NBER WORKING PAPER SERIES

TRADE AND INDUSTRIALISATION AFTER GLOBALISATION'S 2ND UNBUNDLING: HOW BUILDING AND JOINING A SUPPLY CHAIN ARE DIFFERENT AND WHY IT MATTERS

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Working Paper 17716
http://www.nber.org/papers/w17716

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 2011

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NBER Working Paper No. 17716
December 2011
JEL No. F1,F2,F21,F23,F43

ABSTRACT

Revolutionary transformations of industry and trade occurred from 1985 to the late-1990s – the regionalisation of supply chains. Before 1985, successful industrialisation meant building a domestic supply chain. Today, industrialisers join supply chains and grow rapidly because offshored production brings elements that took Korea and Taiwan decades to develop domestically. These changes have not been fully reflected in "high development theory" – a lacuna that may lead to misinterpretation of data and inattention to important policy questions.

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1. INTRODUCTION

For most of the 19th and 20th centuries, "industrialized" and "rich" were synonymous. No surprise then that development economists have long theorised about industrialization and the role of trade in fostering it. Recent work by Rodrik (2011a, b) focuses the development spotlight even more tightly on manufacturing.

Lindauer and Prichett (2002) distinguish three generations of development/industrialization theories – or "Big Ideas" as they call them. The first Big Idea (1945 to 1982) was that governments should drive industrialization; dirigiste policies are needed to get past coordination failures created by the lumpiness of industry. Trade was necessary for importing key inputs but relying on export markets was questionable. Export pessimism ruled the day.

The widespread failure of 'import-substitution industrialization' – or ISI to cognoscenti – was brought home by the 1980s debt crises. The second-generation Big Idea – the 'Washington Consensus' (1982-2002) – pursued the same goal (creating lumpy industry) with different tactics. Governments still mattered but market forces were also critical and exports were central to achieving scale. Import-competition was critical to ensuring market discipline.

By 2002, the second-generation Big Idea was past its sell-by-date, according to Lindauer and Prichett. Many developing nations had followed its precepts only to see slowing or negative growth. The good news, which Lindauer and Prichett call "puzzling", was the roaring success of Asia, especially China. To explain this, Paul Krugman called for a counter-counter-revolution in "high development theory" (Krugman 1992). The world is still waiting.

As Dani Rodrik wrote: "Maybe the right approach is to give up looking for 'big ideas' altogether," (Rodrik 2005); there is one "economics", but many ways to apply it (Rodrik 2008). However, as Lindauer and Prichett pointed out: "The current nostrum of one size doesn't fit all is not itself a big idea, but a way of expressing the absence of any big ideas."

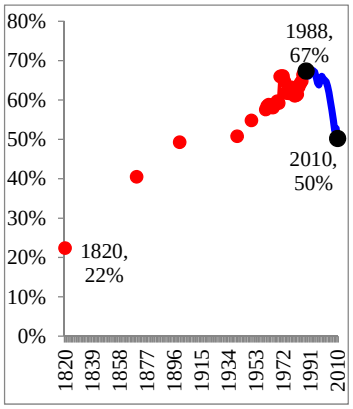
This paper does not propose a new Big Idea. Rather it argues that the quest for one may have failed because high development theory overlooked the radical change in globalization that occurred from the mid-1980s.

1.1. Globalization's transformation

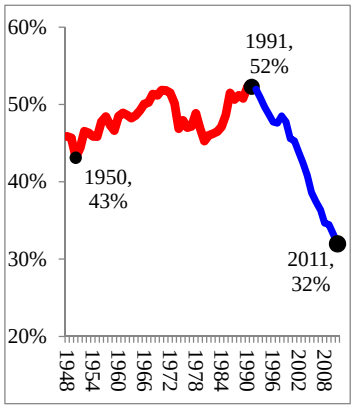
High development theorists are making the common mistake of viewing globalization as driven by the gradual lowering of natural and man-made trade costs. This is a serious misunderstanding. Globalization has been driven by advances in two very different connective technologies: transportation and transmission.[i]

From the steam revolution till the mid or late 1980s, globalization was mostly about falling trade costs; this was globalisation's 1st unbundling. Since 1980, trade costs changed little but the ICT revolution radically lowered transmission costs; this was globalisation's 2nd unbundling. The difference in outcomes is startling.

