countries wish to participate in global value chains for the production of ICT parts, components, and final products. In contrast, maintaining high ICT tariffs (in part by not joining the ITA) harms both developing countries' ICT-producing and ICT-consuming sectors.⁴² In particular, failure to join the ITA has caused nations to be excised from global production networks for ICT products, causing them to miss out on tremendous opportunities for growth.

Indeed, countries imposing high tariffs on ICT parts and products only make themselves unattractive to multinational enterprises wishing to seamlessly integrate into global supply chains. This explains why the Organization for Economic Cooperation and Development (OECD) has found that countries not participating in the ITA saw their participation in global ICT value chains decline by more than 60 percent from 1995 (two years before the ITA went into effect) to 2009, as figure 4 shows.⁴³

Figure 4: ITA Membership and Participation in IT GVCs (Participation Index in Percentage of Gross Exports)⁴⁴



Brazil provides an instructive example: Brazilian innovation in ICT has lagged that of the rest of the world, primarily because the country hasn't been involved in global value chains and thus has enjoyed only limited market-based technology and skills transfer in the ICT sector. Put simply, if countries wish to participate in global value chains for ICT products, they have to remove the barriers. As the OECD's "Measuring Trade in Value Added" research finds:

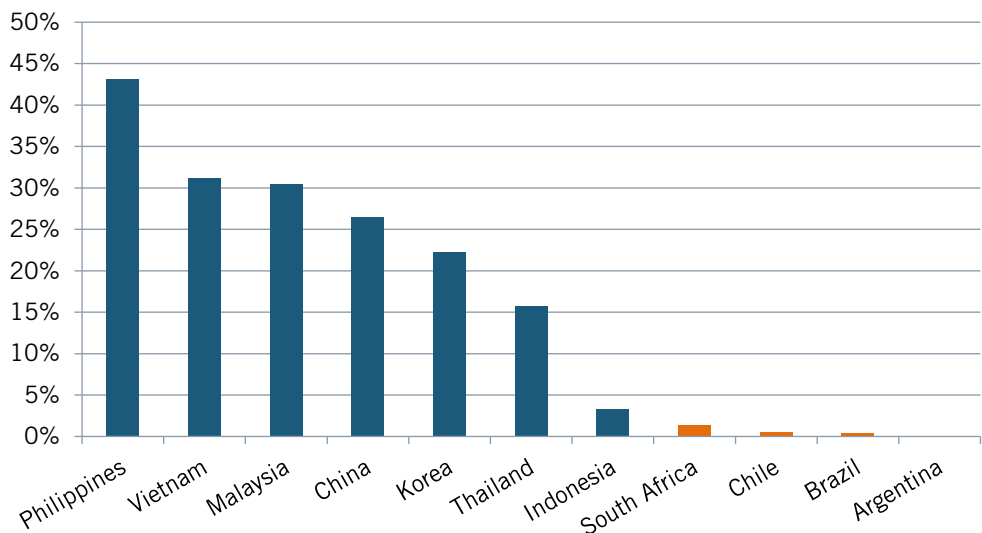
The growing fragmentation of production across borders has important policy implications. It highlights the need for countries wanting to reap the gains from value chain participation to have open, predictable, and transparent trade and investment regimes as tariffs and other unnecessarily restrictive non-tariff measures impact foreign suppliers, international investors, and domestic producers.⁴⁵

It's also important to note that it's not just about producing final goods; countries can derive significant value added from the production of intermediate inputs. A “zero-in; zero-out” tariff environment can help countries attract production for a wide range of goods—and over time, as countries' enterprises and their employees develop knowledge, skills, and relationships with international partners—they can move up the value chain to produce higher-value-added goods.

