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Globotics and development

When manufacturing is jobless and services are tradable

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Abstract: Globalization and robotics (globotics) are transforming the world economy at an explosive pace since they are driven by digital technology that is advancing in phenomenal increments. This paper—which should be considered a 'thought piece'—argues that the globotics transformation is likely to disable the traditional manufacturing-led development 'journey' of the type China is taking, while enabling the service-led development journey of the type India is following. We start with a historical perspective on the current transformation before turning to a consideration of the technology and a closer look at the economic logic that is making manufacturing jobless and services traded. Finally, we discuss how one might conceptualize service-led development.

Keywords: globalization, robotics, service-led development

JEL classification: F10, F14, O10, O14

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1 Introduction

Globalization and robotics (globotics) are transforming the world economy at an explosive pace since they are driven by digital technology that is advancing in phenomenal increments—increments that get twice as large every couple of years or so. The impact of the change is likely to be felt quite strongly in developed nations (Baldwin 2019; Brynjolfsson and McAfee 2014).[1] The change is also quite likely to transform development in important ways.

This paper—which should be considered as a 'thought piece'—argues that the globotics transformation is likely to disable the traditional manufacturing-led development 'journey' of the type China is taking, while enabling the service-led development journey of the type India is following. While these conjectures are unprovable since they concern the future, we believe they may merit consideration.

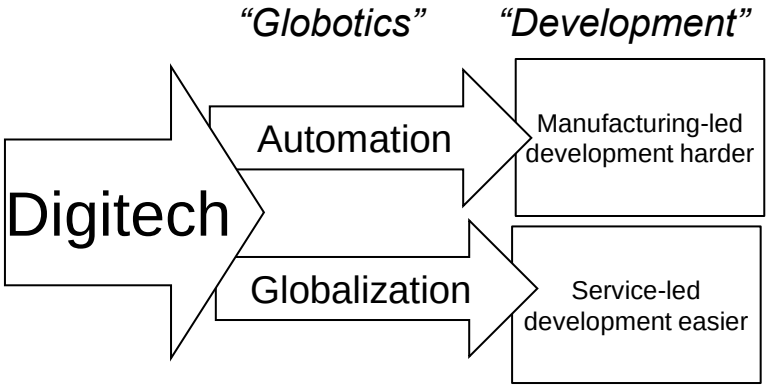
A growing body of evidence has begun to challenge the view that manufacturing is the prime route for development (e.g. Hallward-Driemeier and Nayyar 2017; Loungani et al. 2017). First, many of the pro-development characteristics traditionally associated with manufacturing—tradability, scale, innovation, learning-by-doing—are increasingly features of services (Ghani and O'Connell 2014; Primo Braga et al. 2019). Second, digital technology is changing globalization in a way that is making services easier to trade by creating forms of communication that make remote workers seem less remote (OECD 2019). Third, other aspects of digital technology ('digitech') are changing the nature of manufacturing by taking the 'manu' out of manufacturing and replacing it with robots, turning manufacturing into 'robofacturing', so to speak (Gilchrist 2016).

Taken together, these aspects of globotics are pulling the rug out on the traditional development strategy that equates development with industrialization. While nations may still export robofactured goods, these sectors will be more like oil wells, which create value and exports but few jobs.

The premise of this paper is based on an extreme thought experiment. That is, we ask: what does development look like when manufacturing becomes jobless, but most services are freely traded? More precisely, we assume that digitech's advance has no effect on the trade costs of goods, but a big effect on the labour cost share for manufacturing goods. For services, we assume the opposite: trade costs for services fall a lot, but the labour cost shares are unaffected. The basic point is illustrated in Figure 1.

[1] This paper draws on previous work the authors have published; it is intended as a policy piece aimed at a broader audience rather than a free piece of original research.

Figure 1: Globotics and development



Source: authors' elaboration.

We start with a historical perspective on the current transformation (Section 2) before turning to a consideration of the technology (Section 3) and a closer look at the economic logic that is making manufacturing jobless and services traded (Section 4). These background considerations are then matched with case studies that contrast the experiences of India, the Philippines, and China (Section 5), and a more thorough consideration of a form of services trade called telemigration (Section 6). The paper ends with a section on how we might conceptualize service-led development (Section 7) and a consideration of how mindsets might have to change when switching from national development strategies premised on industrialization and those premised on service exports (Section 8).

2 The globotics transformation in historical perspective

Many believe that the economy is on the cusp of a third grand transformation; there are various names for it—the 'rise of the robots', the 'second machine age', and the Fourth Industrial Revolution'–to name a few (see Brynjolfsson and McAfee 2014; Bughin et al. 2018; Ford 2015; Schwab 2017). Another name for it is the globotics transformation—a portmanteau that stresses how the changes are being driven by *both* globalization and automation. We start by putting the globotics transformation into historical perspective to illustrate how grand transformations naturally arise from technological breakthroughs (Table 1).

The first transformation shifted people from farms to factories and it was driven by mechanization. The second transformation shifted people from factories to offices and it was driven by computerization. The third has yet to happen so its impact on jobs is harder to encapsulate; it is driven by machine learning and communication technologies (Table 1).

Table 1: The three grand economic transformations of modern times

Transformation	Employment shift	Technological breakthrough	Related automation starts	Related globalization starts
The Great Transformation (industrialization)	From farm to factory	Mechanical power (steam, etc.)	1720	1820
The Service Transformation (post-industrial society)	From factory to office	Computerization	1973	1990
The Globotics Transformation (sheltered service society)	From service jobs to sheltered service jobs	Machine learning	2016?	2016?

Note: the year 2016 was chosen since *Fortune* and *Forbes* magazines dubbed it the year of artificial intelligence (AI) (despite the phrase having been coined in the 1950s).

Source: authors' elaboration.

2.1 The Great Transformation

The first transformation—what Karl Polanyi called the 'Great Transformation'—started in the early 1700s. It moved people from the farm to the factory, and from the countryside to the city—all while shifting the focus of value creation from land to capital.

This one really does deserve its capitalized 'G'. As well as lengthening life expectancies, eliminating plagues and pests, supporting a quantum jump in the human population, and sparking modern economic progress, it produced two World Wars, the Great Depression, as well as the rise of imperialism, fascism, communism, and New Deal capitalism.

According to O'Rourke and Williamson (2001), modern globalization started around 1820. The automation aspect of the Great Transformation started a century before, when commercially useful steam engines were first deployed.

Within rich nations, the transformation eventually lowered income and wealth inequality in a dramatic fashion—the last phase of which is called the Great Compression (Goldin and Margo 1992). The nature of technology helps explain this.

Mechanization put massive power into the hands of manual workers and thus vastly boosted their productivity. It also helped people who worked with their heads—think of ballpoint pens, calculators, electric lights, and telephones—but the technology's first-order effect was to create better tools for manual work, not for mental work. Since manual-worker wages were lower than average to start with, the pro-manual bias of the technology was equalizing.

However, that is not what happened internationally. While equalizing within industrialized countries, the transformation was unequalizing across nations.

For developing nations, a key aspect of the Great Transformation was the 'Great Divergence', or what Lant Pritchett (1999) calls 'Divergence, Big Time'. Civilizations in Asia and Africa—which had dominated world economic, political, cultural, military, religious, artistic, and social matters for over 4,000 years—found themselves under the thumb of previously primitive countries in the

northwest promontory of the Eurasian landmass, together with their settler offshoots (Fernandez-Armesto 1995; Frankopan 2016).

2.2 The services transformation

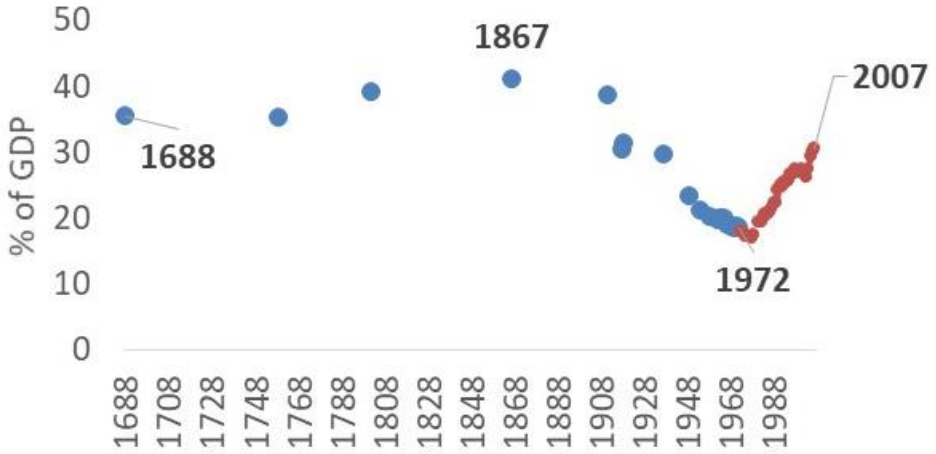
The second transformation, which was a shift to a post-industrial society, might be called the 'services transformation'. It started in the early 1970s when the share of jobs in industry peaked in many rich nations and workers started moving from factories to offices (Touraine 1971). Urbanization continued apace, but the source of value creation started shifting from capital to knowledge—eventually giving rise to what some call 'capitalism without the capital' (Haskel and Westlake 2018).

The automation part of this second economic transformation can be dated to 1973—the year the computer-on-a-chip was patented. As it turned out, the combination of computer chips and robotic arms permitted the automation of many manufacturing tasks that previously required humans.

The globalization part came around 1990, when information and communication technology (ICT) reached a level that allowed rich-nation firms to unbundle their factories and ship some stages abroad, along with chunks of their advanced manufacturing know-how (Baldwin 2016). Globalization now meant factories crossing borders, not just goods crossing borders. The big change, however, was not the offshoring of jobs, it was the ability of rich-nation manufacturing firms to create a new form of competitiveness. Now they could make manufactured goods with high-technology combined with low-wage labour. Before, firms had to use high-tech and high wages in rich nations, or low-tech and low wages in poor nations.

In industrial nations, computerization reversed the equalizing trend associated with the first transformation (Figure 2). Computerization destroyed jobs for those who worked mostly with their hands (in factories) while making jobs for those who mostly worked with their minds (in offices). ICT, in other words, created good substitutes for those working with their hands but better tools for those working with their heads. Since incomes of the 'hand workers' were lower than those of the 'head workers', the biased technological progress drove inequality to late nineteenth-century levels. Again, the international impact was the opposite.

Figure 2: Equalizing and unequalizing economic transformations: share of UK income, top 5% of earner, 1688–1972



Source: authors' elaboration, based on Baldwin (2019).

A key implication for the developing world was a partial undoing of the Great Divergence. Once the new technology launched the new globalization, where factories were crossing borders, it produced what could be called the 'Great Convergence' (Baldwin 2016). The advanced economies deindustrialized and their growth diminished, while many developing nations industrialized and their growth boomed.

The nature of the new globalization helps explain the turnaround in international inequality. The geographic unbundling of manufacturing facilities and offshoring of some manufacturing stages was accompanied by an unprecedented international shift of manufacturing know-how. The Canada-based firm Bombardier, for example, started making the tails of some of their business jets in central Mexico, but not with Mexican manufacturing know-how. Bombardier 'taught' Mexico how to make parts that would have taken the latter decades to master on its own. Industrial offshoring, in other words, was a massive movement of technology from rich-nation firms to facilities located in a handful of developing nations (those who got to join global value chains).

And then the equalizing impact spread. Rapid industrialization of a handful of developing nations triggered rapid income growth, which in turn launched a commodity super-cycle. Commodity-exporting developing nations experienced rapid commodity-export-led development as a result. The G7's share of world gross domestic product (GDP), for example, fell from about two-thirds in the late 1980s to under one-half today due to the fact that many emerging markets grew two to five times faster than those of the G7 countries.