Figure 1 shows that up to the late 1980s, globalization was associated with rising G7 shares of world income (left panel).[ii] The radical reversal since 1988 suggests that globalization is no longer working as it was when the Big Ideas were formulated. An equally stark turnaround was seen in the G7's world trade share (middle panel). These G7 facts reflect a reversal of fortunes rather than some structural break in global trends (right panel).[iii]



G7 share of world GDP
Source: World Bank from 1960; Maddison pre-1960.



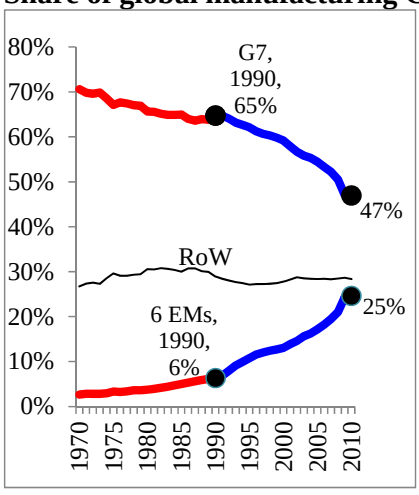
G7 share of world exports
Source: WTO online database.

World exports & manufacturing
Source: UNSTAT online database.

Figure 1: Globalization changed: G7 share of world income and exports

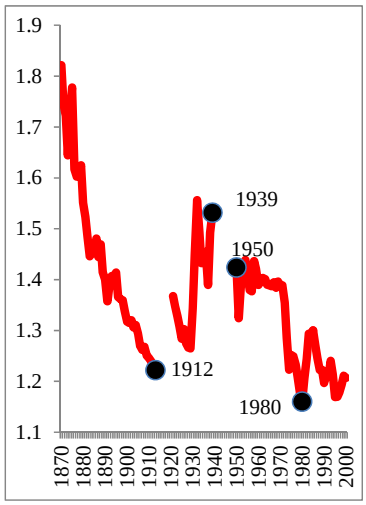
Figure 2 (left panel) shows that global manufacturing was also transformed. Until the mid-1980s, 'industrialized nations' meant 'high-wage nations'. Since then, some low-wage nations are industrializing faster than high-wage nations.[iv] But the share-winners are few. Just seven have gained more than one percentage point of world manufacturing GDP since 1970 -- China, Korea, India, Indonesia, Thailand, Turkey, and Poland. All of the G7 are share-losers over this period.[v] Apart from India, all of their manufacturing sectors are heavily involved in the international supply chains of Japan (the East Asians) or Germany (Poland and Turkey).

Share of global manufacturing GDP



Source: unstat.un.org, 2005 prices; 6Ems = China, India, Indonesia, Thailand, Turkey and Poland; Korea (which gained 3 points) is in RoW.

Estimated trade costs



Source: Jacks, Meissner, and Novy (2011).

Figure 2: Global manufacturing shares and trade cost trends.

The right panel of Figure 2 suggests that the standard culprit in globalization stories – changes in trade costs – is unlikely to be guilty for the reversals. Estimated trade costs –

which encompass trade barriers and transport cost – plummeted from 1870 to 1910. They rose till the 1940s and plummeted again up to 1980. Since then they have stabilised.

These figures make the prima facia case that globalization has changed. Baldwin (2006) argues that globalization driven by lower ICT costs is fundamentally different than globalization driven by lower trade costs. In the 1st unbundling (pre 1980s), international competition occurred mainly at the level of sectors (say Japanese versus Thai cars). In the 2nd unbundling (post-1985), international competition occurs at a finer degree of resolution – the level of production stages (Thai cars may contain Japanese components and vice versa).

But has the changed nature of globalization impacted developing nations' trade and industrialization outcomes? Figure 3 shows that something seems to have changed here as well. The left panel of Figure 3 looks at the shares of manufactures in developing nations' exports – focusing on non-tiny nations, i.e. those with populations at least as large as a big city like Paris.[vi] The bars (one per nation) show the decadal changes in the nations' share of exports in manufacturing (in percentage points). Here the 1985 to 1995 period stands out as extraordinarily positive – even more so than the initial push that came during the decolonisation period (1965-1974). The changes in manufactured export shares both before and since have been modest by contrast.