Thus, the message is clear: Countries that don't participate in open, cross-border flows of ICT products (whether by imposing high tariffs or by applying other restrictive measures such as localization barriers to trade) only end up excluding themselves from global value chains and production networks for ICT products and services.⁴⁶

Figure 5, which shows developing country ICT goods exports as a share of total goods exports for 2016, drives this phenomenon home in stark relief. Countries that are ITA members enjoy a far-higher share of ICT goods exports as a share of total goods exports than non-ITA members. For instance, ICT goods exports as a share of total goods exports are a robust 43 percent in the Philippines, 31 percent in Malaysia and Vietnam, 27 percent in China, and 22 percent in Korea. In contrast, they are an anemic 1.4 percent in South Africa, 0.57 percent in Chile, 0.39 percent in Brazil, and 0.09 percent in Argentina. In the latter two South American countries, a history of import substitution policies and correspondingly high tariffs on ICT products—ostensibly intended to seed the development of an indigenous ICT production sector—has actually accomplished the opposite effect: underdeveloped ICT production sectors that represent a fraction of their potential.

Figure 5: Developing Country ICT Goods Exports as Share of Total Goods Exports, 2016⁴⁷



This dynamic explains why research by P.D. Kaushik and Nirvikar Singh found that for every dollar of tariffs India imposed on imported ICT products (in the years before it joined the ITA) in its pursuit of import substitution industrialization policies, the Indian economy suffered a loss of \$1.30 due to lower productivity. As Kaushik and Singh

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concluded from their study of ICT adoption in India, “High tariffs did not create a competitive domestic [hardware] industry, but [they] limited adoption [of ICT by users in India] by keeping prices high.”⁴⁸ In other words, India’s tariffs on ICT products reduced domestic ICT investment, which in turn limited productivity growth.

It should be noted Indonesia is an outlier here, with its ICT goods exports as a share of total goods exports at a mere 3.5 percent. Indeed, Indonesia appears a laggard compared with other ITA-member ICT goods exporters shown in figure 5. Thus, it should be noted that membership in the ITA is not a panacea; it must be complemented with other tech-sector trade liberalization policies as well as a welcoming environment for domestic and foreign investment. In other words, ITA membership is necessary but not sufficient for ICT industry success. For instance, since 2012, Indonesia’s Ministry of Communication and Information Technology (MCIT) has operated Regulation 82/2012, which includes requirements for source-code surrender as a condition of market access and a requirement for the local storage of data.⁴⁹ These types of forced localization policies counteract the positive benefits of ITA accession, and in part explain why Indonesia isn’t enjoying a higher share of ICT goods exports.

Another important point, as Christian Henn and Arevik Gnutzmann-Mkrtychyan write in their paper “The Layers of the IT Agreement’s Trade Impact,” is that “reducing tariffs to zero may have an additional impact on imports beyond tariff reduction.”⁵⁰ This means that fully eliminating tariffs has a tremendously powerful effect, much more than marginal tariff reductions. Eliminating tariffs creates a “commitment effect” that sends a signal to firms across all industries that a country provides a robust environment for both imports and exports. Without tariffs, firms can also be more confident in their targets for long-run production, since they no longer have to factor in possible tariff cuts or hikes on ITA intermediate goods.

Finally, it should be emphasized once again that cutting tariffs on ICT capital goods is indeed in countries’ own self-interest. For instance, in April 2017, Argentina’s Ministry of Production announced that the import tariff on personal computers, notebooks, and tablets would be eliminated, with officials expecting that the prices of these products could drop by as much as 50 percent. Argentinean officials estimated that the tariff elimination will help create more than 15,000 new jobs in three years related to commercial and repair activities and in other industries benefited by the access to cheaper ICT products.⁵¹ Countries such as Argentina are increasingly recognizing that high tariffs have failed to achieve their goal of spurring development of indigenous ICT production sectors but are actually impediments to them and inhibitors of productivity growth across all other sectors of an economy.

Boosting the Competitiveness and Productivity of Downstream Manufacturers

Information and communications technologies are increasingly vital inputs not just to finished ICT goods but also to a range of manufactured products, from automobiles and airplanes to home appliances and medical devices. ITA accession can thus bolster the

competitiveness of a country's downstream manufacturers by, through tariff elimination, reducing the cost of ICT parts and components such as printed circuit boards and integrated circuits that are essential inputs into finished manufactured products. For instance, in China, over 50 percent of semiconductors imported into the country serve as inputs to re-exported products.⁵² A similar dynamic will become increasingly important for Brazil's manufacturing sectors, which account for 10.2 percent of Brazilian GDP.⁵³ Tariffs on ICT parts and components diminish the competitiveness of a nation's manufacturing industries.