2.3 The globotics transformation

The third transformation has just started, so all that follows is conjecture. Like the last one, this transformation is likely to focus on the service sector, but the impact is likely to be very different—especially for developed nations. Workers in advanced economies are likely to shift from service jobs to 'sheltered' service jobs (Baldwin 2019). In this paper, we argue that workers in developing nations are likely to shift from agriculture and manufacturing to export-oriented service sectors.

Inside developed and developing nations, this is likely to be unequalizing, but the transformation is likely to continue the 'Great Convergence' internationally as more emerging nations develop on the back of service-export-led growth. Urbanization is likely to continue worldwide. Value creation is likely to continue shifting from capital to knowledge (human capital and explicit intellectual property).

The impact of mechanization, computerization, and now machine learning on automation are easy to grasp. Understanding the dramatic shifts in the nature and consequences of globalization requires some background since it does not fit in the standard paradigm that focuses on goods crossing borders.

2.4 Understanding globalization's radical changes

Changes in globalization are a big part of how digital technology is changing the realities facing developing nations. Since we are discussing the third big change in globalization, it is worth putting it into a framework in which the changes all fit together in a single piece of intellectual infrastructure. One name for this is the 'three cascading constraints' view of globalization.

The framework views globalization as international arbitrage, focusing on arbitrage in mostly goods in the first phase of globalization, goods and manufacturing know-how in the second phase

of globalization, and goods, know-how, and labour services in the third.[2] Arbitrage in these three things is hindered by the cost of moving goods, know-how, and people. The three phases of globalization emerged in sequence when these three costs changed: first the cost of moving goods (thanks to steam power), then the cost of moving ideas (due to ICT), and lastly face-to-face costs (owing to digital technology). We start with globalization's first phase.

Globalization's 'first unbundling' launches the Great Divergence

Modern globalization started in the early 1800s with arbitrage in goods. Technological breakthroughs in mechanical power radically lowered the cost of moving goods over long distances. Once this was possible, national differences in comparative advantage made it profitable. This was globalization's 'first unbundling'—the spatial unbundling of production and consumption of goods (before, the production of most goods was spatially bundled with their consumption).

Lower trade costs, however, didn't make the world 'flat'—just the opposite. The world's economic geography became lumpier. Inside industrializing nations like Britain, manufacturing shifted from cottages to factories. Why was this?

The ability to sell to world markets shifted the advantage to firms operating at previously unknown scales of production, which involved previously unknown levels of complexity. To economize on coordination costs—basically communication costs—firms microclustered the production into huge factories. Interestingly, this knock-on effect of globalization produced a revolution in human affairs.

Large-scale manufacturing boosted the demand for innovation. Any firm that could make goods better or cheaper received a handsome reward in the world market. Simultaneously, the microclustering of production boosted the supply of innovations since it meant having lots of people in the same place thinking about similar problems. Productivity surged in today's advanced economies and this sparked a cycle of industrialization, innovation, and income growth. But since it was still very difficult to move know-how across borders—especially the sort of complex, tacit knowledge it takes to run large-scale industry—the innovations stayed local.

This is why advanced-economy growth took off sooner and remained faster than it did in the ancient civilizations in China, India/Pakistan, Egypt, Iran, Iraq, Turkey, etc. Due to the magic of compound growth, the two centuries of income growth asymmetries produced what Kenneth Pomeranz called 'the Great Divergence' (Pomeranz 2000). For example, per capita incomes weren't too dissimilar in the USA and China in 1820, but by 1970 US income was almost 20 times higher.

In short, mechanical power loosened the constraint on arbitrage in goods, but not the constraint on arbitrage of know-how. The booming trade in goods combined with little trade in know-how meant that the North industrialized and grew while the South deindustrialized and grew more slowly.

Little wonder, then, that manufacturing-led growth became an idée-fixe in the minds of scholars and governments. Globalization's next phase did nothing to unfix the idée.

[2] Many other things could be added to this list, especially, financial capital.

Globalization's 'second unbundling' and the Great Convergence

The constraint on moving know-how across borders loosened from the late 1980s with revolutionary advances in ICT. Excellent, cheap, and reliable communications made it technically feasible to geographically unbundle the microclustered processes across borders and still keep the dispersed parts operating as a whole.

Once this 'second unbundling' was feasible, the vast wage gap caused by the Great Divergence made the unbundling profitable—or, more precisely, it allowed firms in advanced economies to arbitrage international differences in know-how per worker by combining their firm-specific manufacturing know-how with low wages in developing nations.

The North-to-South flow of know-how was not an unintended consequence; it was the key to the arbitrage. The point is that since the offshored production stages had to work together with those left onshore, the offshoring firms had to send their marketing, managerial, and technical know-how along with the offshored jobs. This, in turn, meant that the flows of knowledge that used to happen only inside rich-nation factories had now become part of globalization. These flows allowed a handful of developing nations to industrialize at a dizzying pace—and the result was a massive shift of industry from the North to the South.

This second unbundling was ultimately responsible for the 'Great Convergence' that the world has seen since the late 1980s, but the offshoring of production stages wasn't the driving force. It was the arbitrage of know-how. The point is that know-how is the key to modern growth, so the massive flows of manufacturing know-how sparked unprecedented rates of industrialization and income growth in the receiving nations. Since the handful of rapidly industrializing nations accounted for a big slice of the world population, the rapid income growth sparked a commodity boom, or super-cycle, that allowed many commodity-exporting nations, such as those in Africa, to profit from the second unbundling via commodity exports rather than participation in international supply chains. By the same token, the offshoring of industrial jobs amplified the loss of jobs from automation in the advanced economies.

These changes meant that the growth asymmetry from the first unbundling was flipped on its head. Some developing nations have grown many times faster than advanced economies since the 1990s.

Globotics and globalization's 'third unbundling'

The globalization part of globotics can be thought of as a 'third unbundling'—the geographic separation of labour and labour services. Digital technology is lowering face-to-face costs at a frenetic pace, and this, in turn, is making it easier for people to provide services internationally. Technology is making this separation feasible. Vast wage differences are making it profitable. In the arbitrage framework, this is international arbitrage in labour services.

We discuss this trade in services much more extensively below, especially 'telemigration', which is the sort of trade that happens when workers sitting in one nation telecommute into offices in another. Barriers to the export of labour services are not only about the cost of meetings; some types of service providers have to be in front of a machine to get the job done. But digitech is changing this reality, and the introduction of 5G will change it much more. There are already instances of these 'telerobots' being controlled at long ranges, including telesurgery and drone operations.

As various forms of virtual-presence technology are combined with human-controlled robots, an expanding range of manual services could be provided at a distance. At the high end, technicians could conduct inspections or undertake repairs from remote locations, and nurses in the Philippines could care for elderly people in Japan. At the low end, hotel rooms in Oslo could be cleaned by robots controlled by cleaners in Kenya. Lawns in Texas could be maintained by robots steered by Mexican gardeners sitting in Mexico.

As with telepresence, the widespread use of telerobots is constrained by high costs. But if it is possible to develop systems that allow surgeons to fix people at a distance, surely it is possible to develop systems that allow technicians sitting in Stuttgart to fix machinery in Brazil. Given the falling cost of manufacturing things, the rapid expansion of bandwidth, and the reduction in latency that will come with 5G, it would seem to be only a matter of time before the face-to-face and face-to-machine constraints are relaxed.

The implications for global economic geography are likely to be immense. Digitech will allow developing nations to better exploit their key comparative advantage, namely labour that is very low-cost, even when quality-adjusted. Developing-nation workers will not have to embed their labour in a good and then export the good to exploit this advantage. They will increasingly be able to export labour services directly. This should keep the emerging-market miracle going and allow it to spread. It is easy to imagine that Africa would tend to provide the services to Europe, Latin America, and North America, and Southeast Asia to Northeast Asia since time zones matter more for services.

3 Digitech: why this time is different

There is a very natural, very healthy tendency of economists to view research as a linear approximation around a steady state. Each contribution is small, and those that look like they are not are usually old wine in new bottles (no value creation) or, worse yet, new wine in old bottles (false value creation). The tendency is in full swing when it comes to many economists' reactions to digital technology. Digital technology, after all, is really just ICT that is faster and cheaper. Since ICT has been a factor since the late 1980s or early 1990s, claims that digitech is changing the world tend to get classified as old wine in new bottles. In this section, we make the argument that something really has changed.

3.1 Computers gain a new type of cognitive capacity

When computers became generally useful in the 1970s, automation crossed one cognitive threshold. Computerization allowed the automation of many tasks that previously had to be done by hand. The way today's robot arms in automobile assembly plants sense and interact with chassis as they pass down the line would look very much like magic to a 1950s worker—or at the very least like science fiction.

But the range of tasks that could be automated is, even today, highly restricted compared to the vast range of tasks done by all workers in all occupations. Mostly, the automation affected routine, repetitive, manual tasks like those found in assembly line factories. Indeed a very large share of industrial robots work in the automotive sector. This limitation was not due to a lack of creativity on the part of factory designers. There was a very clear structural reason for the limited automation.

Computers back then were just following an explicit set of logical steps called a computer program. Automation was limited because computers were limited by programming; they were strictly

obedient to the computer code written by a human. Since the human could only program in the type of thinking that people understand, the cognitive capabilities of computers were limited to a narrow range of human thinking. This cognitive limitation created Moravec's Paradox.

Hans Moravec wrote: 'It is comparatively easy to make computers exhibit adult level performance on intelligence tests or playing checkers, and difficult or impossible to give them the skills of a one-year-old when it comes to perception and mobility' (Moravec 1988: 15). In short, computers were good at what humans found hard but bad at what humans found easy. The reason was all down to the nature of classical computer programming.

Humans taught computers to do things with computer programs, so computers could only perform mental tasks where humans understood precisely how we humans do the mental task. But as Marvin Minsky (1986: 29) put it, humans are 'least aware of what our minds do best'. Machine learning—which really came into its stride around 2016—solved the paradox by skipping the programming. The Nobel-winning psychologist Daniel Kahneman characterized Minsky's distinction between the thinking we do best and the thinking we are aware of as 'thinking slow and fast'.

With machine learning, computers started to be able to do some types of fast thinking as well as the slow thinking they'd been doing since the beginning. With machine learning, computers could do some of the things that human brains do well, but where it was impossible to write a classic computer program because humans are unaware of how they perform the task (like recognizing a cat in a photo). How does machine learning do this?

It is significant that computer scientists use the word 'training' instead of the word 'programming' when they develop computer programs to perform thinking-fast tasks. Machine learning 'trains' a very large statistical model that is designed to guess solutions to particular problems. This requires very large amounts of data and huge amounts of computing power to invert the matrices needed to 'train', that is estimate, the computer model.

With this new way of 'programming' computers, white-collar robots (i.e. AI software) can perform as well as humans in many new mental tasks, like photo recognition, handwriting recognition, or language translation. This is one key reason that this time is different. Software robots can perform a whole range of mental tasks that they could not before 2016 or so. Of course, the breakthrough was incremental and based on advancing ICT (gathering, storing, process, and transmitting information), but the result was quite discrete. Most people in developing nations are using vastly more AI-enabled services without even knowing it.

As it turned out, many of the new mental capacities gained by computers are useful in the office and service jobs, and so many new service-sector tasks are automatable now, whereas before they were not. This is one reason digital technology is more than just better ICT.

As far as development is concerned, the upshot is that many manufacturing tasks that previously required a human hand can now be automated with robot hands. And many office tasks involving information 'assembly line' work can be automated by robotic process automation (RPA) suites, virtual assistants, and the like. This matters in offices, but it is also leading to factories that need very few manual workers.

3.2 Globalization and automation are also affecting the service sector

To date, the gains and pains of globalization and automation have been mostly felt by the manufacturing sector or commodity-producing sectors—both in developed and developing

nations. Going forwards, the gains and pains will be felt by professional and service-sector jobs. But since most services are under-priced in developing nations compared to developed nations, it is likely that this will mostly be an export opportunity for developing nations and an import opportunity for developed nations. The basic point is that service jobs were shielded by high face-to-face costs. As digital technology tears down those barriers, the differences between the wages of accountants in, say, the UK, and in, say, Kenya, will narrow.