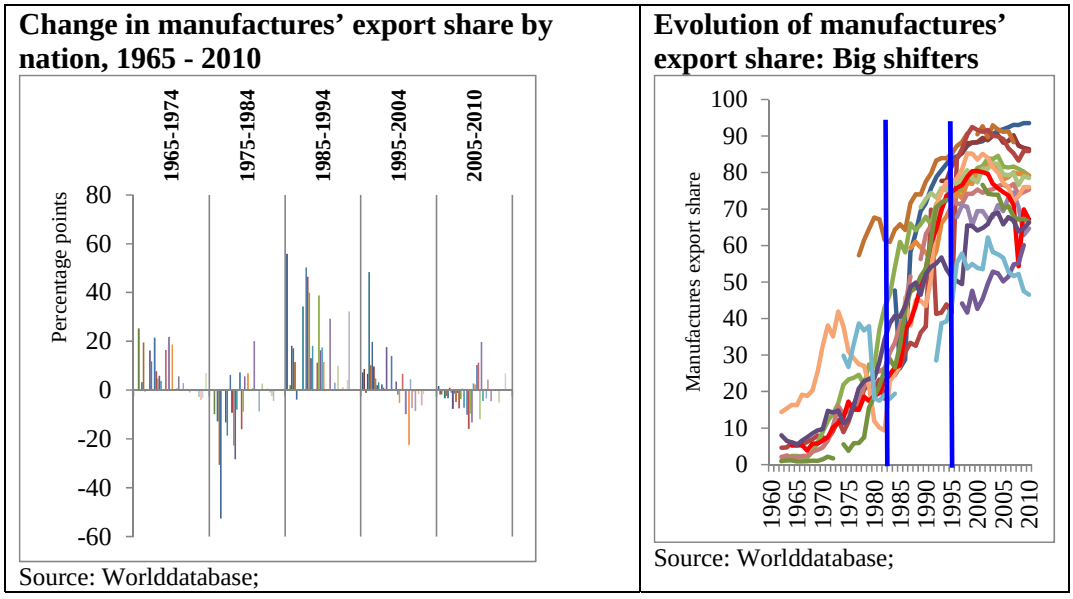


Figure 3: The evolution of developing nations' manufactured export shares.

The right panel focuses on the big share-winners – namely nations that had manufactured export shares below 50% in 1970 but above 50% in 2007 (the last year before the Great Trade Collapse).[vii] The 1980s to mid-1990s period was a time of 'take-offs' for most of these.

Another clue comes from the geography of shifting export compositions. If we again look at nations that are not tiny and rely on manufactured exports (manufactures accounting for more than 50% of exports in 2007-08) then a very clear pattern emerges. Some of these nations saw their manufacturing export shares rise and others saw them fall during globalisation's 2nd unbundling. The winners and losers, however, are remarkably clustered geographically around the nations that dominated world manufacturing until the second unbundling – the US, Japan and Germany. There seems to be one group of low-wage share-winners and high-wage share-losers around Germany, another around the US, and a third around Japan. India

may also be at the centre of a cluster of winners (Figure 4).

