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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. While much of the literature has focused on rich nations, the changes are quite likely to affect developing nations in important ways. The premise of the paper - which should be regarded as a thought-piece - is based on an extreme thought experiment. What does development look like when digitech has rendered manufacturing jobless and many services freely traded? Our conclusion is that the service-led development path may become the norm rather than the exception; think India, not China. Since success in the service sector is based on quite different factors than success in manufacturing, development strategies and mindsets may have to change. This is an optimistic conclusion since it suggests that developing nations can directly export the source of their comparative advantage - low-cost labor -without having first to make goods with that labor.

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Globotics and Development: When Manufacturing is Jobless and Services are Tradable

Richard Baldwin & Rikard Forslid, October 2019

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 (Brynjolfsson and McAfee 2014, Baldwin 2019).[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. Since these conjectures concern the future, they're unprovable. Nevertheless, we believe they merit consideration.

A growing body of evidence has begun to challenge the view that manufacturing is the prime route for development (e.g. Loungani et al. 2017; Hallward-Driemeier and Nayyar 2017). First, many of the pro-development characteristics traditionally associated with manufacturing—tradability, scale, innovation and learning-by-doing—are increasingly features of services (Ghani and O'Connell 2014, Schwarzer and Stephenson et al 2019). Second, digital technology is reshaping 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 replacing the 'manu' with robots, so that we now speak of 'robofacturing', (Gilchrist 2016).

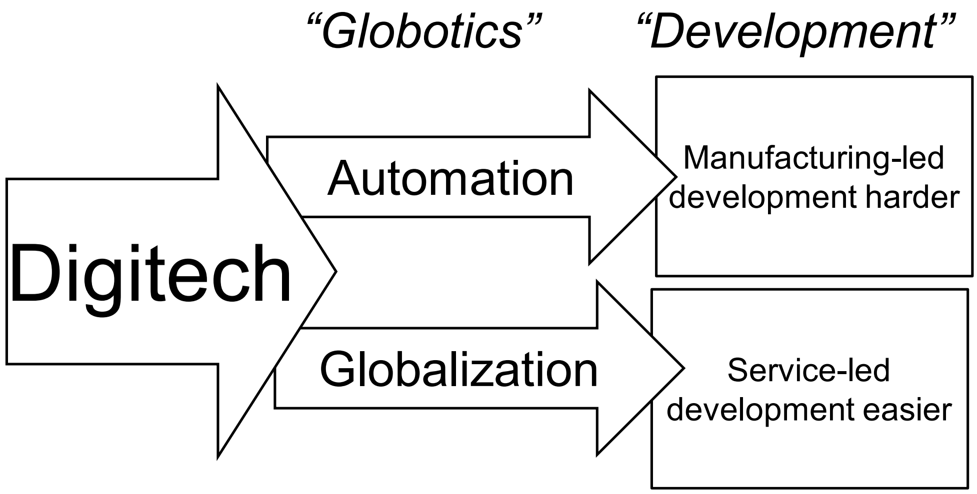
Taken together, these aspects of globotics are pulling the rug from under traditional development strategies that equates development with industrialization. While nations may still export robofactured goods, these sectors will be more like oil wells that create value and exports but few jobs.

The premise of the 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 labor-cost share for manufacturing goods. For services, we assume the

[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.

opposite: trade costs for services falls a lot, but the labor-cost shares are unaffected. The basic point is illustrated in Figure A.

Figure A: Globotics and development



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 to those premised on service exports (Section 8). Our hope is that this thought piece inspires reflection among policy makers as well as empirical research on the hypotheses posited.

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.[2] Another name for it is the globotics transformation—a portmanteau word that stresses how the changes are being driven by both globalization and automation. We start by putting the globotics transformation into an 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).

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[2] See E. Brynjolfsson and A. McAfee's (2014) *The Second Machine Age*, M. Ford's 2015 *Rise of the Robots: Technology and the Threat of a Jobless Future*, K. Schwab's 2017 *The Fourth Industrial Revolution*, and the 2018 McKinsey Global Institute discussion paper 'Notes from the AI Frontier: Modeling the Impact of AI on the World Economy' by J. Bughin, J. Seong, J. Manyika, M. Chui, and R. Joshi.

Table 1: The three grand economic transformation in 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 to sheltered service jobs in G7; into export services in Emerging Markets	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 and the spread of democracy, it produced two world wars, and the Great Depression. The resolution of the backlash involved 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 un-equalizing cross nations. For developing nations, a key aspect of the Great Transformation was the 'Great Divergence', or what Lant Pritchett calls 'Divergence, Big Time'. Civilizations in Asia and Africa had dominated world economic, political, cultural, military, religious, artistic, and social matters for over four thousand years. But they 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

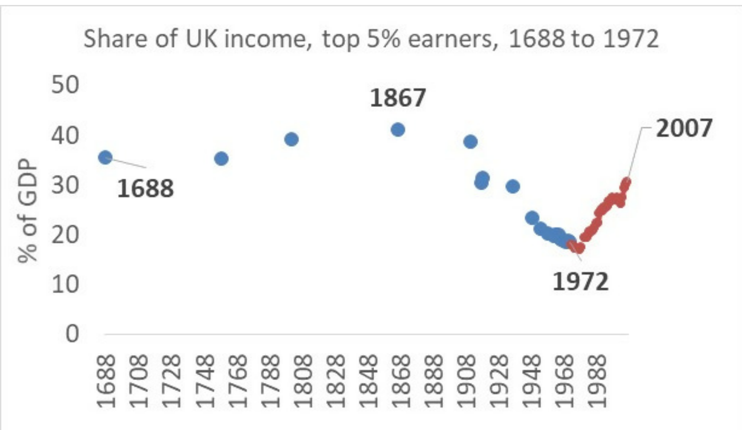
The second transformation, which shifted economies to a post-industrial society, might be called the 'services transformation'. It started in the early 1970s when the share of jobs in industry peaked in many rich nations, and workers started moving from factories to offices (Touraine 1971). Urbanization 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) reach a level that allowed rich-nation firms to unbundle their factories and ship some manufacturing stages abroad, along with chunks of their advanced manufacturing know-how (Baldwin 2016). Globalization now meant that factories were 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 using high-tech, combined with low-wage labor. 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 1). 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). The 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 that of the 'head workers', the biased technological progress drove inequality to late 19th century levels. Again, the international impact was just the opposite.