Finally, it should be noted that ICT accession tends to cause both a country's ICT goods exports *and* imports to grow, a result of countries becoming more deeply integrated in global supply chains. For instance, Henn and Gnutzmann-Mkrtchyan document the importance of the ITA in integrating developing countries into global supply chains, finding that, on average, ITA exports increase by 37 percent post-ITA implementation.⁵⁴ At the same time, they estimate that joining the ITA increases a country's ICT imports by 21 to 30 percent.⁵⁵ Yet this finding is not surprising; it's a fundamental characteristic of global production chains for ICT products, as imported ICT parts and components are regularly reassembled as part of value-added or final ICT goods exports. This explains why four of the five largest importers of ICT products in the world—China, the United States, Hong Kong, and Singapore—also are four of the top five ICT exporters in the world.

Supporting Sustainable Development Goals

By eliminating tariffs on hundreds of high-tech goods and components, from semiconductors to smartphones, the ITA has made technology more affordable and accessible to consumers, businesses, innovators, and entrepreneurs. This in turn has promoted growth and prosperity through expanded e-commerce, access to the Internet, and the availability and affordability of innovative technologies used in a variety of traditional sectors, from agriculture to healthcare, construction, and energy. This means ITA accession can make important contributions toward achieving the United Nations' Sustainable Development Goals (SDGs), which seek to end poverty, protect the planet, and ensure prosperity for all. SDGs are part of a sustainable development agenda that has articulated 17 "Sustainable Development Goals" with 169 associated targets to be achieved over the next 15 years.⁵⁶ ITA accession can contribute to realization of virtually all of the stated objectives, from promoting access to quality education and healthcare services to fostering sustainable cities and communities, protecting the environment, combatting hunger and poverty, providing decent work, and fostering economic growth.⁵⁷ ITIF extensively documented these dynamics in its "Digital Quality of Life" report.⁵⁸

A specific SDG for which ITA participation will be particularly helpful is lowering the cost of healthcare. As the WTO's "20 Years of the Information Technology Agreement" report notes, "No economy is entirely self-reliant in terms of the products and equipment it needs for its public health system, with most economies relying in varying degrees on imports. As a result, the factors affecting imports will influence the availability, as well as the prices, of health-related products and technologies, and thus have immediate consequences for access

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to and affordability of healthcare.”⁵⁹ Indeed, public health sectors stand to benefit from the reduction and elimination of tariffs through ITA expansion on a number of medical products and equipment, such as magnetic resonance imaging (MRI), ultrasound, and computed tomography units.⁶⁰ The ITA expansion includes medical devices from 17 six-digit-level HS codes, which has led to meaningful tariff reductions in ITA accession countries.⁶¹

Yet some countries, like Indonesia and Laos, continue to apply a 5 percent tariff to X-ray tubes (HS 902230).⁶² That’s a 5 percent cost to those countries’ health-care systems that could be eliminated. In Brazil, imports of medical diagnostic equipment, ranging from electrocardiographs to MRI machines are all projected to experience the double-digit import growth in both value and quantity in the near future.⁶³ To its credit, Brazil has already eliminated ad valorem tariffs on a number of medical devices that incorporate ICT components, such as computer tomography apparatus (HS 902212), pacemakers for stimulating the heart (HS 902150), and electro-diagnostic apparatus such as electrocardiographs, ultrasonic scanning apparatus, and magnetic resonance imaging devices (HS 901819).⁶⁴ This is wise, because not only does eliminating these tariffs improve Brazilian healthcare system costs, it improves health outcomes for Brazilian citizens. Full ITA accession would replicate that dynamic across additional sectors of Brazil’s economy.