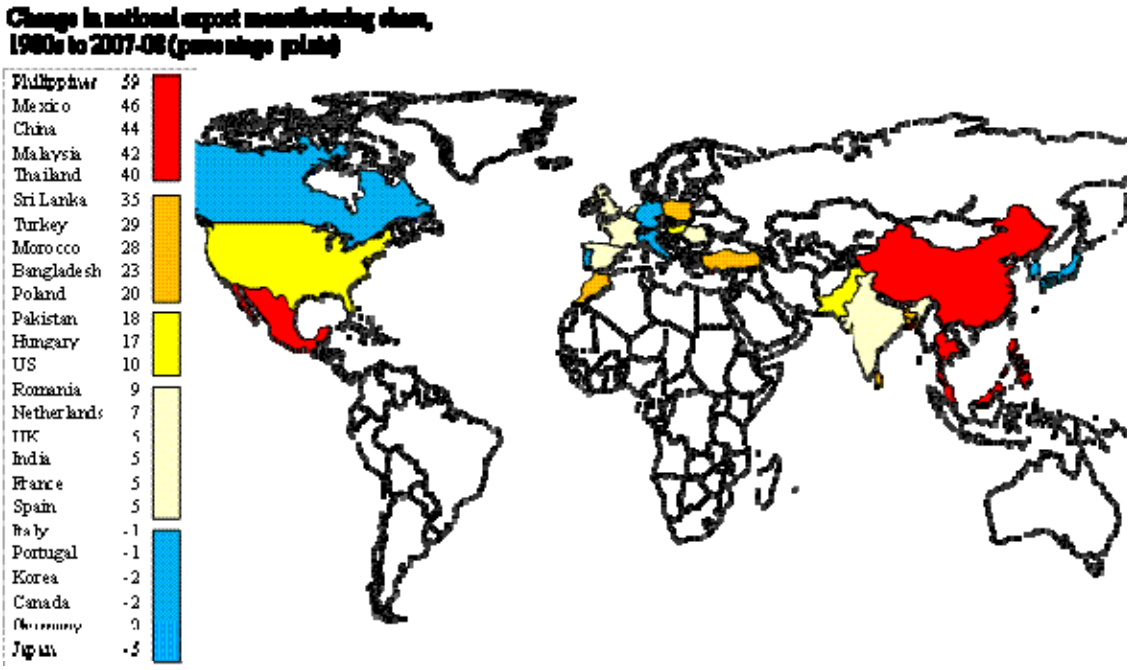
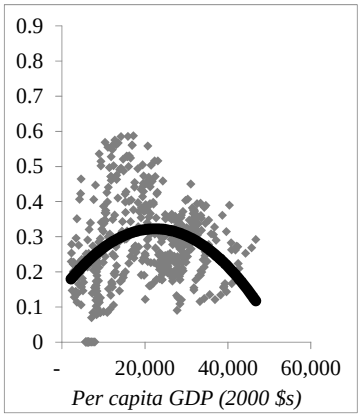
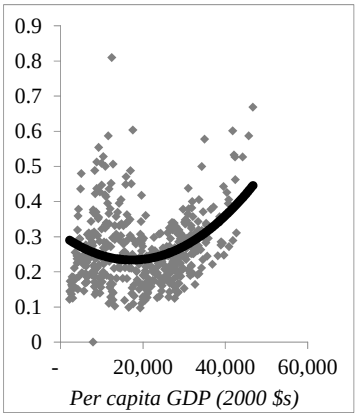


Figure 4: The tight geographical clustering of manufactures export swings.
Note: Data for all nations with 1) population over 10 million, 2) manufacturing export share over 50% in 2007-08, 3) at least 90% data coverage 1985 to 2008. Source: Author's calculations on World Bank data.



Sourcing intermediates: Share of imported intermediates in exports.



Selling intermediates: Share of exports compromising intermediates used in the importer's exports.

Figure 5: The Lopez-Gonzales-Holmes curves: Supply-chain trade and income.
Source: Lopez-Gonzales and Holmes (2011).[viii]

The final bit of prima facie evidence comes from the link between income levels and participation in supply-chain trade. Lopez-Gonzales and Holmes (2011) shows empirically that the pattern of sourcing (importing) from international supply chains are quite different than selling intermediates (exporting) to them. The sourcing share rises up to about $25,000

and then declines (Figure 5, left panel). Selling intermediates falls for low income levels but rises beyond a point near $15,000 (right panel). Combining the two measures, a nation's total involvement in supply-chain is tilde shaped.

While this research is very recent and need further testing, the top-line message is very intuitive. When a nation like China moved up from making clothing to assembling electronics and machinery, the import content of its exports rises, but at the other extreme, a nation like Finland has all but exited from the fabrication end of manufacturing, so domestic value added content of its exports tends to be higher.

These charts paint a picture of two transformations: one in globalization itself, and one in developing nations' experiences with industrial exports. The next task is to suggest how the two might be connected.

1.2. Building versus joining a supply chain

When ISI policies worked – as they did for the US, Germany, Japan, etc. (Clemens and Williamson 2004) – industrialization meant building the whole supply chain at home. This took decades due to learning-by-doing in creating and coordinating the vast array of necessary competencies. Given the simple communication technology available at the time, extreme proximity was essential to coordinating sophisticated manufacturing processes. All the stages of production had to be inside a single factory or industrial district. Most of the necessary competencies had to exist domestically; no nation could be competitive without building a broad and deep industrial base – a hurdle that precious few nations could surmount.

The radical change in globalization – globalization's 2nd unbundling – upended this touchstone fact. The ICT revolution made it feasible to spatially separate some stages of production without much loss in efficiency or timeliness. Once feasible, scale economies and comparative advantage made separation inevitable – especially unskilled labour-intensive stages given the vast international wage differences. In 1985, for example, Japanese wages were 40 times higher than Chinese wages even though Shanghai was close to Japan's automobile hub – just a few days by sea and a few hours by air.