Figure 1: Equalizing and unequalizing economic transformations



Source: Baldwin (2019), which is based on data provided privately by Max Roser (Our World in Data).

A key implication for the developing world was a partial undoing of the Great Divergence. Once the novel 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 GDP, for example, fell from about two-thirds in the late 1980s to under a half today due to the fact that many emerging markets grew two to five times faster than the G7.

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 emerge 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 within 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 (Baldwin 2016).

The framework views globalization as international arbitrage. In the first phase of globalization, the focus is on arbitrage of goods. Goods and manufacturing know-how constitute the second phase of globalization. And goods, know-how, and labor services make up the third phase.[3] Arbitrage in goods, know-how, and labor services is hindered by the cost of moving goods, know-how, and people. The three phases of globalization emerged when these three costs plummeted in sequence: 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 by considering globalization's first phase in a bit more detail.

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 decoupling 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'. In fact, the opposite happened and 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 micro-clustered 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 faced a handsome reward in the world market. Simultaneously, the micro-clustering 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 US 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 at a slower pace.

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

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.

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 micro-clustered processes across borders while still keeping the disperse parts operating as a whole.

Once this 'second unbundling' had become feasible, the vast wage gap caused by the Great Divergence made the unbundling profitable. 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 driving force was actually the arbitrage of know-how and not the offshoring of production stages. 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 sparked a commodity boom, or super-cycle, that allowed many commodity-exporting nations, e.g. 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 labor and labor 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 labor services.

We discuss this trade in services much more extensively below and give special attention to 'telemigration' which involves the sort of trade that happens when workers sitting in one nation telecommute into offices in another. Barriers to the export of labor 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 only accelerate this change. There are already instances of these 'telerobots' being controlled at long ranges. Telesurgery and drone operations are two examples of this.

As various forms of virtual presence technology are combined with human-controlled robots, an expanding range of manual services could be provided at 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 gardeners sitting who live 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 patch people up 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 products, 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 of very low-cost labor, namely, even when quality-adjusted. So, instead of developing-nation workers having to embed their labor in a product and then export that product to exploit this advantage, they will increasingly be able to export labor 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 services to Europe, Latin America, and North America, while Southeast Asia concentrate more on Northeast Asia, since time zones are a more critical factor for service delivery

3. Digitech—why this time is different

Economists have a very natural and healthy tendency 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' reaction 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 has radically changed.

3.1 Computers gain a new type of cognitive capacity

During the 1970s when computers became generally useful, 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 can 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 and 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 by computer programming, and machines were strictly obedient to the computer code written by a human. And since a 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 play checkers, but difficult or impossible to give them the skills of a one-year-old when it comes to perception and mobility' (Moravec 1988). In short, computers were good at doing the tasks that humans found hard, but bad at executing tasks that humans found easy. And the reason was all down to the nature of classical computer programming.

Humans have been using computer programs to teach computers how to carry out tasks. But this meant that computers could only perform tasks where we actually understand how the human mind carries the task. This ruled out a vast range of mental tasks. As Marvin Minsky put it, humans are: 'least aware of what our minds do best'. Machine learning—which really came into its stride around 2016—solved this 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', i.e. estimate, the computer model.

With this new way of 'programming' computers, white-collar robots (i.e. artificial intelligence, or 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 were not capable of before 2016. Of course, this 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. So many new service-sector tasks are more automatable now than previously and 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 robots. 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 the trend means that factories are requiring significantly fewer 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. But in future, these gains and pains will also be felt by professional and service-sector jobs. However, since most services are underpriced in developing nations compared to developed nations, it is likely that this will mostly represent an export opportunity for developing nations and an import opportunity for developed nations. The basic point here is that in the past service jobs were shielded by high face-to-face costs. But as digital technology tears down those barriers, the difference between the wages of an accountant in, say, the UK and Kenya will narrow.

Another big difference between today's transformation and the last two is 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). However, 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 that it's different this time. 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 movement and automation of the manipulation of digitized ideas, i.e. data and services. The big difference lies in the fact that the laws of physics for data and goods are very different.

To illustrate this difference, we 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 modeling 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 toward 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), i.e. 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 labor cost and the unit cost of all other inputs. The unit labor cost in sector i in a typical country consists of a unit-labor input coefficient, a_i, and the wage, so that the unit labor cost is wa_i. The non-labor costs, which we denote as r_i, consists of machines, intermediate inputs, and the like. For simplicity, we assume labor is perfectly nontraded, but all non-labor factors are freely traded and so cost the same in all nations (thus r_i has no country superscript). The unit production cost for good or service i in typical industry nation n is thus:

$$c_i^n = w^n a_i^n + r_i$$

The proportional difference between the production cost of i in two nations (denoted by the superscripts n and s, short for 'North' and 'South') is:

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

where θ_L is the labour-cost share in North.