Another big difference between today's transformation and the last two is the timing. During the Great Transformation, globalization started a century after automation (1820 versus 1720). For the service transformation, the lag was two decades (1970 versus 1990). Today's globotics transformation is seeing new forms of globalization and automation taking off at the same time.

3.3 A different physics applies

Speed is another reason this time is different. Globalization and automation in the past two transformations were mostly about physical goods in the manufacturing, mining, and farm sectors. The globotics transformation will have its main impact on the moving and automating of the manipulation of digitized ideas—that is, data and services. The big difference lies in the fact that the laws of physics for data are very different from the laws of physics for goods.

To illustrate this difference, observe that it would be physically impossible to double imports and exports in 24 months. World information flows, by contrast, have doubled every two years for decades, and they are projected to continue doubling every couple of years for a decade at least. Electrons can ignore many of the laws of physics that slow down globalization and automation in industry and agriculture. This is why historical lessons must be treated with great care when applied to the third transformation.

The next section considers in more depth how digitech is making manufacturing jobless and nontraded while making services freely traded.

4 Globotics are making manufactures less traded and services more traded

Every economic theory starts with a handful of bold and useful—but incorrect—distinctions and assumptions. Or, as Krugman (1994) put it when describing Albert Hirschman's theorizing: 'You make a set of clearly untrue simplifications to get the system down to something you can handle; those simplifications are dictated partly by guesses about what is important, partly by the modelling techniques available. And the end result, if the model is a good one, is an improved insight into why the vastly more complex real system behaves the way it does.'

When it comes to trade theory, one of the most useful—but most incorrect—distinctions has been to separate things into traded and nontraded categories. When using simple models to talk about reality—where services often make up a very thick wedge of the economy's total production, consumption, and trade—the standard approach is to take all services as nontraded and all goods as traded. The usual justification is that the trade costs for services are many times higher than they are for goods since many services require face-to-face interactions and moving people is very expensive.

Since digitech is shifting the ground when it comes to automation of goods production and the cost that remoteness engenders for services, we review the basic economics of tradability as the

first step towards organizing our thinking on how digitech will affect the tradability of goods and services.

4.1 Production cost differences versus trade costs

We start from the simple proposition that goods will be traded if international differences in production costs (using a very broad definition of production costs) exceed international 'separation' costs, using a very broad definition of separation costs, that is the cost of moving goods, ideas, people, capital, and services from sellers in one nation to buyers in another. Operationalizing this point requires more specificity.

We conceptualize the cost of production of a given good or service as consisting of two components: the unit labour cost and the unit cost of all other inputs. The unit labour cost in sector *i* in a typical country compromises a unit labour input coefficient, a_i, and the wage, so that the unit labour cost is wa_i. The non-labour costs, which we denote as r_i, consists of machines, intermediate inputs, and the like. For simplicity, we assume labour is perfectly nontraded, but all non-labour factors are freely traded and so cost the same in all nations (thus r_i has no country subscript). The unit production cost for good or service *i* in a typical nation is thus:

$$c_i^n = w^n a_i^n + r_i \tag{1}$$

where *n* denotes the nation under consideration (the North in this case).

The proportional difference between the production cost of *i* in two nations (denoted by the superscript *n* and *s*) is:

$$\frac{c_i^n - c_i^s}{c_i^n} = \theta_L \left(1 - \frac{w^s a_i^s}{w^n a_i^n} \right) \tag{2}$$

where θ_L is the labour cost share in the North.

In words, this equation says that the cost difference depends upon the relative labour cost in the two nations and the importance of labour in total costs. A good or service is traded if the proportional production cost differences exceed the proportional separation cost. In the extreme, a labour cost share of zero would imply a zero production cost differential across countries since all other factors of production are freely traded.

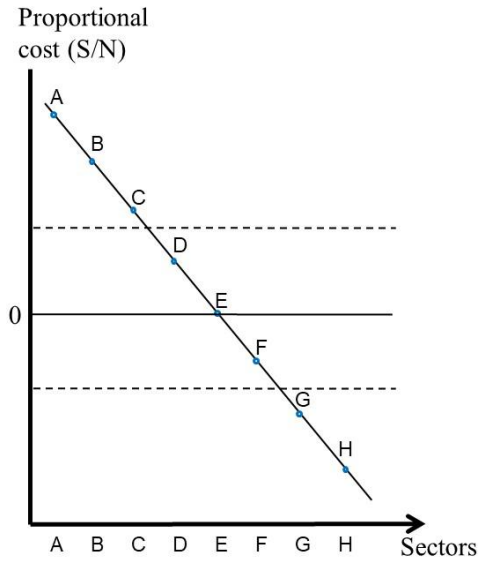
The endogeneity of tradability, and how digitech changes it, requires us to look across all goods and services. To this end, we employ a modified version of the Dornbusch et al. (1977) analysis. To start simply, we initially ignore trade costs and focus only on comparative advantage, which means, in a trading equilibrium, comparative costs.

4.2 Comparative advantage and trade costs in a simple diagram

Comparative advantage analysis starts with a comparison of nations' sector-by-sector competitiveness and we limit ourselves to two nations, the North and the South, to keep the analysis simple. We assume the North is at the technological frontier while the South is not in the sense that Northern labour is more productive in every sector. We also assume that the North's technological edge is greater in some sectors than others. Since Northern labour is more productive in every sector, the Northern wage, in equilibrium, exceeds the Southern wage (measured in terms of the numeraire).

As is well-known from standard comparative advantage analysis, equilibrium wages will be such that the North's comparative advantage sectors are those where its technological strengths are most marked. For the South, its comparative advantage sectors are those where its technological weaknesses are the least telling. A simple way to illustrate this is to plot the proportional production cost difference for each sector, namely $(c^s - c^n)/c^s$, having labelled the sectors so that the differences are declining as in Figure 3.

Figure 3: Endogenous tradability diagram



Source: authors' elaboration.

The horizontal axis of Figure 3 lists the sectors—denoted by the shorthand A, B, C, etc., recalling that the sectors are labelled such that the North's cost advantage over the South is highest in A and lowest in H. Think of sector A as, say, a high-tech capital good, and sector G as, say, cotton shirts.

The North exports the goods/services where its technology edge outweighs its higher wage—that is to say, where the South's proportional cost difference is positive (sectors A to D); the South exports the other sectors. As a matter of convention, we assume that there is no production cost difference in sector E. Note that the North–South wage ratio is endogenous and not addressed in Figure 3. We know, however, that in equilibrium, the wages must adjust such that the North exports some goods and the South exports others. Since the point of this conceptualization is to examine the determinants of tradability, we introduce trade costs.

Even in today's world, trade costs are quite substantial for most manufactured goods. One often-cited estimate by Anderson and Van Wincoop (2004) puts the ad valorem cost at 170 per cent on average. More recent work indicates that these costs have fallen, but not much; trade costs are still adding something like 100 per cent to the price of imported goods on average. Allowing for trade cost is simple in the figure. The trade costs are represented by the dashed horizontal lines.

Consider a sector, like sector D, where the South's proportional production cost is higher than the North's, but the gap is less than the per-unit trade cost (i.e. sector D is below the upper horizontal dashed line). In this case, Northern goods will not be cost-competitive in the South, given that they must bear the trade costs. By the same token, Southern sector D goods are uncompetitive in the North, so each nation makes its own sector D goods. Good from sector D are thus

endogenously nontraded; their production is fully localized. Or to put it in unbundling terms, production and consumption are fully bundled in sector D. The same holds for sectors E and F.

This setup allows us to focus on two determinants of tradability—the trade costs and the labour cost share. Automation is rapidly lowering the latter.

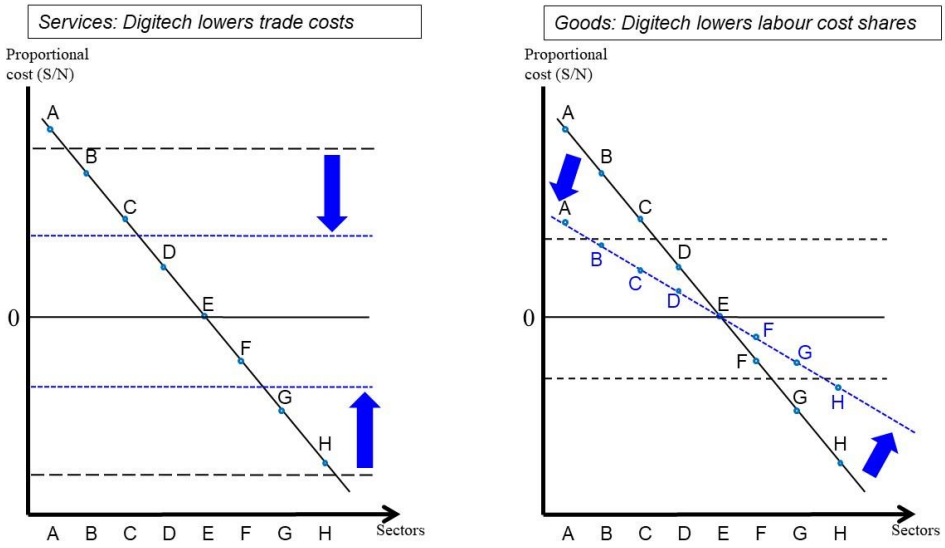
4.3 Digitech drives manufacturing automation and lowers service trade costs[3]

All around the world—including in developing nations—machines are taking over tasks that used to be performed by workers. The result has been a significant drop in the number of workers involved in manufacturing and thus a drop in the labour cost share (see, for example, Dauth et al. 2018; Dinlersoz and Wolf 2018). Whereas jobs in developing countries still are less exposed to automation by ICT, this is now changing with rising exposures in developing economies and falling exposures in developed countries (Das and Hilgenstock 2018). The resulting reduction in labour cost shares dampens comparative advantage based on international differences in technology and wages.

A core premise in this paper is the claim that advancing digitech is lowering trade costs and lowering labour cost shares in both goods and services, but not at the same pace. For services, digitech is radically lowering trade costs, but lowering the labour cost share only marginally (since robotic automation is still mostly focused on manufacturing). For manufactured goods, digitech is only marginally lowering trade costs (the big steps came with containerization and air cargo), but radically lowering the labour cost share via robotics.

We simplify to clarify by positing extreme assumptions. We assume that digitech's advance has no effect on the cost of trading goods, but a big effect on labour cost share in goods production. For services, we assume the opposite: digitech has a big downward effect on the cost of trading services, but an insignificant impact on the labour cost shares in services. The effects of these assumptions are easy to study in Figure 4.

Figure 4: Digitech's impact on the tradability of goods and services



Source: authors' elaboration.

[3] This section draws heavily on Baldwin and Forslid (2014) and Baldwin (2016: ch.7).

Intuitively, the pair of results from the left and right panels says that when labour cost differences are the key to international competitiveness, labour-saving automation dampens international production cost differences. Given constant trade costs, the result is a 'rebundling' of consumption and production. But when digitech primarily lowers trade costs and has little effect on trade cost shares, the result is more types of services being traded. Obviously, our extreme assumption on labour cost shares and trade costs could be softened and the impact on endogenous tradability would depend upon the balance of the two changes.

This analysis puts aside a whole range of important factors. Perhaps the most important is the endogeneity of the relative wages. A massive reshuffling of tradability of goods and services would surely have a massive impact on relative wages—just as globalization's first and second unbundlings did during the Great Divergence and Great Convergence. We do not account for that in this diagram, but it would be simple to include.