The top-line implications for trade and industrialization are threefold.

- First, with globalization operating at the level of production stages rather than at the level of sectors, industrialization became less lumpy and thus easier.

Nations could industrialize by joining a supply chain.

- Second, as firms with advanced manufacturing know-how offshored some stages, they moved their know-how along with the production.

Managerial and technical know-how became more internationally mobile. After all, the off-shored stages of production had to mesh seamlessly and evolve in tandem with the rest of the production network. This 'technology lending' – which is very different from the 1970s 'technology transfer' – could create advanced manufacturing activity in a developing nation in a matter of months. Developing nations no longer had to follow Korea's decade-long slog up the value chain (a feat that dozens of developing nations tried and failed before the 2nd unbundling).

- Third, distance matters more in supply chains (Gamberoni et al 2010).

Even with today's ICT, coordinating a production network involves some face-to-face and face-to-machine interactions. Technicians and managers must travel from the advance-

technology headquarter nations to the developing host nation. And this must be quick; if something goes wrong, the whole production network may suffer until the failing node is back on line. This is perhaps one reason why we see most production networks concentrated in low-wage nations that are near, or even contiguous with high-technology nations, especially the US, Japan and Germany (Baldwin and Lopez-Gonzales 2012).

1.2.1. Big-Ideas development theory and international supply chains

Given these stylised facts and widespread discussion of international supply-chains, it is surprising that supply-chains have not played a greater role in 'high development' theory. Take, for example, the Spence Growth Commission (2008). The Commission's factual basis rests on 13 success stories. Every single case started well before globalization's 2nd unbundling in the mid-1980s. The Report's lessons are all very sensible – good governance, judicious use of domestic and global markets, etc. – but it seems rather brave to suggest that lessons from Japan's and Korea's industrialization in the 1970s and 1980s can be applied to the world of international value chains (Cattaneo et al 2011).[ix] Specifically, leading development models continue to view industry as purely national. They assume that national production is a package containing only the nation's productive factors and technology.[x] As it turns out, it is rather easy to integrate globalization's 2nd unbundling into a simple version of the canonical high development frameworks.

High development theory starts from the presumption that something is stuck (Harrison and Rodrigues-Clare 2010). A nation has not developed modern industry but could, so market forces must be supplemented by direct government action (first Big Ideas like Big Push and ISI), or by removing the barriers that had hereto prevented otherwise profitable industrialization (Washington Consensus). The deep economic logic in both cases turns on multiple-equilibrium economics.

Successful development policy before the 2nd unbundling

To fix ideas, consider the simplest general equilibrium model with multiple equilibriums (the model here is a simplified version of the one in Harrison and Clare-Rodrigues 2009). Assume a small open economy with a single productive factor and two sectors, one of which is marked by external economies of scale (EES). The perfectly competitive, numeraire sector (call it A), produces under constant returns. The perfectly competitive manufacturing sector (call it M) produces one unit of output with a_M units of labour, but a_M falls as total employment in the sector rises due to EES. Thus:

$$\begin{aligned} &Q_M = \frac{L_M}{a_M}; \quad a_M = \frac{2\beta}{\mu L_M}, \qquad Q_A = L - L_M \\ &SVMPL_M \equiv p\mu L_M / \beta, \qquad VMPL_A \equiv 1 \end{aligned} \tag{1}$$

Where Q_M, L_M and a_M are output, labour employed and the unit labour input coefficient in M; μ (a mnemonic for Marshallian) is the EES parameter and β (a mnemonic for backwardness) governs the nation's native comparative advantage in M (units are choose so the unit input coefficient of A is unity). $SVMPL_M$ and p are the 'social' value of the marginal product of labour (i.e. including EES) and the domestic relative price of M, respectively. $VMPL_A$ is the value of the marginal product of labour in A.