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

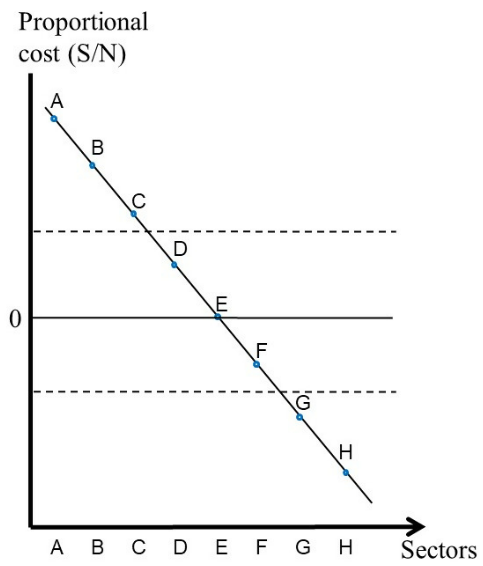
The endogeneity of tradability, and how digitech changes it, requires us to look across all goods and services. To this end, we employ a modified version of the Dornbusch, Fisher, and Samuelson (1977) analysis. To start simply, we initially ignore trade costs and focus only on comparative advantage, 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. For simplicity's sakes, we limit ourselves to two nations, North and South. North is at the technological frontier while South is not, in the sense that Northern labor is more productive in every sector. We also assume that North's technological edge is greater in some sectors than others. Since North labor 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 d the sectors so that the differences are declining as in the diagram (Figure 2).

Figure 2: Endogenous tradability diagram



Source: Authors' elaboration.

The horizontal axis of the diagram lists the sectors—denoted by the shorthand A, B, C, etc., recalling that the sectors are labeled such that the North's cost advantage over 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.

North exports the goods/services where its technology edge outweighs its higher wage, i.e. where the South's proportional cost difference is positive (sectors A to D); 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 the diagram. We know, however, that in equilibrium, the wages must adjust such that North exports some goods and 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% on average. More recent work indicates that these costs have fallen, but not much; trade costs are still adding something like 100% 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 D, where South's proportional production cost is higher than North's but the gap is less than the per-unit trade cost (i.e. D is below the upper horizontal dashed line). In this case, Northern goods will not be cost-competitive in South, given that they must bear the trade costs. By the same token, Southern D goods are uncompetitive in North, so each nation makes its own D. Good D is thus endogenously nontraded; its production is fully localized. Or to put it in unbundling terms, production and consumption are fully bundled in the D sector. The same holds for the E and F sectors.

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

4.3 Digitech drives manufacturing automation and lowers service-trade costs[4]

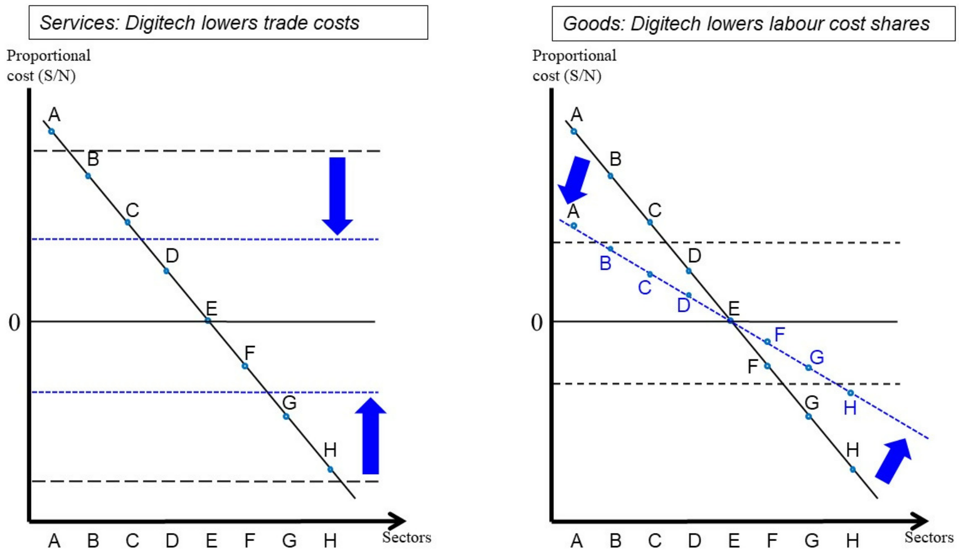
All around the world—including in developing nations—machines are taking over tasks that used to be performed by factory workers. The result has been a significant drop in the number of workers involved in manufacturing and thus a drop in the labor-cost share (see, for example, Dinlersoz and Wolf 2018 or Dauth et al. 2018). Whereas jobs in developing countries are still 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 labor-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 as well as labor-cost shares in both goods and services, but not at the same pace. For services, digitech is radically lowering trade costs, but lowering the labor-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 labor-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 labor-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 labor-cost shares in services. The effects of these assumptions are easy to study in the diagram (Figure 3).

[4] This section draws heavily on Baldwin and Forslid (2014) and Baldwin (2016, Chapter 7).

Figure 3: Digitech's impact on the tradability of goods and services



Source: Authors' elaboration.

In the left panel, which represents the impact of digitech on services trade, the dashed horizontal lines both approach zero. The result is that more services become tradable. Specifically, sectors B, C, G, and H switch from nontraded to traded. In the right panel, which represents digitech's impact on goods sectors, the reduced labor-cost shares rotate the relative cost-competitiveness line counter-clockwise (the fact that it rotates on sector E was chosen as a matter of convenience). The obvious impact is that additional goods-producing sectors switch from traded to nontraded.