In the diagram, a relative wage change would show up as a secondary shifting down in the cost-competitiveness lines—assuming that the extra service-export opportunities would boost the productivity of Southern labour more than it would boost the productivity of Northern labour. While allowing for such considerations will be important in a more formal presentation of the theory, it is clear that the shift of the trade cost line for services and a relative cost-curve rotation for goods would lead to qualitatively identical outcomes—services would become more tradable and remain labour intensive, while manufactured goods would become less tradable and less labour intensive. The effect of digitech on goods trade can already be seen in data; Artuc et al. (2018), for example, find that robotization leads to a significant reduction in net imports from less-developed countries within the same sector.

Labour service arbitrage in a CAGE

The sorts of trade costs that come to mind when using Figure 4 are largely related to shipping costs and policy barriers. But these are not the only costs that matter—especially when it comes to services. The business professor Pankaj Ghemawat has captured many aspects of this point with his CAGE framework, which stresses that cultural, administrative, geographic, and economic (CAGE) differences between countries create barriers to international commerce (Ghemawat 2001).

Digital technology can help lower some of these, but not all. As we shall see in the case study of the Philippine service-export industry, one factor that is commonly cited as an advantage for the country is the ability of Filipinos to understand Western, especially American, ways of thinking. This is not the place to delve deeply into the implications of broader constraints on labour services crossing borders, but it is worth noting that digitech alone will never produce a completely level playing field across advanced- and emerging-economy labour markets.

We turn next to case studies of three countries that have followed different development routes.

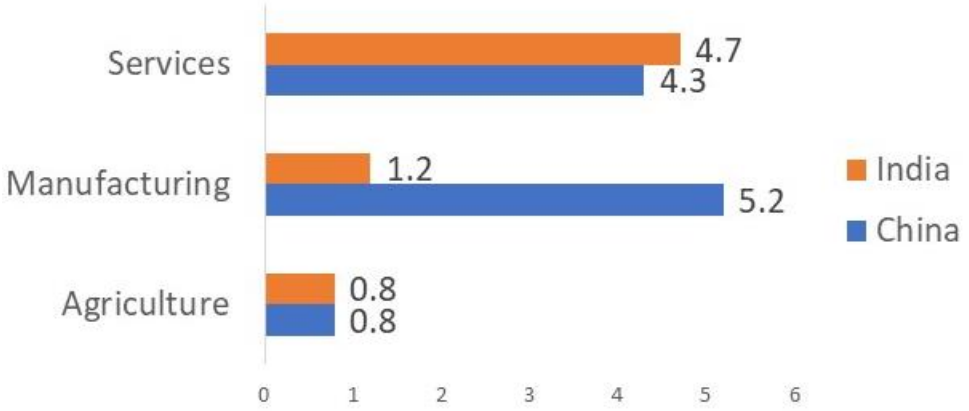
5 Three case studies: India and the Philippines versus China

Since at least the 1950s, development theory has stressed industrialization as a key to development. China is perhaps the classic example of this trade-and-development paradigm. A very different development journey was taken by India—at least de facto. Most of the policy and scholarly thinking about India's experience remained firmly focused on manufacturing, but facts on the ground turned out differently. For example, Basu (2018) describes, saying: 'What India saw

subsequently was a most unusual growth pattern for a developing country. It was not the manufacturing sector that led India's growth but the services sector.'

Two charts help illustrate the stark contrast between China, which 'did it' based on manufacturing, and India, which 'did it' based on services. Figure 5 shows the sectoral contribution to overall GDP growth stemming from each of the three sectors—agriculture, manufacturing, and services.

Figure 5: Contribution of different sectors to total GDP growth rate, 1990–2012 (percentage points)

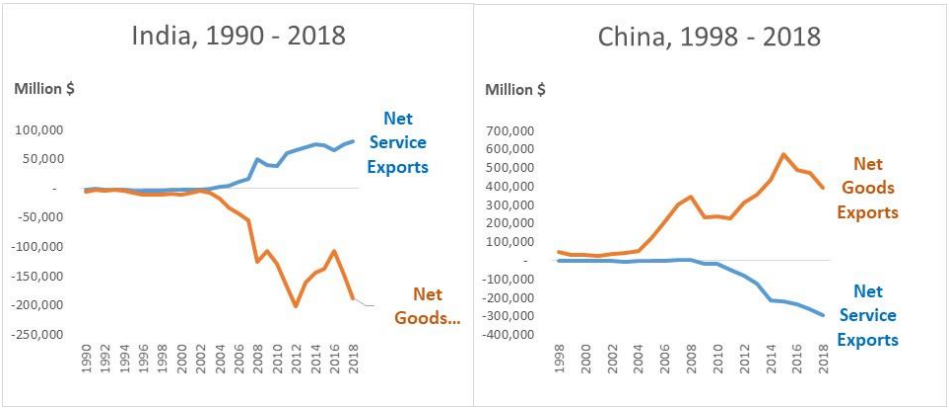


Source: authors' elaboration based on data from Ghani and O'Connor (2014).

China's overall growth was much higher than India's, 10.3 versus 6.7 per cent, but the chart clearly shows that while manufacturing was the dominant sector in terms of growth in China, services were the driving sector in the Indian case.

Figure 6 shows the evolution of net trade positions of the two nations in goods versus services. Since neither India nor China is a major commodity exporter, most of the goods exported are manufactured goods.

Figure 6: Evolution of net trade positions, India and China



Source: authors' elaboration based on online World Bank Data.

The rapid growth period from around 1990 was associated with India becoming a substantial net exporter of services and a net importer of goods. The Chinese experience was just the opposite. China's balance of trade in goods swung to the positive—suggesting that it has a comparative advantage in goods—while its balance in services swung into negative territory.

Behind this rather stark, macro-level contrast are two enticingly similar development stories. We start with India's.

5.1 India's trade and development journey

India threw off the yoke of British imperialism in 1947 and settled into a development strategy based on classic 1950s principles. It sought to drive development via rapid industrialization, and that drive was marked by heavy-handed state intervention and an explicit anti-trade and anti-international investment bias.

Rapid industrialization was the goal. The path was lighted by five-year plans that guided the central planning body to focus massive resources on the creation and expansion of large industrial state-owned enterprises. This led to inefficiency of the type that was not uncommon in centrally planned systems—but with Indian characteristics.

One telling example is that of the Haldia fertilizer plant (Das 2000). This facility was established in the 1970s, employing some 1,500 workers, and it was a success in some sense. The employees and managers were diligent, showed up to work, and kept the facilities in good shape. Many were housed in a nearby newly built township that had excellent roads, schools, and homes. The problem was that the plant never produced even an ounce of fertilizer due to a whole series of problems. This went on for 21 years.

State-owned enterprises, however, were not the only problem. A particularly notable element of the central planning was the tight leash on which planners held private industry. The pervasive strictures came to be known as the 'licence Raj'. It required firms to have permits for almost everything. To keep private firms aligned with the plan, firms need a government licence to expand, produce new goods, change the input combination, import inputs, or move production plants. On top of this heavy-handed intervention, hiring manufacturing workers was (and still is) a risky business in India given its extreme employment protection laws—which, even today, are stricter than those of many Southern European nations. The result was widespread shortages, delays, and bottlenecks. For example, Indians had to wait eight years to buy a scooter.

The development results of this strategy were modest. Industry's share of GDP rose from about 15 per cent to about 25 per cent in the first two decades, 1950–1969, but the share has risen only a couple of percentage points more in the subsequent five decades. Overall growth performance was low on average and highly variable—at least in part since agriculture's high share of GDP (over 40 per cent) held the economy hostage to weather shocks.

The development strategy started to change in the 1980s. There was a mild loosening of the licensing regime and foreign trade and investment restrictions (Panagariya 2004; Rodrik and Subramanian 2005). Average growth rates rose, but part of this stemmed from fiscal spending that turned out to be unsustainable—a fact that became clear after the 1991 Gulf War debt shock. The shock raised the cost of imported fuel at the same time as it crushed remittances from Indians working in Gulf states.

To stave off a foreign exchange crisis, India turned to the International Monetary Fund (IMF) in 1991 for credit lines—and the credit had strings attached, namely reform. By this time, thinking in India and around the world had shifted away from the old, statist, self-reliance path, and towards more reliance on markets and openness. There are many causes of this shift in development thinking, but the stark contrast between the collapse of the ultimate planned economy—the USSR—and the roaring success of East Asian export-dependent economies was surely critical in

changing many minds (planning was important in East Asia, but manufacturing was aimed at export markets, not just domestic markets).

In cooperation with the IMF, the Indian government dismantled the licence Raj, lifted price and entry controls on private firms, sold off several of the old state-owned enterprises, welcomed foreign investors, lowered domestic tax rates, and cut import tariffs unilaterally. Areas that remained largely untouched by reforms in the 1990s were the labour market; small-scale reservations (where there has been some movement only in the last 4–5 years); privatization both of non-financial enterprises and of banks; and further agricultural sector reforms.

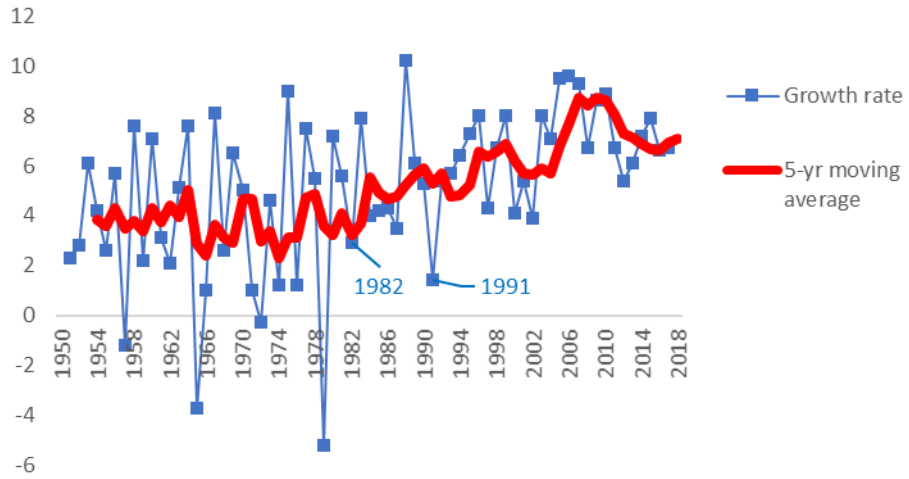
The liberalization of investment restrictions was particularly noteworthy. Before 1991, foreign firms were limited to 40 per cent ownership. When this limit was lifted, many multinationals increased their stakes. The outcome was a several-fold increase in foreign direct investment (FDI) in just three years (Gosai 2013).

Many G7 firms shifted part of their research and development departments to India (to reduce costs and overcome talent shortages). Likewise, the unbundling of services benefited India's middle-income workers as the country attracted outsourced call centres, medical billing back-office services, business administration services, and all sorts of skilled labour-intensive insurance-related services.

The foreign investment combined with local information technology (IT) and engineering expertise produced masses of new good jobs and triggered the growth of a thriving middle class. This new mass domestic market, in turn, primed the growth pump. It attracted more foreign investment and stimulated job and firm creation, which rose to meet the rise in Indian consumer demand.

The reforms helped the overall growth rate to rise from its sub-4 per cent performance for most of the post-independence period. In recent years, India has become one of the great growth success stories of the twenty-first century, and this has lifted hundreds of millions of people out of abject poverty. From the 1980s, but especially from the 1990s, India's growth shifted into higher gear. Now, an annual growth rate of over 8 per cent is expected by many (see Figure 7), and poverty rates have dropped by half (from 55 to 28 per cent) between 2005 and 2015 according to the United Nations Development Programme's (UNDP's) multidimensional poverty index.

Figure 7: Indian GDP growth rate, 1950–2017



Source: authors' elaboration based on UNDP Global Multidimensional Poverty Index.