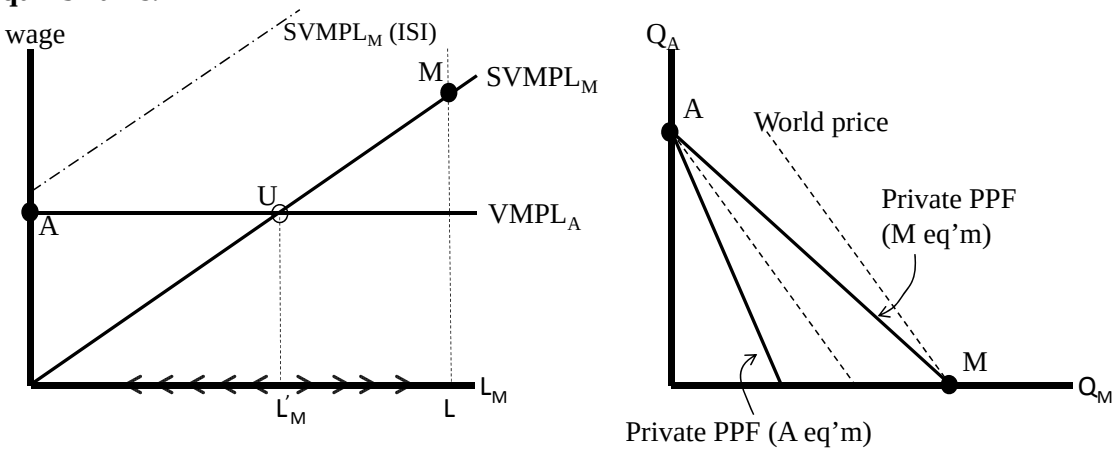
The model can be solved graphically with the help of Figure 6. The state variable is L_M and the left figure shows the tendency of labour to move between the two sectors assuming the migration of the Krugman (1991) type. When L_M is below L'_M, competitive wages are higher in the A sector so the equilibrium is at point A and L_M=0. If L_M is above L'_M, wages are higher in manufacturing so the equilibrium is at M. Liebenstien (1957) calls the unstable

equilibrium U the 'critical minimum effort'; L'_M measures the lumpiness of industry and thus the difficulty of industrializing.

Real incomes are higher in M, so the goal of development/industrialization policy would be to shift to point M, a nation that is stuck at point A. For instance, temporary protection that raised p and thus SVMPLM above VMPLA at L_M=0 (dashed line) would shift labour to M. Once L_M passes the critical minimum effort, protection can be removed; the market will complete the nation's industrialization. This is how ISI was supposed to work.

In trade terms, this is a Ricardian model with an endogenous a_M. Under A and M equilibriums, the nation's comparative advantages are in A and M respectively. This is shown with the 'private' (i.e. ignoring EES) production possibility frontiers (PPFs) in the right panel.

Figure 6: Canonical Big Idea model development/industrialization: Multiple equilibriums.



The very intuitive condition for multiple equilibriums to exist – and thus for ISI succeed – is that $SVMPL_M$ is above $VMPL_A$ at $L_M = L$, namely:

$$\frac{p}{\beta}\mu L > 1 \qquad (2)$$

This requires that that nation's native comparative advantage (as measured by $p/w\beta$) is not too bad, and/or that Marshallian spillovers (as measured by μ) are sufficiently important, and the nation is not too small (as measured by L) to realize sufficient EES.

2nd unbundling: Making industry less lumpy and industrialization easier

This approach pushes the Marshallian spillovers into a black box – a reasonable modelling strategy before globalization's 2nd unbundling. To allow for international supply chains, we introduce intermediate goods in a way that mimics the previous model as closely as possible. Specifically, we maintain all the assumptions except those concerning the M-sector technology. Now M is produced from differentiated varieties with an Either-style, CES production function, and the market structure is Dixit-Stigliz monopolistic competition.

Specifically $Q_M = \left(n_D x_D^{1-1/\sigma} + n_F x_F^{1-1/\sigma}\right)^{\frac{1}{1-1/\sigma}}$ where the subscripts denote domestic, D, and foreign, F, varieties (number, n, and quantity, x) and $\sigma > 1$ is the elasticity of substitution. Using the well-known Dixit-Stiglitz properties, it is easy to show that:

$$SVMPL_M = p\left(\frac{L_M}{2F} + n_F\gamma\right)^{\frac{1}{\sigma-1}}\left(\frac{1-1/\sigma}{\beta}\right) \quad (3)$$

where F is the Dixit-Stiglitz fixed cost and $\gamma > 0$ is a collection of parameters related to the optimal mix of varieties. It is easy to show that if $\sigma = 2$ and $n_F = 0$ (i.e. no unbundling of production), this model is identical to the previous one with $\mu = 1/F$.