Intuitively, the pair of results from the left and right panels says that when labor-cost differences are the key to international competitiveness, labor-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 that more types of services are being traded. Obviously, our extreme assumption on labor-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. For one, there is not free trade in services (Borchert, Batshur and Mattoo (2012). At least as 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. 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 labor more than it would boost the productivity of Northern labor. 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 labor-intensive, while manufactured goods would become less tradable and less labor-intensive.

The effect of digitech on goods trade can already be seen in data. For example, Artuc et al. (2018) find that robotization leads to a significant reduction in net imports from less-developed countries within the same sector.

Labor-service arbitrage in a CAGE

The sorts of trade costs that come to mind when using this diagram are largely related to shipping costs and policy barriers. But these are not the only costs that matter, especially when it comes to services. Business professor Pankaj Ghemawat has captured many aspects of this point with his CAGE framework, stressing 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 barriers, 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 labor services crossing borders, but it is worth noting that digitech alone will never produce a completely level playing field across advanced- and emerging-economy labor markets.

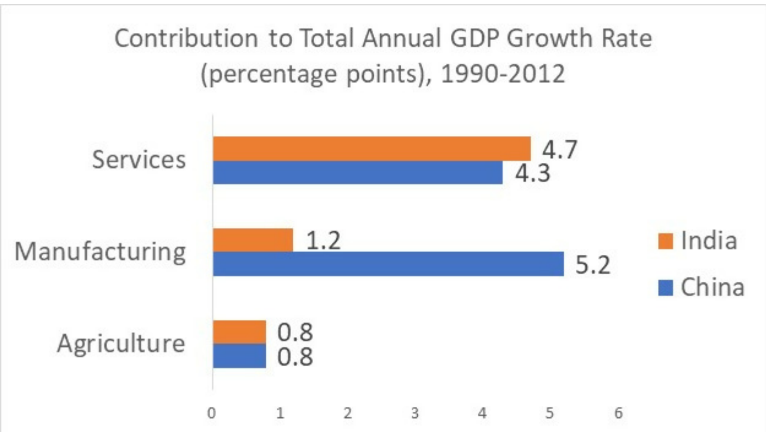
We turn next to case studies of three countries that have followed different development routes.

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, although 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 have turned out differently. For example, Basu (2018) describes it as: '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.'

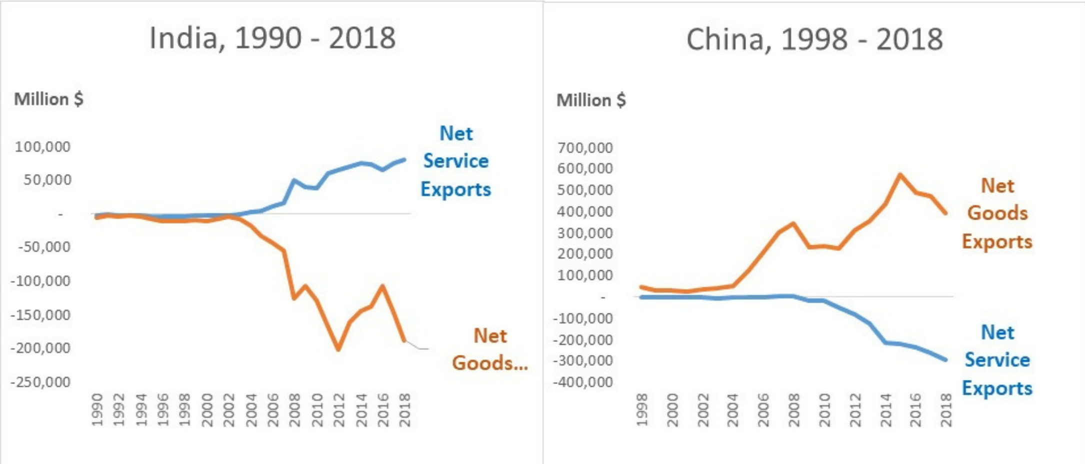
Two charts help illustrate the stark contrast between China which 'did it' based on manufacturing, and India, which 'did it' based on services. The first chart (Figure 5) shows the sectoral contribution to overall GDP growth stemming from each of the three sectors—agriculture, manufacturing, and services. China's overall growth was much higher than India's, showing 10.3% versus 6.7%. However, the chart also clearly shows that while manufacturing was the dominant sector in terms of growth in China, services were the driving sector in India.

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



Source: Based on data from Ghani and O'Connor (2014)

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



Source: Elaboration by authors based on online World Bank Data.

The second chart (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. 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 yolk 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 combined with an explicit anti-trade and anti-international investment bias.

Rapid industrialization was the goal. The path was cleared 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 inefficiencies of the type characteristic of centrally planned systems, but with Indian attributes.

One telling example is that of the Haldia fertilizer plant case (Das 2000). This facility was established in the 1970s, employed some 1,500 workers and was considered somewhat of a success. 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. However, 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 central planning was the tight leash held by planners over private industry. These pervasive strictures came to be known as the 'license Raj' and required firms to have permits for almost everything. To keep private firms aligned with the plan, firms need a government license 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 resulting in Indians having to to wait eight years to buy a scooter for example.

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

This development strategy started to change in the 1980s with 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.