Note that the connection between the reforms in the 1980s and 1990s and the resulting growth take-off has been questioned by Rodrik and Subramanian (2005). They argue that the growth was not the outcome of economic or policy changes, but rather due to social-psychological factors that they call 'an attitudinal shift' towards a pro-business stance. As they put it: 'the trigger for India's economic growth was an attitudinal shift on the part of the national government … that unleashed the animal spirits of the Indian private sector'. Panagariya (2004) disputes their conclusions, arguing for a more traditional policy-linked explanation, where trade liberalization and relaxation of industrial controls had a major role.

The service sector and export boom

The post-reform growth pattern, however, was not what many were expecting. The received wisdom was that adopting the 'Washington Consensus' reforms would unleash rapid industrialization and manufactures-export-led growth. In India, however, the services sector took the lead (Basu 2015; Murthy 2004; Nayyar 2006). Conventional thinking about development, especially trade and development, has largely ignored services in general and service exports in particular, so this outcome was unexpected.

The canonical treatment about what we should expect from services in the course of economic development is the study by Eichengreen and Gupta (2011). They document two distinct phases where the service sector is important in development. When an economy moves from low-income to middle-income, various informal services sectors grow rapidly. When it moves beyond middle-income, more sophisticated service sectors become important—like IT and finance.

India's post-1991 growth performance was, in essence, the second phase come early in the Eichengreen–Gupta story. Basu (2015) describes it thus: 'this second-stage services sector growth that happened in India, rather early and with a vigour rarely seen anywhere else'. Even stranger was the fact that the leading service sectors were those of the 'knowledge economy'—a set of activities that were 'traditionally viewed as the preserve of advanced economies'. But perhaps the outcome should not have been so unexpected, given the constraints on Indian manufacturing production and trade.

The Indian education sector has long favoured high-quality universities, especially in science, technology, and engineering disciplines. As a result, it had an abundance of well-trained and talented technological workers. While this might have fostered manufacturing as it did in Germany and Switzerland, the policy environment did not allow it. The reforms removed some of the barriers, but key limitations continued in Indian manufacturing. The poor transportation infrastructure and the great distance to the manufacturing giants (the USA, Germany, Japan, and China) tended to shelter the Indian market from foreign competition. While this might have fostered production, it also made India an unlikely participant in the global value chains that had become essential to competitiveness since the late 1980s.

Services, by contrast, were largely unaffected by these constraints. The service sector, especially the IT services sector, was untouched by transportation issues, faced no explicit import or export barriers, and additionally was largely untaxed. In short, what Basu (2015) calls 'India's over-production of engineers through the 1960s, 1970s, and 1980s' matched Silicon Valley's booming demand for tech workers (and the USA's underproduction of engineers).

For a variety of reasons (see Weiner 1991), India spent, and still spends, relatively far more resources on higher education than on primary education. India spent 86 per cent of per capita GDP on each student in tertiary education in 2000, while it spent 14 per cent of per capita GDP per student in primary education. By contrast, China spent 10.7 and 12.1 per cent of per capita

GDP per student in tertiary and primary education, respectively. And the students coming through this system were world-class: Indians got more than 50 per cent of the US non-immigrant work visas requiring specialized skills.

While it is impossible to identify the causes with certainty, the outcome was plain for all to see. India became a magnet for IT and knowledge-based jobs that were offshored from advanced economies. Western firms shifted their research and development activities to India in order to reduce costs and avoid talent shortages. It became host to outsourced call centres and many so-called business process outsourcing (BPO) activities, including many back-office jobs like medical billing, business administration, and labour-intensive insurance-related services. The rapid development of the sector was accompanied by the rise of several world-beating multinationals like Infosys, HCL, and Wipro.

5.2 The Philippines

'I couldn't do my job without her and I tell her that', related Alison De Kleuver when she was finance and operations director for the global company EY. Referring to Sandy, her Manila-based remote assistant, De Kleuver continues: 'She helps to optimise my time, both in what she does for me but also in organizing my schedule, and that is invaluable to me' (Tadros 2018). And it is cheaper: 'The key number is we're finding with this model that an offshore [Executive Assistant] costs approximately 40% of an onshore Executive Assistant', according to De Kleuver. That is a big saving as the firm used to spend between US$50,000 and US$95,000 for an executive assistant in Sydney or Melbourne. This is not an unusual story.

The Philippines has reaped the benefits of the technology-led freeing of service-sector trade. 'Rarely has a new industry traced the trajectory from concept to prime economic driver as quickly as business process outsourcing (BPO) has in the Philippines', noted a report by the consultancy Oxford Business Group (2016). The sector, particularly call centres, has seen stellar growth. The call centre subsector, for example, soared from just four with 2,400 employees in 2000 to 425 call centres with 373,500 workers in 2012 (Chang and Huynh 2016).

In 2000, the IT-based business process outsourcing (IT-BPO) sector contributed almost nothing to the nation's GDP; in 2016 it accounts for about 7 per cent of GDP and employs over 1.1 million people—1000 per cent more than in 2004 (IBPAP 2016). Indeed, IT-BPO is the country's largest private employer of white-collar workers. The industry projects the creation of over 600,000 new jobs in the sector by 2022. And they are good jobs: in the Philippines, IT-BPO employees typically earn twice the national average.

A bit on the history

Why the Philippines? The answer lies partly in factor 'endowments' and partly in government policy. The international BPO industry was attracted by the country's youthful, literate population, armed with good English-language communication skills. Some analysts also cite Filipinos' strong customer-service orientation and adaptability to consumers' Western culture as an advantage (IBPAP 2016). It also helped that the government set up special economic zones in 1995 that provided tax incentives to call centre operators.

While the push was led by call centres, the availability of talented, low-cost service workers attracted multinationals interested in setting up 'shared services offices', namely offices where a variety of the company's operations (like accounting, payroll, human resources, some legal services, and IT services) are clustered together and offshored to reduce the wage bill. The companies

engaging in this include HSBC, Standard Chartered, Capital One, Citibank, and JP Morgan, as well as Accenture, Oracle, Microsoft, and Dell.

The industry was initially clustered near Manila but it has more recently started to spread well beyond—thus helping regional development in the Philippines. The industry is expanding into what they call Next Wave Cities such as Baguio, Bacolod, and Cagayan de Oro.

International freelancing, while not as large as BPO activities, is also important. There is no official data on freelancing, but a survey conducted by PayPal suggests that freelancing is booming in the Philippines. The firm estimates that there are approximately 1.5 million freelancers in the country, and most of them were expecting to do more freelancing in the future. Many of them are young, with 90 per cent of respondents under 40 years old; 61 per cent were women. In terms of services provided, about one-third engaged in data entry or internet research. A large share, about 60 per cent, were working for clients in the USA. Most obtained work via internet freelancing platforms like Upwork.com, Freelancer.com, or Shutterstock.com (*PayPal Global Freelancer Insights Report 2018* as cited by Esmael 2018).

Policy support

The country launched into labour service exports via call centres where Filipinos answered phone-in questions. The Philippines, however, has experienced a very clear 'upgrading' in its labour service exports. Activities are moving up the skill/wage scale into what is known as knowledge process outsourcing, including back-office services such as healthcare processing and coding, legal transcription, IT outsourcing, and—more recently—animation and game development. The sector is increasing selling high-end services like data analytics, business and financial research, mortgage servicing, software development, legal process and patent research, and engineering. It is estimated that there are already 200,000 Filipinos working in these higher-paid knowledge process outsourcing jobs (Oxford Business Group 2016).

The IT-BPM Roadmap 2022 (IBPAP 2016) classifies the jobs under four main headings with a number of subheadings:

- Contact Center and BPO subsector
  - Engineering Services Outsourcing (ESO)
  - Data Analytics
  - Performance Management
  - Legal Process Outsourcing (LPO)
- Information Technology (IT) Services subsector
  - Application Development Management (ADM)
  - System Integration
  - Automation Enablement
  - IoT-Enablement languages
- Health Information Management (HIM) subsector
  - Preventive Health
  - Remote Healthcare Management
  - Provider Services
- Animation and Game Development subsector
  - 3D Animation
  - Augmented & Virtual Reality (AR/VR)
  - Gamification

This move into higher-value-added IT-based services depended critically on two key laws: the Data Privacy Act of 2012, which established penalties for unauthorized use or disclosure of personal information; and the Cybercrime Prevention Act of 2012, which set up a legal framework to identify, prevent, and punish cybercrime.

Education policy has also been supportive. The 'machinery' of IT-BPO are not machines; they are humans. Education and training are thus critical to keep the industry expanding and upgrading. Noting this, the leading industry association, IBPAP, worked with the government's Commission on Higher Education to maintain the flow of skilled service-sector workers. One notable output of the cooperation was the Service Management Program, which offers specialized courses for students of business administration, management, or IT, with the goal of placing them in entry-level IT-BPO positions. The programme also funds a 'train the teachers' programme, again focusing on teaching IT-BPO subjects to the industry's standards. The effort has spread across the country and now includes 17 state universities and colleges.

The future is looking bright, according to the IT-BPM Roadmap 2022. By 2022, the sector is projected to account for 7.6 million direct and indirect jobs—half a million of which would be outside the Manila area. Of these, one million are projected to be in higher-value jobs. To support this growth, the government created a Department of Information and Communication Technology.

In terms of policies to support future growth, the industry has concentrated on three action areas: (1) widening and deepening human capital by scaling up industry public–private partnerships; (2) strengthening Philippine attractiveness as an investment destination through advocacy activities; and (3) building the Philippine IT-BPM brand globally through marketing programmes.

Automation poses challenges

Globally, automation is creating displacement in the service sector as well as the manufacturing sector. While the biggest impact is likely to be in advanced economies, the trend is affecting the Philippine service-export sector. A global network of shared-service and outsourcing professionals, called SSON, has produced a report that looks into some of the challenges (Shared Services and Outsourcing Network 2018). It notes: 'While local Shared Services providing global enterprise support will continue to play their role, there is no denying the signs that robotic process automation (RPA) is emerging as a solution that will impact the offshore services equation.' RPA is a widespread form of service-task automation that is spreading to offices around the world. It allows computers to take over some 'knowledge assembly line' tasks that used to require humans until machine learning became commercially viable.

Some of the Philippines-based companies in the sector have started to embrace RPA solutions as part of the services they offer to advanced-economy firms. For example, they can offer RPA-based automation with humans that can deal with the inevitable exceptions that the RPA cannot manage. One consulting firm active in the area relates the example of Philippine outsourcing firms leveraging chatbots, machine learning, and natural-language processing in the contact centres to enhance the capacity and productivity of their human workers in handling customer interactions (Karthik and Kala 2019).

5.3 The Chinese case

The People's Republic of China was founded on 1 October 1949 by the Communist Party of China under the leadership of Mao Zedong, ending the long chaotic period that followed the 1911 overthrow of the Qing dynasty. Industrialization was shallow in 1949 and largely a coastal

phenomenon. In 1952, the secondary sector produced 8 per cent of GDP and employed 7 per cent of the workforce, whereas the primary sector produced 74 per cent of GDP and employed 84 per cent of the workforce. The coastal provinces had 72 per cent of fixed assets and accounted for 69 per cent of the gross value of industrial output (Yang 1997). Naturally, the Communist Party at its accession to power in 1949 saw its most important economic task to be industrialization.

A large share of the country's economic output was directed and controlled by the state, which set production goals, controlled prices, and allocated resources throughout most of the economy. During the 1950s, all of China's individual household farms were collectivized into large communes. To support rapid industrialization during the 1960s and 1970s, the central government undertook large-scale investments in physical and human capital. As a result, by 1978 nearly three-quarters of industrial production was in centrally controlled, state-owned enterprises, following centrally planned output targets. Private enterprises and foreign-invested firms were generally barred.