The impact of allowing international supply chains is immediately obvious from the formula for $SVMPL_M$. The ability to employ foreign varieties in the domestic production processes (i.e. $n_F > 0$) raises the social value of labour's marginal product in manufacturing. Looking at Figure 6, we see this lowers the 'critical minimum effort' (i.e. the U equilibrium shifts left). What this means in practice is that industry is less lumpy and industrialization is easier.

Additional considerations

For simplicity's sake, we've assumed that the developing nation's comparative advantage in every variety is identical. Given the range of factor intensities in various production stages, it seems quite likely that the developing nation has a greater comparative advantage in some varieties. Before production unbundling, what mattered was the average comparative advantage across all varieties so assuming them all equal entailed no loss in clarity. After unbundling, however, the nation can specialise in varieties where its technological disadvantage is least marked, so the symmetry misses an important gateway to industrialization.

Hereto we have been agnostic as to whether M is a final good or simply one component of a larger production process. If we added more structure, say M being a final good that involves two components, unbundling can even further reduce the 'minimum critical effort' since now the nation could industrialize by making only one of the components and exporting it into an international supply chain. Before unbundling, the nation had to make both. If the unbundling of production stages goes far enough, the minimum critical effort might be so low as to be within the reach of individual firms from advanced technology nations.

Finally, the ICT revolution made it safer for firms with sophisticated know-how to combine their competencies with low-cost labour in a developing nation. For example, if the developing nation does join an international supply chain, the advanced technology firm behind the network has an incentive to lower its costs by combining advanced technology with developing nation labour, i.e. lowering the parameter β and thus make industrialization even less lumpy by shifting equilibrium U to the left.

Distance may matter more in a slight extension of this set up. As mentioned above, even with today's ICT, coordinating a production network still involves some face-to-face and face-to-machine interactions that require technicians and managers to travel from the advance-technology home nation to the developing host nation. This is perhaps one reason we see most production networks concentrated in low-wage nations that are near high-technology nations US, Japan and Germany (Johnson and Noguera 2012, Baldwin and Lopez-Gonzalez 2012).

1.3. Why the difference matters

The role of governments, trade, and multinationals is completely different when a nation joins a supply chain. Two points:

- Industrialization is easier and faster; but
- Industrialization is less meaningful.

It became faster and easier since the supply chain makes industry less lumpy and less interconnected domestically; it became less meaningful for the same reasons. That Korea could export domestically-designed car engines was a testimony to its rich-nation status. Now, exporting sophisticated manufactured goods is no longer the hallmark of having arrived. It may simply reflect a nation's position in an international supply chain.

Moreover the challenges facing policy makers are quite different. Under the 20th century view of industry, a deep industrial base was a prerequisite for export success, but a large market was necessary to support the industrial base. The search for markets was thus a key element of trade and industrialization policy. With international supply-chains, however, demand is easy to find. Instead, policy makers face many new questions: Which supply chains should be joined? Should nations strive to set up their own international production networks? What is the optimal technology policy (intellectual property rights, etc.)? What is the role of size; can smaller nations do what China has done on forced technology transfer? Different nations are trying different things without guidance from formal models that explicitly incorporate supply chains.

This lacuna at least partly accounts for why Big Ideas don't fit all cases. It is easy to see how a comparison between Brazil and China is puzzling when one ignores supply chains.

- China – which is physically in the middle of 'Factory Asia' – is not using Chinese factors of production, Chinese technology, or relying on Chinese policy for most of Chinese exports.
- The Chinese content of its 'processing exports' is less than 20% (Ma and Van Assche 2010), and this type of trade accounts for more than half of the nation's boom in manufactured trade.

Of course China-specific factors also matter, but if you want to fully understand Chinese export success, you have to look at the productive factors, technology, and government policies of Japan, Korea, Taipei, and ASEAN nations – that is where many of the critical components, and most of the design, marketing, and management expertise lie.

- Brazil is too far from 'Factory North America' and 'Factory Europe' to enjoy such a free ride.

Most goods Brazil exports depend solely on Brazilian inputs, technology and policies.