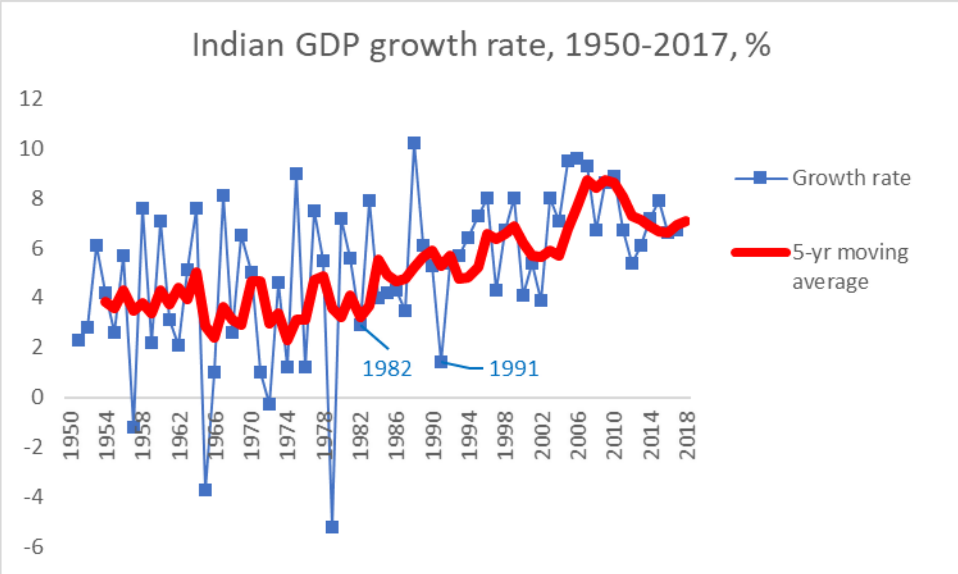
To stave off a foreign exchange crisis, India turned to the International Monetary Fund in 1991 for credit lines. But this credit had strings attached – namely reform. By this time, thinking in India and around the world had shifted away from the old, statist, path of self-reliance toward a wider embrace of 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 International Monetary Fund, the Indian government dismantled the license 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 included the labor market, small-scale reservations (where there has been some movement only in the last 4–5 years), privatization of both non-financial enterprises and of banks, as well as further agricultural sector reforms.

The liberalization of investment restrictions was particularly noteworthy. Before 1991, foreign firms were limited to a 40% ownership ceiling, but once this ceiling was removed, many multinationals increased their ownership stakes. The outcome was a several-fold increase in foreign direct investment in just three years (Gosai 2013).

Many G7 firms shifted part of their research and development departments to India, mostly to reduce costs and/or overcome talent shortages). Likewise, the unbundling of services benefited India middle-income workers as the country attracted outsourced call centers, medical billing back-office services, business administration services, and an array of skilled labor-intensive, insurance-related services.

Figure 7: Indian GDP growth rate, 1950–2017



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

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. In turn, this new mass domestic market primed the growth pump by attracting more foreign investment and stimulating job and firm creation that rose to meet the rise in Indian consumer demand.

These reforms helped the overall growth rate to rise from its sub-4% performance for most of the post-independence period. In recent years, India has become one of the great growth success stories of the 21st century, lifting hundreds of millions of people out of abject poverty. From the 1980s, and especially from the 1990s, India's growth shifted into higher gear. Now, an annual growth rate of over 8% is expected by many (see Figure 7), and poverty rates have dropped by half (from 55% to 28%) between 2005 and 2015 according to UNDPs 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' toward 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 manufacturing-led-export growth. In India, however, it was the services sector that led the way (Murthy 2005; Nayyar 2012; Basu 2015). 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 highlighted in the study by Eichengreen and Gupta (2009). They document two distinct phases where the service sector is important in development. First, when an economy moves from low-income to middle-income, various informal services sectors grow rapidly. Second, when it moves beyond middle-income, more sophisticated services sectors become important, such as information technology and finance.

India's post-1991 growth performance was, in essence, the early arrival of the second phase in the Eichengreen-Gupta story. Basu (2015) describes it as: 'this second-stage services sector growth that happened in India, rather early and with a vigor rarely seen anywhere else'. Even more intriguing 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 favored high-quality universities, especially in science, technology, and engineering disciplines. As a result, it presented an abundance of well-trained and talented technological workers. However, while this might have fostered manufacturing as it did in Germany and Switzerland, the policy environment did not allow it. And while reforms removed some of the barriers, key limitations continued to restrict Indian manufacturing. A poor transportation infrastructure as well as a great distance to the manufacturing giants (US, Germany, Japan, and China) tended to shelter the Indian market from foreign competition. And 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 in addition remained largely untaxed. In short, what Basu (2015) calls 'India's over-production of engineers throughout the 1960s, 1970s, and 1980s' matched Silicon Valley's booming demand for tech workers (and the US'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. In 2000, the country spent 86% of per capita GDP on each student in tertiary education, compared to 14% of per capita GDP per student in primary education. By contrast, China was spending 10.7% and 12.1% of per capita GDP per student in tertiary and primary education respectively. And the Indian students coming through this system were world-class, receiving over 50% of 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 had become a magnet for IT and knowledge-based jobs that were offshored from advanced economies, and Western firms were shifting their research and development activities to the country in order to reduce costs and avoid talent shortages. India was becoming host to outsourced call centers and many so-called business process outsourcing (BPO) activities, including many back-office jobs like medical billing, business administration, and labor-intensive insurance-related services. And this 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', relates 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 optimize 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 we're finding with this model is 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 also reaped the benefits of the technological-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, in particular the call center industry has seen stellar growth, soaring from 2,400 employees across just four operations in 2,400 in 2000 to 375,5000 employees across 425 call center operations in 2012 (Chang and Huynh 2016).

In 2000, the IT-based business process outsourcing (IT-BPO) sector was contributing almost nothing to the nation's GDP. By 2016 it had accounted for about 7% of GDP and was employing over 1.1 million; 1,000% 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 these are good jobs, with IT-BPO employees typically earning twice the national average in the Philippines.