A central goal of the Chinese government was to make China's economy relatively self-sufficient. Foreign trade was generally limited to obtaining those goods that could not be made or obtained in China. The State Planning Commission's import plan covered more than 90 per cent of all imports. The export plan was similarly comprehensive, specifying the physical quantities of more than 3,000 individual commodities. Prior to 1978, a handful of foreign trade corporations owned and controlled by the Ministry of Foreign Trade were responsible for carrying out the import and export plans. The volume of Chinese trade, relative to world trade, declined sharply from 1.5 per cent in 1953 to 0.6 per cent in 1977 (Lardy 1994: 2).

In 1978, things changed. China decided to break with its Soviet-style economic policies by gradually reforming the economy according to free-market principles and sequentially opening up to trade and investment with the West, in the hope that this would significantly increase economic growth and raise living standards. As Chinese leader Deng Xiaoping, the architect of China's economic reforms, famously put it: 'Black cat, white cat, what does it matter what colour the cat is as long as it catches mice?'

Growth accounting reveals that much of China's rapid economic growth after 1979 can be attributed to two main factors: large-scale capital investment (financed by large domestic savings and foreign investment) and rapid productivity growth (Bosworth and Collins 2008). This coincided with a massive reallocation of labour from agriculture to non-agriculture, made possible by a green revolution in agriculture that sharply increased productivity in this sector. The share of the labour force in agriculture fell from 75 per cent in 1977 to 33 per cent in 2012, while the share of value-added produced in the agricultural sector fell from 30 to 5 per cent.

China also gradually reformed its trade regime. These reforms led China's foreign trade to soar from US$21 billion in 1978, when China at best was a marginal player in global trade, to more than US$2.2 trillion today, when China has become the world's largest exporter (National Bureau of Statistics data; World Bank Data).

The Open Door Policy

An important piece of China's trade reforms was the Open Door Policy that consisted of attracting FDI and promoting foreign trade in targeted areas. This opening up initially was limited to two southern provinces (Guangdong and Fujian), then gradually was extended to larger geographical units—first along the coast and then to the inland provinces. The open economic zones provided investors with various preferential tax treatments and exemptions on duties and from labour regulations. The leading role of this selective Open Door Policy in regional growth has been

emphasized by a great number of studies (e.g. Berthélemy and Démurger 2000; Chen and Feng 2000; Mody and Wang 1997).

FDI inflows did not occur immediately in large volumes in response to the establishment of special economic zones in Guangdong (1979) and in Fujian (1980), partly out of caution and partly because the liberal regulatory framework began to be introduced only in 1982. FDI started pouring in only from 1984 onward (when it doubled from US$0.6 billion in 1983 to US$1.3 billion in 1984). The second large acceleration of FDI inflow occurred in 1992, when it went from US$4.4 billion in 1991 to US$11 billion in 1992.

China's international trade expanded steadily along with China's share in global trade. The export basket diversified from light manufacturing to heavy manufacturing and electronics. Global value chains in the country expanded rapidly starting in the early 1990s—a trend that was accelerated by the lock-in provided by China's World Trade Organization membership in 2001.

6 Telemigration

Companies in G7 nations are turning to remote workers to perform an increasingly wide range of tasks. For the most part, these remote workers are in the same nation as the companies, so it is not globalization, but wage differences and talent shortages are driving more and more companies to turn to foreign-based online service workers, whom we could call 'telemigrants'. A recent study of Upwork contracts found that the top three nations hiring telemigrants were high-wage English-speaking nations—the USA, Australia, and the UK. The three biggest sources of telemigrants were the Philippines, India, and Bangladesh (Horton et al. 2017). The USA was the only high-wage nation that was both a major buyer and seller of this sort of online remote labour.

When it comes to accountants, computer programmers, engineers, nurses, and many other service jobs, complete replacement of a domestic worker with a telemigrant would be impossible, but some substitution of low-cost foreign remote workers for high-cost domestic workers would surely save money.

Who are today's foreign freelancers? The online payments company, Payoneer.com, queried 23,000 freelancers worldwide. About one-quarter of respondents were in Latin America and Asia, 20 per cent in Central and Eastern Europe, and about 15 per cent in both the Middle East and Africa (Sukman 2015). The vast majority of freelancers surveyed are in their twenties and thirties (about 85 per cent). A bit more than half had a university education. The companies paying for their services were about half in North America and Europe (split equally), about 15 per cent in both Latin America and Asia, and 7 per cent in Australia and New Zealand.

How fast will telemigration grow? The answer will differ across the various types of service sectors since some lend themselves much more easily to integrating remote workers or have more widely accepted standards. Government regulation will also surely play a large role.

6.1 Factors driving telemigration

There are four factors suggesting that telemigration will grow faster than most think in almost all sectors. Perhaps the most remarkable is how fast digitech is lowering the language barrier.

Machine translation now rivals average human translation for language pairs where large, hand-translated datasets are available. According to Google research, which uses humans to score machine translations on a scale from zero (complete nonsense) to six (perfect), in 2015 Google

Translate got a grade of 3.6—far worse than the average human translator, who gets scores like 5.1; by 2016, Google Translate had hit numbers like 5.

Machine translation is on smartphones, laptops, and tablets today. Free apps like Google Translate and iTranslate Voice are now quite good across the major language pairs, and machine translation is widely used. Google does one billion translations per day for online users. YouTube has instant machine translation for many foreign-language YouTube videos, showing the results instantly in the form of English subtitles. Instant and free-spoken translation is also possible with the Skype Translator add-on option.

Computing power and massive new datasets are the reasons why machine translation got so good, so fast. Machine-learning-trained AI systems can now recognize language patterns well enough to do human-level translation—the real constraint is the lack of human-translated sentences. For the language pairs where the data is available, the translation is good; for others, it is poor.

The switch came in 2016 when Jeff Dean switched the Google Translate AI team from hands-on programming to machine learning. The data constraint was relaxed when the UN posted online a dataset with nearly 800,000 documents that had been manually translated into the six official UN languages: Arabic, English, Spanish, French, Russian, and Chinese. The EU has also released huge datasets along with the EU Parliament, as did the Canadian Parliament. With data and the computer power to process it, the Google Translation app improved more in one month than it had in the previous four years.

Machine translation will fundamentally alter the global supply of service workers. About 400 million people speak English as their first language, and including good second-language speakers there are something like one billion people who could sell services in English online. It would seem that machine translation might multiply this number by two or three, creating a tidal wave of online talent.

6.2 Work reorganization and telecoms

Another factor that is accelerating the trend towards remote work is the way US and European companies are reorganizing themselves to make it easier to slot in telecommuting workers. They are using new collaborative platforms—things like Business Skype, Slack, Trello, Basecamp, and more—that help organize communication among team members.

These new collaborative platforms are designed to facilitate all manner of team communication—everything from text chats, emails, and discussion groups to phone calls, Facebook posts, and multi-person video calls with screen sharing. Technology also facilitates telemigration via better communication.

Telecommunications are an essential ingredient in the globotics transformation. These have been improving at the explosive pace at which digital technology is advancing. It started as telephone calls got cheaper and then mobile phones became universal. Skype and other video-enabled communication technologies helped, especially once cheap and widely available broadband made it reliable. But things have gone further in recent years.

Recently, new technologies have been creating more options between talking on the phone and a face-to-face meeting. These new options are a long way from perfect—they may never replace in-person contact—but they hold out options that are far cheaper and faster to arrange than physical meetings, yet are much higher quality than standard phone calls. The main new communication technology is called 'telepresence'. It is already widely used by big banks, consultancies, law firms,

and governments. Telepresence makes it seem, or almost seem, like people are in the same place even when they are not.

Augmented and virtual reality devices

One telecommunication technology that is coming on fast uses augmented reality—that is, the projection of a digital image onto reality via a headset or glasses, or even a smartphone screen. The two key technologies are augmented reality (AR) and virtual reality (VR). Many companies, both start-ups and giants like IBM, are using AR and VR to improve remote collaboration. They are redefining what it means to work side-by-side with someone. They are going a long way towards taking the 'remote' out of remote work.

The big selling point of AR is that it allows an expert sitting somewhere else to 'augment' the reality you are looking at through a video screen on your phone, tablet, or laptop. They can explain what you need to do almost as if they were standing by your side. They do this by placing computer graphics on your screen in a way that looks like it is part of the reality you are looking at. Instead of 'talking you through it', they show you with arrows, circles, and the like. There is no need for the remote expert to 'paint a word picture' of what needs to be done since both workers are looking at the same reality on the screen, augmented by things added by the expert.

Virtual reality is a far more immersive experience than AR—it completely hijacks your visual and audio channels, filling them with a computer-generated reality. It is a bit disorienting since you have no direct connection with where you are actually sitting. To date, the images are too grainy to fully convey microexpressions and the like, but body language has amazing effects on how you perceive people.

There are other forms of telecommunication technology in the testing stages, things like 'holographic telepresence'. This projects real-time, three-dimensional images of people (along with audio) in a way that makes it seem as if the remote person is right next to you. This is the stuff of science fiction, but it is not unimaginable—having been used in the 2017 French presidential election and the 2014 Indian election.

7 What globotics and telemigration means for development strategies: conceptualization

If the automation of manufacturing means localized, jobless manufacturing, many national development strategies will have to be rethought. The changes may not appear for 10–20 years, but this is in line with the timeline of most national industrialization strategies, so looking ahead is important.

That manufacturing is changing is not a new point. 'A nascent yet growing body of evidence has begun to challenge the long-held tenets of economic development that industrialization is the prime engine of growth', write Loungani et al. (2017: 3). This message is also clear in the work of Hallward-Driemeier and Nayyar (2017): Globalization and new technologies are impacting the desirability and feasibility of what has historically been the most successful development strategy, namely manufacturing. Many of the pro-development characteristics traditionally associated with manufacturing—tradability, scale, innovation, learning-by-doing—are increasingly features of services. As Primo Braga et al. (2019: 3) put it: 'While industrial development has played a key role in export-led development trajectories in the past … ICT-enabled services in particular offer potential for export diversification that defy the logic of traditional paradigms by relying purely on

electronic cross-border delivery, making it accessible even to countries with underdeveloped physical trade infrastructure.'

This section explores conceptualization issues and asks the question: how may switching to service-led development change thinking about national development strategies?

Before turning to the economic logic of a service-led development strategy, we review why manufacturing was the linchpin of so many countries' development strategies.

7.1 Why industry was viewed as so important to development

Most of today's rich nations got rich by industrializing. Since 1970 or so, the same nations have been deindustrializing due to globotics, but their historical growth take-offs were closely associated with a rapid structural transformation that shifted workers from farms to factories. The intense industrialization–growth correlation continued in the post-war period with the four Tigers (Hong Kong, Korea, Singapore, and Taiwan), and a few second-generation tigers such as Thailand, Vietnam, the Philippines, Malaysia, and Indonesia. For these nations, industrialization was closely linked to export-led manufacturing, not just manufacturing.

This plain-as-day evidence is explained by a number of well-known mechanisms that made manufacturing-led development particularly attractive for developing-nation governments. First, rising manufacturing absorbed a lot of unskilled workers with only minimal formal education, especially in unskilled, labour-intensive sectors like clothing and shoes. They could, as it were, walk off the farm and into factories. In countries with growing masses of relatively uneducated young people and few jobs outside of subsistence agriculture, manufacturing was a blessing for social and political stability.

Second, manufacturing activities were viewed as development escalators. Marked by scale economies and technology spillovers, each extra manufacturing job was viewed as helping the nation, not just the individual worker. At least since the massive opening embraced by developing nations as part of the second unbundling, these manufacturing jobs were tied to flows of international trade, investment, and know-how as rich-nation firms offshored production (and manufacturing know-how) to nearby developing nations (Baldwin 2014).