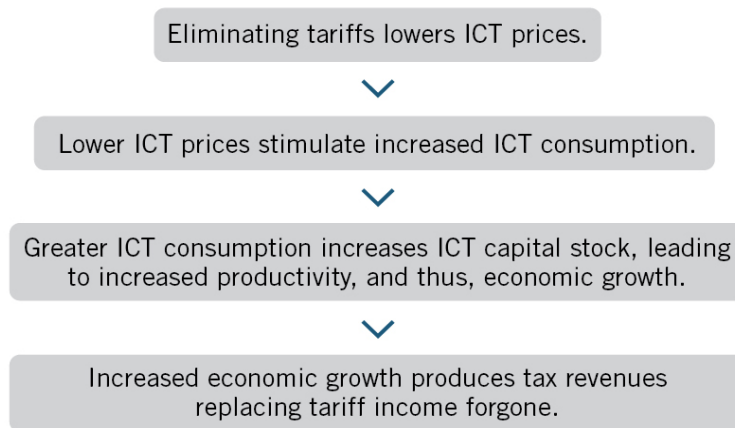
ANALYTICAL METHODOLOGY

To assess the economic impact of full ITA participation for Brazil, ITIF’s analysis starts by identifying the effective tariff rates Brazil applies (i.e., once its current free trade agreement commitments are considered) to ITA-covered ICT products and by determining the current value of Brazil’s ITA imports on a trade-weighted basis (across all ICT products in the original and expanded ITA). This allows us to calculate the dollar value of tariff revenues Brazil would forgo by eliminating ICT tariffs. Further, it’s important to recognize that tariffs on ICT products effectively represent a transfer payment from ICT consumers (both businesses and citizens) to governments, and in the absence of those tariffs, the prices of ICT products could be expected to fall in importing countries by a corresponding amount. Such a decrease in ICT prices should lead to an increase in ICT consumption, especially since, as noted, demand for ICT products is price elastic—meaning that a 1 percent decrease in ICT prices leads to a 1.3 percent increase in consumption.

Combining these concepts allows us to estimate the increase in ICT consumption in an economy that would result from tariff elimination as part of ITA accession. Over time, this increased ICT consumption leads to an increasing ICT capital stock in a country—and, as noted, that ICT capital stock exerts powerful effects, enabling domestic enterprises (private and public) to become more productive and innovative—thus raising a country’s productivity and economic growth levels. This is why economists estimate that a 1 percent increase in ICT capital stock increases a country’s GDP by approximately 0.06 percent per year. The study leverages this dynamic—while distinguishing and accounting for the fact that a certain percentage of the increased imports of ICT products would be for intermediate goods and thus be re-exported, while others represent final goods that would

remain in the domestic economy and boost its capital stock (and while also applying appropriate depreciation rates)—to calculate how increased ICT capital stocks engendered by ITA adoption would bolster countries’ economic growth rates over 1- and 10-year periods. The study concludes by assessing the increased tax income (from a variety of sources) this increased economic growth could be expected to produce and comparing that to the amount of tariff revenue forgone. Figure 6 graphically depicts the report’s core analytical framework.

Figure 6: Graphical Depiction of Study’s Conceptual Analytic Framework⁶⁵



Data for calculating trade in ITA goods comes from the United Nations’ Comtrade Database.⁶⁶ ITIF developed a list of commodity codes based on WTO documentation. A detailed listing of all 269 commodities can be found in Appendix B. Trade flows for Brazil for the year 2017 were then estimated by identifying the relevant commodities covered under the ITA, and summing the value of those imports.⁶⁷ Data for estimating the value of tariffs comes from the WTO’s Tariff Analysis Online (TAO) database.

RESULTS

ITIF finds that if Brazil joins the ITA in full (the original and expanded ITA), then after 10 years its economy would be 0.82 percent larger than would otherwise be the case, solely as a result of ITA accession, as table 2 shows. The ITA-attributable increase in Brazilian GDP output in the 10th year post-ITA accession would reach \$19.6 billion. Over the 10 years following ITA-accession, Brazil would be able to reclaim (in the form of increased tax revenues generated through increased economic growth) 123 percent of the tariff income it would have received from imports of ICT goods now coming under ITA coverage.