A bit on the history

So, 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 as well as the country's 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 center operators.

While this push was led by call centers, the availability of talented, low-cost service workers also attracted multinationals interested in setting up 'shared services offices'. These are offices where a variety of the company's operations, such as accounting, payroll, human resources, and various legal and IT services are clustered together and offshored to reduce the wage bill. Companies engaging in these activities include HSBC, Standard Chartered, Capital One, Citibank, and JP Morgan as well as Accenture, Oracle, Microsoft, and Dell.

Originally, the industry was initially clustered near Manila but it has more recently started to spread further afield, thus stimulating regional economic 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. While there is no official data on freelancing, a recent PayPal survey 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 continue freelancing in the future. Many of them are young, with 90% of respondents under 40 years old. 61% were women. In terms of services provided, about a third engaged in data entry or internet research, and a large share, about 60%, were working for US-based clients. Most lined up work via internet freelancing platforms such as Upwork.com, Freelancer.com, or Shutterstock.com (*PayPal Global Freelancer Insights Report 2018* as cited in Esmael 2018).

Policy support

The country initially launched into labor-service exports via call centers, where Filipinos answered phone-in questions. Since then, the Philippines has experienced a very clear 'upgrading' in their labor-service exports and the country's activities are moving up the skill/wage scale into what is known as knowledge process outsourcing. This includes back-office services such as health-care processing and coding, legal transcription, IT outsourcing, and more recently, animation and game development. The sector is increasing the provision of high-end services such as data analytics, business and financial research, mortgage servicing, software development, legal process and patent research as well as 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 these jobs under four main headings with a number of sub-headings, namely:

- 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, but humans, and education and training programs are critical for the continued expansion and evolution of the industry. 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 program also funds a 'train the teachers' initiative, again focusing on teaching IT-BPO subjects at 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—a half million of which would be outside the Manila area. Of these, a million jobs are projected to be in higher-value areas. 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) bolstering the attractiveness of the Philippines as an investment destination through advocacy activities; and (3) building the Philippine IT-BPM brand globally through marketing programs.

Automation poses challenges

Globally, automation is creating displacement in both the service and 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 their services offering 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 centers to enhance the capacities 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 remained largely a coastal phenomenon. In 1952, the secondary sector produced 8% of GDP and employed 7% of the labor force compared with the primary sector, which produced 74% of GDP and employed 84% of the workforce. The coastal provinces retained 72% of fixed assets and accounted for 69% of the gross value of industrial output (Yang 1997). Naturally, the Communist Party at its accession to power in 1949 regarded industrialization as its most important economic task .

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 75% of industrial production was in the hands of centrally controlled, state-owned enterprises that followed 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 and 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% of all imports, with the export plan being 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% in 1953 to 0.6% in 1977 (Lardy 1994: 2).

In 1978, things changed. China decided to break with its Soviet-style economic policies by gradually reforming the economy and sequentially opening up trade and investment with the West, in line with free-market principles, and 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 color 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 labor from agriculture to non-agriculture, made possible by a green revolution in agriculture that sharply increased productivity in this sector. The share of the labor force in agriculture fell from 75% in 1977 to 33% in 2012, while the share of value-added produced in the agricultural sector fell from 30% to 5%.

China also gradually reformed its trade regime and these reforms led China's foreign trade to soar from US$21 billion in 1978, when China was, at best, 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 2005: 161; World Bank Data).

The Open Door Policy

An important piece of China's trade reforms was the Open Door Policy that consisted of attracting foreign direct investment and promoting foreign trade in targeted areas. This opening up was initially limited to two southern provinces (Guangdong and Fujian), and then gradually was extended to larger geographical regions: 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 labor regulations. The leading role of this selective open door policy in regional growth has been emphasized by a great number of studies (e.g. Mody and Wang 1997; Berthélemy and Démurger 2000; Chen and Feng 2000)

Foreign direct investment 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 only began to be introduced in 1982. Foreign direct investment 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 foreign direct investment inflow occurred in 1992, expanding 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. Hence, it is less globalization and more wage differences and talent shortages that are driving an increasing number of companies to turn to foreign-based online service workers, or 'telemigrants' (Baldwin 2019). A recent study of Upwork contracts found that the top three nations hiring telemigrants were the high-wage English-speaking nations of US, Australia, and the UK. Conversely, the three biggest sources of telemigrants were the Philippines, India, and Bangladesh (Horton et al. 2017). The US was the only high-wage nation that was both a major buyer and seller of this sort of online remote labor.

When it comes certain service professions such as accountants, computer programmers, engineers, nurses, and many others, complete replacement of a domestic worker with a telemigrant would be impossible. However 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 25% respondents were in Latin America and Asia, 20% in Central and Eastern Europe, and about 15% in both the Mideast and Africa (Sukman 2015). The vast majority of freelancers surveyed are in their 20s and 30s (about 85%). A bit more than half had university educations. The companies paying for their services were about half in North America and Europe (split equally), about 15% in both Latin America and Asia, and 7% 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 across 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 received a grade of 3.6—far worse than the average human translator who receives scores like 5.1; by 2016, Google Translate had hit numbers like 5.

Today, machine translation is on smartphones, laptops, and tablets. Free apps like Google Translate and iTranslate Voice are now quite good across the major language pairs, and machine translation has been widely adopted. Google carries out a billion translations a day for online users. YouTube has instant machine translation for many foreign-language YouTube videos, showing instantaneous results 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 has become so good, so fast. Machine learning trained AI-systems can now recognize language patterns well enough to carry out human-level translation, with the real constraint being the lack of human-translated sentences. For language pairs where the data is available, translation is good. For others it is poor.