This knowledge transfer aspect was especially powerful in East Asia, where proximity of technology leaders like Japan, Korea, Taiwan, Hong Kong, and Singapore fostered such offshoring. Today, for example, about 40 per cent of world manufacturing is done in countries that are touched by the triangle between Beijing, Tokyo, and Hong Kong. This region is quite simply one of the most attractive locations for offshoring stages of manufacturing. The mechanisms—mostly involving global value chains—linking trade, investment, manufacturing, and productivity growth included alleviation of supply bottlenecks, elimination of small-market demand constraints, transfer of know-how, and connection to worldwide sales networks (Taglioni and Winkler 2016). As an empirical matter, productivity in developing-country manufacturing seems to converge towards that of rich nations with the global technological frontier, regardless of policy and institutional determinants (Rodrik 2013). Development theorists wove these facts into elegant intellectual frameworks.

7.2 Manufacturing-led development theory

The conceptualizations behind manufacturing-led development have a distinguished pedigree starting with the glory days of what Krugman called 'high development theory', namely from

Rosenstein-Rodan (1943) to Hirschman (1958). We should probably add in the contributions from new economic geography, as exemplified by Krugman and Venables (1995).

In these frameworks, development is viewed as a virtuous cycle driven by external economies, with each turn of the wheel providing economic momentum for the next turn. The self-reinforcement came from an interaction between economies of scale at the level of the individual producer and the size of the market. The concept came in two main fashions: 'Big Push' and 'Leading Sectors'.

Paul Rosenstein-Rodan argued for an economy-wide 'Big Push' effort by governments to break out of underdevelopment. Productivity and incomes were higher in industry than agriculture, but poor-nation firms failed to industrialize spontaneously because they could not attain the minimum efficient scale in the face of lacklustre local demand. The lack of local demand, however, was due to the low incomes stemming from the lack of industry.

Albert Hirschman advocated instead for pushing for growth in particular sectors which would—via 'backward' and 'forward' linkages—ignite growth in the rest of the economy. As theories go, these were just about perfect in terms of shaping the thinking of policymakers around the world. It was simple but not simplistic, and it was optimistic. Any nation could do it. But as is usually the case, ideas were the easy part, implementation was the hard part.

A key problem was the demand-creation part—regardless of whether it was to be created by an economy-wide push or sector-specific policies. In the first post-war decades, import protection was the go-to policy. 'All present-day industrial and developing countries protected their incipient manufacturing industries producing for the domestic market', wrote Bela Balassa in his 1981 book, *The Newly Industrializing Countries in the World Economy*.

In this so-called import substitution industrialization (ISI) strategy, importing was necessary for key inputs, but the output was headed for the local market. Early thinkers like Raul Prebisch, touting 'export pessimism', doubted that a developing nation could rely on export to gin up the necessary demand for the output of their factories, especially since many Northern markets were still heavily protected. While a very small number of developing nations managed to trigger what looked like a self-fuelled virtuous cycle in manufacturing (e.g. Korea and Taiwan), ISI failed in most places. More precisely, it created jobs in labour-intensive sectors like shoes, clothes, and furniture, but the step to starting competitive heavy industries proved too much for the dozens of nations who tried it. The 1980s debt crises drew a line under ISI.

Attention then turned to a new twist of manufacturing-led development—the 'Washington Consensus'. This leaned on Hirschman–Rosenstein-Rodan conceptualizations of the sales–scale conundrum (need scale for sales, but need sales for scale), but sought to overcome it with different tactics. Governments and markets would do the job, and exports were critical to achieving scale. Import-competition took on a new positive role as a way to avoid abuse of dominant positions in the domestic market. This too passed. By 2002, few of those that tried it managed to launch their industry on an upward spiral.

7.3 A stylized 'old school' development journey

To set the stage for a consideration of service-led development, it may be useful to present a stylized version of development challenges and stages that manufacturing-led development strategies were meant to address in the Hirschman–Rosenstein-Rodan–Prebisch conceptualization.

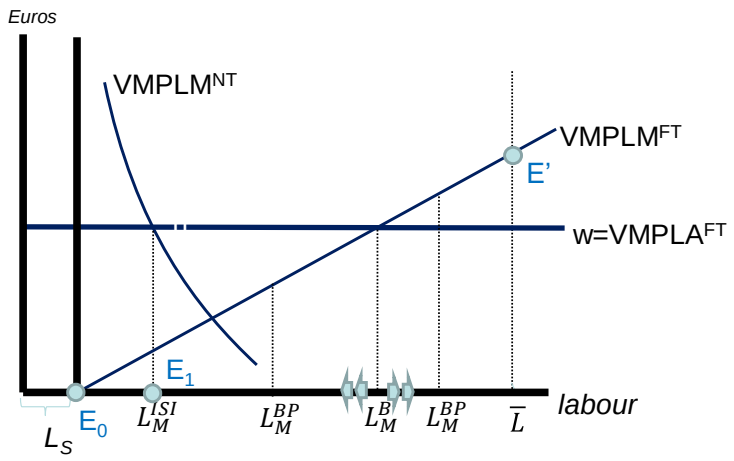
The externalities and spillovers critical to these accounts are economically beneficial for low-income countries who can seize them, but the same features make industry 'lumpy'. That, in turn, makes it hard to start industrialization and keep it going. The basic notion is that a country could be good at industry, if only it had more industry. It is a classic multiple equilibrium problem. A nation with an industrial base can be globally competitive in a wide range of final goods. The competitiveness, in turn, provides the sales necessary to justify the industrial base.

A classic manufacturing-export-led development story involves a shift from the agrarian to the industrial equilibrium and all that that entails. Investment in capital and skills booms, exports rise, foreign investment grows, infrastructure is constructed since it is worthwhile, people move off of farms and into urban areas, young people find education attractive, etc.

Colonialism and underdevelopment

Our stylized development journey opens in the colonial period, when the nation under study either has never had industry or was deindustrialized during colonialism. That is, we start with the nation completely specialized in agricultural goods in the sense that all labour in the trade sectors (manufacturing and agriculture) are in the agrarian sector. This is point E_0 in Figure 8.

Figure 8: Schematic diagram of manufacturing-led development



Source: authors' elaboration.

There is a nontrade service sector, which employs L_S workers, but this doesn't yet enter the analysis. The labour needed to provide the services demanded at the equilibrium price (which is L_S in Figure 8) is just subtracted from the nation's labour endowment, $\bar{L}$, and the remainder is divided between the traded sectors, agriculture, and manufacturing. For simplicity, manufactured and agricultural goods are freely traded under colonialism.

Given the external economies in manufacturing and the assumed constant returns in agriculture, industry is marked by an upward-sloped value of marginal product for labour in manufacturing (VMPLM) and a flat value of marginal product for labour in agriculture (VMPLA). The VMPL curves are equal to the price (which is fixed by free trade) and a physical marginal product of labour (MPL). In manufacturing, it is upward-sloped due to external economies of scale (i.e. the marginal cost of production falls with the economy-wide level of production, but individual firms perceive

constant returns with respect to their own output). In agriculture, the VMPL is flat due to assumed constant returns.[4]

This setup has two stable equilibria. In one equilibrium, all workers are in industry, so the VMPLM is higher than the VMPLA and thus the wages are higher in manufacturing (point E'). This is a stable outcome since the higher wage keeps all the workers in manufacturing. In the other equilibrium (point E_0), no one works in manufacturing, so the wages in manufacturing are lower than they are in agriculture. This too is stable.

A critical point for the analysis is the level of employment in manufacturing, where the two VMPLs intersect (L_M^B in Figure 8). Here, the 'B' stands for 'breakpoint' since if somehow L_M got above the breakpoint, industrialization would be self-sustaining (as shown by the right-pointing arrows). Any change in L_M that pushes it to a point to the right of the breakpoint will, eventually, result in workers leaving industry for agriculture (as shown by the left-pointing arrows). The breakpoint, L_M^B, might also be called the 'minimum efficient scale'.

To think about this, note that if the VMPLM were above w, the country would be price-competitive in the world market for manufactured goods when paying wage w. More specifically, if firms paid w for labour but had MPL corresponding to the VMPLM above the line at world prices, the firms could break even by charging a price below the world price.

Independence and import substitution

In the next phase of the development journey, the nation gains independence and shuts out foreign manufactured goods in an effort to get the virtuous cycle spinning. The VMPLM now depends on the domestic price and the domestic price falls as output rises. Assuming the right combination of demand and scale elasticities, the new curve for industry is VMPLM^{NT} and it is downward-sloped (NT stands for nontraded). The result is that some labour moves into manufacturing, namely it rises to L_M^{ISI}, where the superscript stands for 'import substitution industrialization'.

The critical issue for manufacturing-led development is whether L_M^{ISI} is above or below the breakpoint level, L_M^B. If it is above, then import substitution will produce a self-sustaining industrialization if trade is liberalized—the endpoint of which is E' (all labour in manufacturing). If it is below the breakpoint, the ISI strategy will lead to stagnation. If the nation liberalizes imports, it will deindustrialize back to E_0 since with open trade, the upward-sloped VMPLM is the relevant one.

One strategy would be to try a 'big push' into industry, with the government pushing or pulling labour into manufacturing. If the effort isn't big enough, say it takes the economy to point L_M^{BP} where the superscript stands for 'big push', then the economy gets stuck, and the efforts to expand industry will result in losses. If the push takes the economy beyond the breakpoint, the big push is successful and industrial development becomes self-sustaining. Clearly a large home market is helpful here.

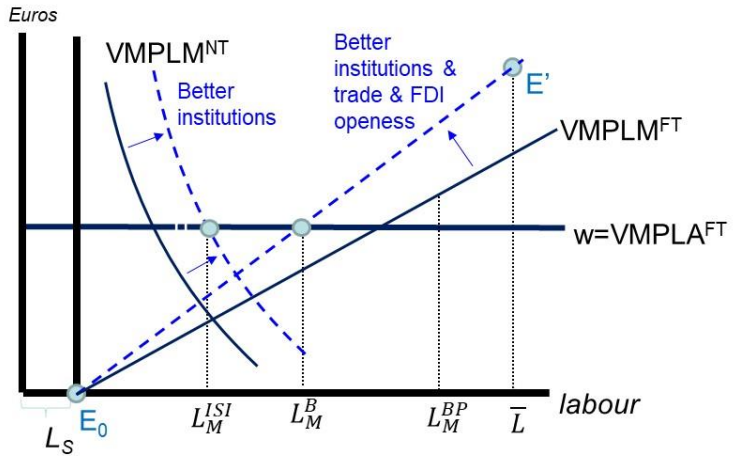
[4] Making agriculture subject to diminishing returns is a simple but unenlightening extension, as long as the model displays multiple equilibria in manufacturing.

Washington Consensus and export-led industrialization

For many nations, the ISI and BP efforts failed to spark endogenous industrialization. In the next phase, our template developing nation tries the Washington Consensus. This involves improving institutions and lowering barriers to trade and investment.

Improved institutions are reflected in two ways in Figure 9. On the demand-enhancement side, it shifts out the VMPLM^{NT} curve since the better institutions effectively increase the size of the domestic market (less waste, better contracting, etc.). What this does is raise L_M^{ISI}. On the supply side, it rotates the VMPLM^{FT} line counter-clockwise. This is due, on one hand, to improvements in production efficiency that come with imported know-how, etc.; this raises the MPL part. On the other hand, openness and international integration also result in a higher net-of-costs price for domestic firms (this affects the 'P' part of VMPL). The P-enhancing aspects and MPL-enhancing aspects bring the breakpoint, L_M^B, closer to L_M^{ISI}.

Figure 9: The effect of better institutions



Source: authors' elaboration.

As with ISI, these reforms may or may not be enough to get our template nation over the hump and send it on its way to a pro-market outward-oriented take-off in exports, industrialization, and economic growth. As history would have it, for a few countries the policy reforms got L_M^B past L_M^{ISI}, but for many it didn't.

If the group of 'it was not enough' nations applying the Washington Consensus is sufficiently large, the Washington Consensus itself would be viewed as a failure by empirical economists who are unfamiliar with multiple equilibrium economics. The next step would be to conclude that no 'big idea' is working in development (Lindauer et al. 2002).