Table 2: Summary Economic Growth and Tax Revenue Impact of Brazilian ITA Accession

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ITA-Attributable GDP Growth (In Year 10)	0.82%
ITA-Attributable Increase in GDP Output (In Year 10, US\$ Millions)	\$19,587
Tax Revenue Gained as % Tariff Revenue Forgone (Year One)	59%
Total Tariff Revenue Forgone (Cumulatively Over 10 Years, US\$ Millions)	\$10,296
Total Tax Revenue Gained (Cumulatively Over 10 Years, US\$ Millions)	\$12,643
Tax Revenue Gained as % Tariff Revenue Forgone (Over 10 Years)	123%
Tax Revenue Gained as % Tariff Revenue Forgone (In the 10th Year Post-ITA Accession)	170%

ITIF further estimates that, in 2017, Brazil imported approximately \$23.2 billion of ITA-covered ICT goods, which represented 7.7 percent of all goods imports into the country. ITIF finds that Brazil's average tariff rate on ITA imports is 9.7 percent, but that its effective applied rate is 3.4 percent. In the first year post-ITA accession, ITIF finds Brazil would forgo \$796 million in tariff revenues. Over 10 years, on a cumulative basis, Brazil would forgo \$10.3 billion in tariff income; however, Brazil's total income tax revenue would increase by \$8.1 billion and its goods and services tax receipts would increase by \$4.6 billion, making ITA accession a clear win for Brazilian government coffers over the ensuing decade. Moreover, Brazil would recover 170 percent of tariff revenue foregone in the 10th year post-ITA accession, a surplus of \$753 million. However, as soon as year four, the expanded economic growth that ITA accession would engender would start to produce tax revenues in excess of tariffs foregone in that year.

CONCLUSION

ICT represents a key driver of growth in developed and developing nations alike and will likely increase in its importance as we move forward with the next ICT-led innovations, including the Internet of Things, 5G, autonomous systems, and artificial intelligence.⁶⁸ As such, government policies that add to the cost of ICT goods and services limit the ICT intensity of an economy and by extension, growth and innovation. In contrast, ITA

participation and attendant tariff elimination leads to greater consumption and investment in ICT goods, spurring productivity and innovation, as well as overall digital transformation. In conclusion, joining the ITA can have a significantly positive impact on innovation, investment, exports, job creation, economic modernization, prosperity, and standards of living.

APPENDIX A: SUMMARY STATISTICS TABLE OF ITA ECONOMIC IMPACT

Trade Impact	Brazil
Imports (2017, US\$ Millions)	\$301,499
Real Import Growth (2007-2017)	3.07%
Gross Tariff Revenue (2017, US\$ Millions)	\$10,329
ITA Imports (2017, US\$ Millions)	\$23,220
ITA Imports as a Share of Total Imports (2017)	7.70%
ITA Tariff Revenue (2017, US\$ Millions)	\$796
Average Tariff Rate on ITA Imports (2017)	9.74%
Effective Realized Average Tariff Rate on ITA Imports (2017)	3.43%
Change in ITA Quantity Imported From Tariff Elimination (From 2017 Baseline)	4.45%
Increase in ITA Imports After Joining ITA (US\$ Millions, From 2017 Baseline)	\$1,034
Increase in Total Imports After Joining ITA (From 2017 Baseline)	0.34%
Growth Impact	Brazil
Current Stock of ICT Capital (2017, US\$ Millions)	\$26,582
ITA Capital and Consumption Imports as a Share of Total ITA Imports (2017)	35.5%
ITA-Attributable Contribution to ICT Capital Stock (US\$ Millions, From 2017 Baseline)	\$367
GDP (2017, US\$ Billions)	\$2,056
Real GDP Growth (Annual Average, 2007-2017)	1.51%
ITA-Attributable GDP Growth (Year One)	0.08%
GDP With ITA Accession (2027, US\$ Billions)	\$2,407
ITA-Attributable GDP Growth (In Year 10)	0.82%
ITA-Attributable Increase in GDP Output (In Year 10, US\$ Millions)	\$19,587
Tax Impact	Brazil
ITA Tariff Rate (2017)	9.74%
Goods and Services Tax Rate (2017)	34%
Income Tax Rate (2014)	6.91%