The switch came in 2016 when Jeff Dean switched 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. The Canadian parliament has also followed suit. With data and the requisite computer power to process it, the Google Translation app improved more in a 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 if one includes proficient second-language speakers, there are something like a 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 toward remote work is the way in which US and European companies are reorganizing themselves to facilitate slotting in telecommuting workers. These companies are now using new collaborative platforms such as Business Skype, Slack, Trello, Basecamp, and others that help organize communication among team members.

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

Telecommunications are an essential ingredient in the globotics transformation and have been improving in line with the explosive pace in the improvement of digital technology. This started out with telephone calls becoming cheaper. Later, mobile phones became universal. And once cheap and widely-available broadband had become more reliable, Skype and other video-enabled communication technologies further stimulated the explosion. But in recent years, things have gone even further.

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 physical human contact, but they nevertheless present far cheaper and faster options than physical meetings, and at the same time deliver much higher quality than standard phone calls. The main new communication technology is called 'telepresence' and is already widely used by big banks, consultancies, law firms, and governments. Telepresence makes it seem, or almost seem, as if people are in the same place, even when they are not.

Augmented and virtual reality devices

One telecommunication technology that is advancing fast uses augmented reality or the projection of a digital image onto reality via a headset, glasses or even a smartphone screen. The two key supporting 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 and are going a long way toward 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 'talk 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, replacing them with a computer-generated reality. It is a little disorienting since you have no direct connection with where you are actually sitting. To date, the images are too grainy to fully convey micro-expressions and the like, but body language has amazing effects on how you perceive people.

There are other forms of telecommunication technology in early testing stages such as '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, then many national development strategies will need rethinking. The changes may not appear for 10 or 20 years, but this is in line with the timeline of most national industrialization strategies, and so looking ahead is of vital importance.

The changing nature of manufacturing 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). This message is also clear in 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 Schwarzer and Stephenson (2019) 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 became 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 minimal formal education, especially in unskilled-labor-intensive sectors such as clothing and footwear. 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 development 'escalators'. Marked by scale economies and technology spillovers, each extra manufacturing job was viewed as helping the nation and 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% of world manufacturing is done in countries that are touched by the Beijing, Tokyo and Hong Kong triangle. 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 toward 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 selfreinforcement 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 lackluster 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. They were simple but not simplistic. And they were optimistic. Any nation could do it. But as is often 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 initial 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-fueled virtuous cycle in manufacturing (e.g., Korea and Taiwan), ISI failed in most places. More precisely, it created jobs in labor-intensive sectors like footwear, clothing, 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 sale-scales 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 trajectory.

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 that industrial base. A classic manufacturing-export-led development story involves a shift from the agrarian to the industrial equilibrium and all that this entails. Investment in capital and skills booms, exports rise, foreign investment grows, infrastructure is constructed since it is regarded as a worthwhile investment, people migrate from farms toward urban areas, and young people find education attractive, etc. Here we depict the canonical development journey graphically to spotlight the key role of external economies of scale.

Colonialism and underdevelopment

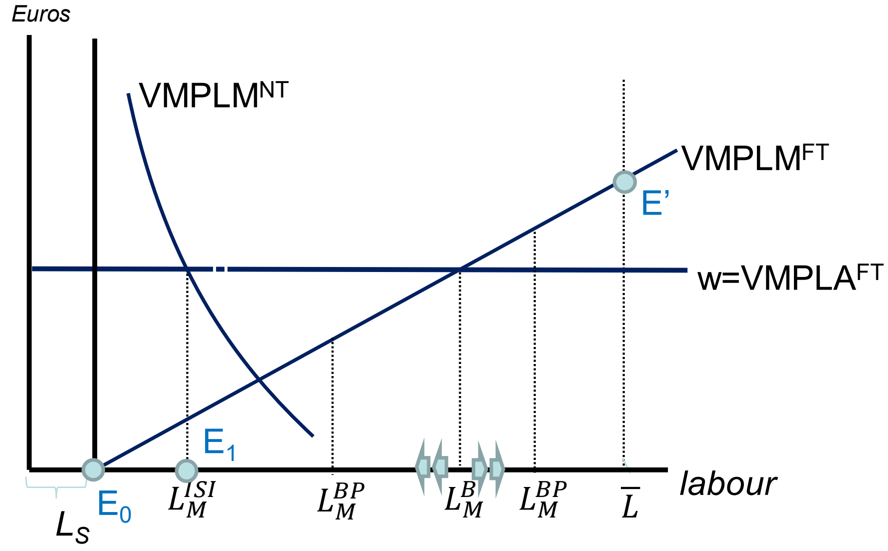
Our stylized development journey opens in the colonial period when the nation under study either has never had industry or was deindustrialized during colonialism. That is, we start with the nation completely specialized in agriculture goods in the sense that all labor in the trade sectors (manufacturing and agriculture) are in the agrarian sector. This is point E_0 in the diagram (Figure 9).

There is a nontrade service sector, which employs L_S workers, but this doesn't yet enter the analysis. The labor needed to provide the services demanded at the equilibrium price (which is L_S in the diagram) are just subtracted from the nation's labor endowment, $\overline{L}$, 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 labor in manufacturing (VMPLM) and a flat value of marginal product for labor in agriculture (VMPLA). The VMPL curves are equal to the price (which is fixed by free trade) and a physical marginal product of labor, 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.[5]

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

Figure 9: Schematic diagram of manufacturing-led development



Source: Authors' elaboration.