Note that since the VMPLM^{FT} depends upon the price received by domestic manufacturers (rather than the price paid by customers abroad), remoteness plays an important role in the position of the VMPLM^{FT} curve. Countries that are remote from large markets—as measured by, for example, market potential—would find it expensive to import essential materials, intermediate inputs, and capital equipment. They would also find it difficult to acquire and sustain relationships with their foreign customers, and lastly, the distance would discourage advanced-economy firms viewing the faraway nation as a good place to put offshored stages of production.

In all phases of this stylized development journey, the key challenge to sparking manufacturing-led development was getting past the hump (the point L_M^B). Beyond this point, industrialization became a self-driving mechanism; before it, nothing worked. Since industry was marked by scale economies, it was very difficult (usually impossible) for all but the largest nations—or those with excellent 'market potential' due to their geographical location—to get over the hump with import-substitution policies, 'big push' policies, or Washington Consensus policies.

The source of this failure might be hard to detect with the usual empirical approaches. If one runs linear regressions of ISI and Washington Consensus policies on development outcomes—treating all nations as random draws from a single distribution—the results may be confusing. The policies could all be 'working' in the sense of narrowing the gap between the employment level and the breakpoint, but not working in the sense of triggering industrialization. As is well-known, standard econometrics has trouble estimating threshold effects without really big datasets. Since so few developing nations have managed to industrialize rapidly, such data is unattainable.

In a nutshell, the key determinants in our recounting of this development journey are domestic market size, institutions, and remoteness. For small remote nations with bad institutions, neither ISI nor the Washington Consensus would work. For big, favourably located nations, both development strategies could work.

The service sector was left completely in the background since that was where it was put in most traditional thinking on national development strategies.

The traditional (minor) role of services in development

Development economics has long relegated services to the side-lines or ignored them altogether. Loungani and Mishra (2014) call it a deeply rooted prejudice against the service sector. Adam Smith, in his famous tome, cast aspersion on the social value of service provided such as 'churchmen, lawyers, physicians, men of letters of all kinds, players, buffoons, musicians, opera-singers, opera-dancers, etc.' (cited in Loungani and Mishra 2014). Karl Marx considered many types of services as 'faux frais' of production—activities that were incurred in the productive use of capital but which do not themselves create any value-added. This was picked up on Soviet planning, where services were downplayed compared to heavy industry—and it was the success of this planning up to the late 1950s that inspired many of the early post-war development thinkers. Similarly, Baumol and Bowen (1966) fostered the view that services are a sector resistant to improvements in productivity. The same message came through in Ghani (2010)—a whole book devoted to illuminating the service-led growth in South Asia.

More formally, Eichengreen and Gupta (2011) noted that the structural transformation literature, which is intimately tied to that of development strategies, downplayed the role of services:

> The pioneers of the literature on structural change, such as Fisher (1939) and Clark (1940), emphasized the shift from agriculture to industry in the course of economic growth; they in fact said little about the share of services. Kuznets (1953) concluded that the share of services in national product did not vary significantly with per capita income. Chenery and Syrquin (1975) regressed the service-sector share of output on per capita income and per capita income squared, concluding that the relationship was concave to the origin—that it rose with per capita incomes but at a decelerating rate.

7.4 Can service exports spark a virtuous cycle?

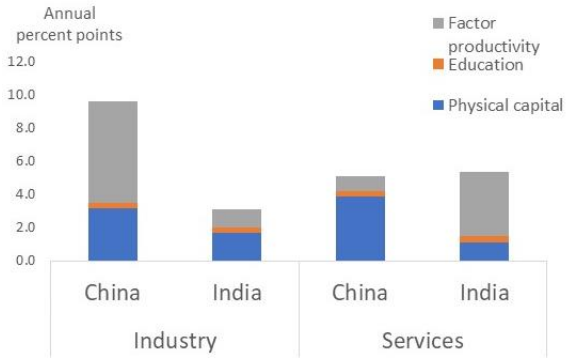
Services played almost no role in the stylized development journey discussed above since services were traditionally viewed as being marked by no scale economies, no positive externalities, and few opportunities for export or inward foreign knowledge transfers. Without these things, services cannot start a classic development spiral where an expanding sector creates forces that encourage further expansion. But is this really true? Are services really bereft of these features?

First, consider the possibility of exports and growth promotion. Service exports are, as we showed above, growing, and growing faster than the export of goods. There is also some evidence that exporting more sophisticated services is pro-growth (Mishra et al. 2011).

What about Baumol's disease? The lack of productivity growth in services, or as Baumol phrased it: one still needs four people to play a quartet despite centuries of technological progress. That too turns out to be untrue, at least in its baldest form. In the USA, Triplett and Bosworth (2004) estimated that services accounted for over 70 per cent of labour productivity growth in the New Economy boom of the late 1990s. Ghani (2010) documents that, after 2000, labour productivity in India, Pakistan, and Sri Lanka grew faster in services than in manufacturing.

Figure 10 shows a decomposition of growth by sector in India and China. In China, factor productivity was a big driver in manufacturing (as would happen in the case of external economies and self-sustaining industrialization), but not so much in services. In India, the order is reversed—even if India's growth was slower overall. At the least, this suggests that services can be a source of progress, like manufacturing.

Figure 10: Sources of growth, India and China, 1993–2004



Source: authors' elaboration, based on data from Bosworth and Collins (2008).

Some services also seem subject to external economies of scale. Inside nations, the notion that service sectors are subject to agglomeration economies or external economies of scale is widely taken as received wisdom—at least by urban economists. In advanced-economy cities, the existence of a substantial wage premium is well documented (Combes and Gobillon 2015).[5] These sorts of premiums are the hallmark of external economies as they indicate that the whole is more than the sum of the parts. More to the point, in our development journey story, the purpose of

[5] Combes and Gobillon (2015) review the empirical literature and find the elasticity of wages with respect to city population is typically around 8–10 per cent, but much of that relationship is driven by the sorting of more skilled individuals into larger cities. Correcting for these biases leads to smaller elasticities of 2–5 per cent. It is also the case that workers may learn more over time in larger cities.

getting more workers in manufacturing was to be able to sustain higher wages. In terms of theory, authors such as Duranton and Venables (2018) draw an upward-sloped VMPL for cities that looks exactly like the $VMPLM^{FT}$ in the figures here.

The assumption that services are subject to something akin to external economies is indeed the heart of urban economics (Black and Henderson 1999). The facts behind this assumption are quite undeniable. The economies of the richest cities in the world are based almost entirely on services, and often service exports. The people in the service sectors earn wages far beyond the average. Moreover, the cities themselves seem to be marked by external economies of scale judging from the high price of apartments in city centres. The good jobs are in big-city service sectors, since cities are where the talented people are. As Ed Glaeser puts it, smart people move to cities and make each other smarter (see Glaeser and Berry 2006).

In terms of explicit modelling, Robert-Nicoud (2008) is a clear example of incorporating trade in services into a standard new economic geography model.

Overall, national development strategies in the digital era may do well to look to urban economics and new economic geography for inspiration and guidance.

8 Globotics and development mindsets

The hardest aspects of development are only marginally changed by globotics for the very simple reason that the trade-and-development component of development is not the hardest part. Even in quite open economies, most economic activity is by and for local citizens. Getting it to work requires all sorts of difficult things like good roads and ports, good institutions, good education, good health systems, trust among citizens, trust by citizens of their government, and much more.

But the globotics transformation is likely to radically change the way we think about development—if the posited thought experiment comes true. If labour-cost-based trade in manufactured goods comes to an end and services become freely traded, ways of thinking about development will have to change. This is not a novel thought.

The Pathways for Prosperity Commission's 2018 report, *Charting Pathways for Inclusive Growth*, lists 'Global trade in services' as its Pathway Three. The report lists the main ways to unlock the pathways—the most relevant of which is about how governments and businesses can create a digital-ready country. Many of the recommendations are akin to those suggested by UNCTAD in its many publications on e-readiness that stress five pillars: enabling digital infrastructure, enabling legal and regulatory frameworks, enabling human capital, enabling finance, and enabling coordination.

A study that focuses on creating digitally enabled jobs for African youths (Mastercard Foundation 2019) suggests a few 'no regret' measures that policymakers could take, such as collecting better data locally, monitoring international developments closely, providing training for local policymakers on digital economy matters, promoting the provision of digital 'soft' commerce skills (such as digital marketing and relationship management) as well as hard skills (such as coding), and embracing a 'test-and-learn approach' to deal with the uncertainties and rapid pace of change. The 2016 ECLAC report, *Innovation and Internationalization of Latin American Services*, presents many ideas for how governments should think about and prepare for digitech's impact on development (Hernández et al. 2016).

Here we do not repeat or even catalogue the suggestions; rather, we attempt to focus attention on how services are different when it comes to development mindsets.

8.1 How are services different?

There are two critical shifts in thinking when it comes to service-led development that we can summarize in two pithy aphorisms:

> **Stop thinking capital equipment and technology and start thinking people and training.**

The key to industrialization was to get the right equipment and the right technology in place and to line up the factories with sufficiently large customer bases. In the traditional development strategy, labour in the manufacturing sector is not viewed as a relevant constraint. It is a bit of a sideshow since one of the great features of manufacturing is that workers can, almost, walk out of the rice fields, into a factory, and start being productive with very little preparation. This is not true of modern services.

When it comes to modern services, the people are the 'capital equipment', so to speak. And the people do not come with embedded technology, unlike a robot welder from Germany. Foreign know-how may be important, but for many types of export services—say coding, copy-editing, or project management—the technology is a bit of a sideshow. The skill and experience of the people, the service providers, are the real constraint.

Joining the service value-added chains require less of a great push than the development of an industrial base, but the accumulation of human capital may take a longer time than the accumulation of physical capital.

Secondly,

> **Stop thinking factories and start thinking of cities as productive platforms.**

Cities are where people meet and form local networks for face-to-face connections and exchanges, where people exchange ideas, and competition among ideas plays out. Cities facilitate matching between service workers and service firms. As the economic geographer Enrico Moretti puts it, cities become 'brain hubs' (Moretti 2013). Workers and firms implicitly benefit from each other's knowledge creation via face-to-face interaction and social networking. This point is not new.

In 2010, the Netherlands Bureau for Economic Policy Analysis wrote a study of how the Netherlands could future-proof its economy and the answer was: cities. 'At the beginning of the twentieth century, manufacturing firms settled near each other in order to benefit from knowledge spillovers in the development of electricity … Cities should not be thought of as mere collections of people, but rather as complex work spaces that generate new ideas and new ways of doing things' (ter Weel et al. 2010).

Governments should start thinking of cities as production hubs, not just living quarters. Cities should be conceptualized as geographic centres for face-to-face interactions that foster the production of export-oriented services. Winning cities will attract high-quality jobs and lock them in with agglomeration forces.

Another change in thinking is actually a continuation of the thinking about manufacturing. We are all by now familiar with the notion of the role of the second unbundling in manufacturing-led

development. The idea that there is a value chain that a developing nation can join is clear. The same thing is true in services.

9 Concluding remarks

This paper seeks to think through the implications that digital technology may have for developing nations, for their development strategies, and for the broader world. Our conclusion is that the service-led development path—like the one India took—may become the norm rather than the exception. Since success in the service sector is based on quite different factors than success in manufacturing, our conclusion suggests that development strategies and mindsets will have to change. While change is always hard, this is a fundamentally optimistic conclusion for developing nations for a very simple reason.

Digitech will allow many emerging markets to directly export the source of their comparative advantage (labour that is low-cost given its quality) without having first to make goods with that labour and then export the goods. One way of thinking about comparative advantage trade in a Ricardian model is that trade in goods is a veil for trade in labour services. Digital technology is merely pulling back the veil. The resulting expansion in service trade is likely to be an overall net export gain for emerging markets and an overall net import gain for developed economies.

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