Tariff Revenue Forgone (Year One, US\$ Millions)	\$796
Goods and Services Tax Revenue Gained (Year One, US\$ Millions)	\$352
Income Tax Revenue Gained (Year One, US\$ Millions)	\$118
Tax Revenue Gained as % of Tariff Revenue Forgone (Year One)	59%
Total Tariff Revenue Forgone (Over 10 Years, Cumulative US\$ Millions)	\$10,296
Total Goods and Services Tax Revenue Gained (Over 10 Years, Cumulative US\$ Millions)	\$4,551
Total Income Tax Revenue Gained (Over 10 Years, Cumulative US\$ Millions)	\$8,092
Total Revenue Gained as % of Total Revenue Forgone (Over 10 Years)	123%
Tariff Revenue Forgone (In Year 10, US\$ Millions)	\$1,076
Goods and Services Tax Revenue Gained (In Year 10, US\$ Millions)	\$476
Income Tax Revenue Gained (In Year 10, US\$ Millions)	\$1,354
Revenue Gained as % of Revenue Forgone (In Year 10)	170%

APPENDIX B: LIST OF ITA-COVERED PRODUCTS (BY HS2002 CLASSIFICATION)

Information Technology Agreement			Information Technology Agreement Expansion			
381800	852910	902730	350691	850590	853190	901820
844331	852990	902750	370130	851430	853630	901850
844332	853120	902780	370199	851490	853650	901890
844339	853190	902790	370590	851519	853690	902150
844399	853210	903040	370790	851590	853810	902190
846900	853221	702000	390799	851761	853939	902212
847010	853222	848620	841459	851762	854231	902213
847021	853223	848690	841950	851769	854232	902214
847029	853224	848610	842010	851770	854233	902219
847030	853225	848640	842129	851810	854239	902221
847050	853229	848630	842139	851821	854290	902229
847090	853230	903082	842199	851822	854320	902230
847130	853290	903090	842320	851829	854330	902290
847141	853310	903141	842330	851830	854370	902300
847149	853321	903149	842381	851840	854390	902410
847150	853329	903190	842382	851850	880260	902480
847160	853331	851840	842389	851890	880390	902490
847170	853339	851890	842390	851981	880521	902519
847180	853340	901390	842489	851989	880529	902590
847190	853390	901380	842490	852110	900120	902710
847290	853400	853180	844230	852190	900190	902780
847321	853650	901720	844240	852290	900219	902790
847329	853669	901710	844250	852321	900220	902830
847330	853690	851590	844331	852329	900290	902890
847350	854110	901190	844332	852340	901050	903010
850440	854121	851490	844339	852351	901060	903020
850450	854129	850870	844391	852352	901090	903031
851711	854130	852871	844399	852359	901110	903032
851712	854140	852872	845610	852380	901180	903033
851718	854150	901090	846693	852550	901190	903039
851761	854160	901790	847210	852560	901210	903084
851762	854190	901290	847290	852580	901290	903089
851769	854231	847310	847310	852610	901310	903090
851770	854232	850490	847340	852691	901320	903110
851810	854233	851440	847521	852692	901390	903149
851829	854239	852290	847590	852712	901410	903180
851830	854290	841990	847689	852713	901420	903190
851950	854370	847790	847690	852719	901480	903220
852329	854390	853890	847989	852721	901490	903281
852340	854442	847990	847990	852729	901510	950410
852351	854449	842191	848610	852791	901520	950430
852352	854470	847340	848620	852792	901540	950490
852359	854890	846694	848630	852799	901580	
852380	902610	846693	848640	852849	901590	
852580	902620	846691	848690	852871	901811	
852841	902680	843139	850440	852910	901812	
852851	902690	842490	850450	852990	901813	
852861	902720	852869	850490	853180	901819	

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ABOUT THE AUTHORS

Vice President, Global Innovation Policy Stephen J. Ezell focuses on science, technology, and innovation policy as well as international competitiveness and trade policy issues at the Information Technology and Innovation Foundation. He is the co-author of *Innovation Economics: The Race for Global Advantage* (Yale 2012) and *Innovating in a Service Driven Economy: Insights Application, and Practice* (Palgrave McMillan, 2015).

Caleb Foote is a research assistant at ITIF. Prior to joining ITIF, Caleb graduated from Brown University, with a concentration in Economics. He previously interned for TechHelp and serves as a trustee of the American Parliamentary Debate Association.

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The Information Technology and Innovation Foundation (ITIF) is a nonprofit, nonpartisan research and educational institute focusing on the intersection of technological innovation and public policy. Recognized as one of the world's leading science and technology think tanks, ITIF's mission is to formulate and promote policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress.

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