This setup has two stable equilibriums. In one equilibrium, all workers are in industry, so the VMPLM is higher than 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 the diagram). Here, the 'B' stands for 'breakpoint' since if somehow L_M arrived 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 break point 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 VMPLM were above *w*, the country would be price-competitive in the world market for manufactured goods when paying the wage, *w*. More specifically, if firms paid *w* for labor 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 labor 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 with an endpoint of E' (all labor 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.

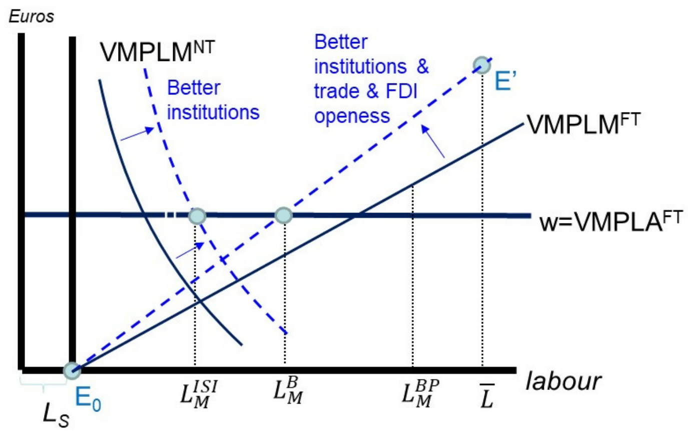
One strategy would be to try a 'Big Push' into industry, with the government pushing or pulling labor into manufacturing. If the effort isn't big enough, and let's say the effort takes the economy to point L_M^{BP} where the superscript stands for 'big push', then the economy becomes stuck. And all efforts 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.

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 the diagram (Figure 10). On the demand-enhancement side, it shifts out the $VMPLM^{NT}$ curve since the better institutions it effectively increases 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 10: 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 and Pritchett 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 finally, the distance would discourage advanced-economy firms viewing the faraway nation as a good place to locate 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, and 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 data sets. 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 favorably-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 (1967) 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 (2013) 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 and 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 US, Triplett and Bosworth (2004) estimated that services accounted for over 70% of labor productivity growth in the New Economy boom of the late 1990s. Ghani (2010) documents that after 2000, labor productivity in India, Pakistan, and Sri Lanka grew faster in services than in manufacturing.

Figure 11 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, like manufacturing, can be a source of progress.

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).[6] 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 whole of 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 diagrams.

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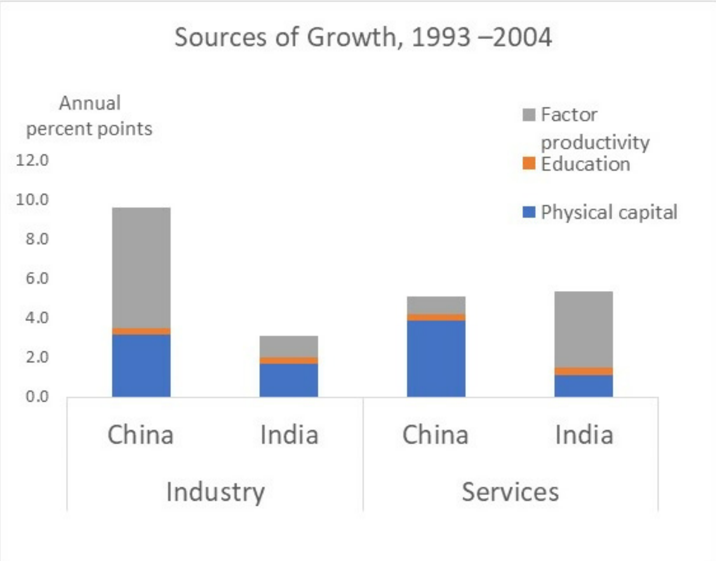
[6] Combes and Gobillon (2015) review the empirical literature and find the elasticity of wages with respect to city population is typically around 8–10% but much of that relationship is driven by the sorting of more skilled individuals into larger cities. Correcting for these biases leads to smaller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

Figure 11: Sources of growth, India and China, 1993–2004



Source: Based on data from Bosworth and Collins (2008).

The assumption that services are subject to something akin to external economies is indeed the heart of urban economics (Black and Henderson 1999) and 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 centers. 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. In terms of explicit modeling, 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 healthcare, trust among citizens, trust by citizens of 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 labor-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. Mattoo (2018) discusses what the new emphasis on services means for international cooperation efforts, and Heuser et al (2017) look at the role of services in global value chains.

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. These include the collection of better data locally, close monitoring of international developments, the provision of 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 pity aphorisms.

> **Stop thinking factories, capital equipment and technology. Start thinking cities, people and training.**

The key to industrialization was the ability to have the right equipment and technology in place and to line up the factories with sufficiently large customer bases. In the traditional development strategy, labor 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 the ability of workers to practically walk out of the rice fields into a factory and to start being productive with very little preparation. This scenario is not true of modern services.

When it comes to modern services, the people are the ‘capital equipment’, so to speak. And 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, for example coding, copyediting, or project management, the technology represents a sideshow. It is the skills and experiences of the people, the service providers, that are the real constraint.

Joining service value-added chains require less of a great push than the development of an industrial base. However, the accumulation of human capital may take a longer amount of time, compared to 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, 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 workspaces that generate new ideas and new ways of doing things' (Bas ter Weel et a. 2010).

Governments should start thinking of cities as production hubs, not just living quarters. Cities should be conceptualized as geographic centers 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 a developing nation can join a value chain is clear. The same can be held true in services.

9. Concluding remarks

This paper seeks to think through some of 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, such as the path that India took, may actually 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 (i.e. labor which is low cost given its productivity) without having first to make goods with that labor 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 labor 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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