1.4. Plan of the paper

The next section briefly recalls the main outlines of globalization's 1st and 2nd unbundlings to set the stage for an illustrative case study (autos) in Section 3. Section 4 seeks to crystallise the economic logic linking trade and industry when industrialization meant building a supply chain. Section 5 extends the framework to allow explicit consideration of supply chains, their internationalization, and the role of multinationals. The penultimate section explores why the difference between building and joining a supply chain matters. Section 7 looks at the implications for multilateral cooperation and the last section presents the concluding remarks.

2. GLOBALIZATION AS TWO UNBUNDLINGS

Globalization is not a smooth process driven by lower natural and manmade trade costs. Globalization made a giant leap when steam power slashed shipping costs; and advanced in the post-war period when trade barriers erected in the inter-war years were reduced. It made another when ICT decimated coordination costs. The implications of the two are dramatically different; understanding why requires a bit of background.[xi]

2.1. *Steam revolution and the 1st unbundling*

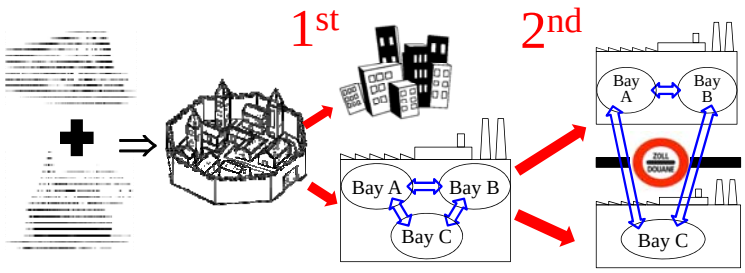
When clippers and stage coaches were high-tech, few items could be profitability shipped internationally. This forced the geographical bundling of production and consumption; each village had to make most of what it consumed (central illustration in Figure 7). Steam power changed this by radically lowering transport costs (Figure 8, left panel).

- Railroads and steamships made it feasible to spatially separate production and consumption.
- Once the separation was feasible, scale economies and comparative advantage made it inevitable.

This was globalization's 1st unbundling. Trade theory was developed to understand its economic impact.

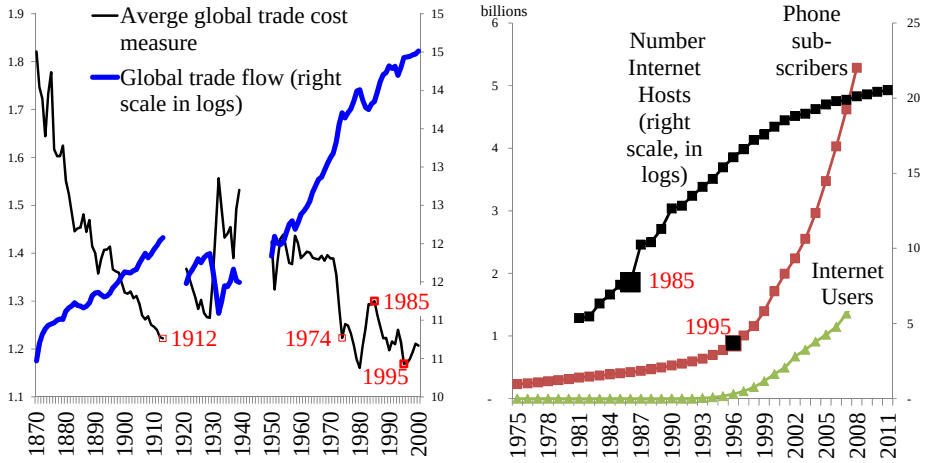
The 1st unbundling created what might seem to be a paradox – production clustered into factories and industrial districts even as it dispersed internationally (Figure 7). The paradox is resolved with three points: i) cheap transport favoured large-scale production, ii) such production is very complex, and iii) close proximity lowers the cost of coordinating complexity. Consumption clustered in cities for reasons that do not concern this paper.

Figure 7: Steam & 1st unbundling and ICT & 2nd unbundling.



Source: Baldwin (2011).

Figure 8: Trade costs (left, 1870 – 2000) & ICT indicators (right, 1975-2011).



Notes: Trade cost measure (left panel) estimated from gravity equations. Source: Jacks, Meissner, and Novy (2011). ICT indicators (right panel). Source: WDI for phone and internet users; www.isc.org for internet hosts.

Thoughtful readers will have already guessed what the 2nd unbundling involves. To set the scene, however, consider the forces that produced the local clustering of production.

ICT revolution and the 2nd unbundling

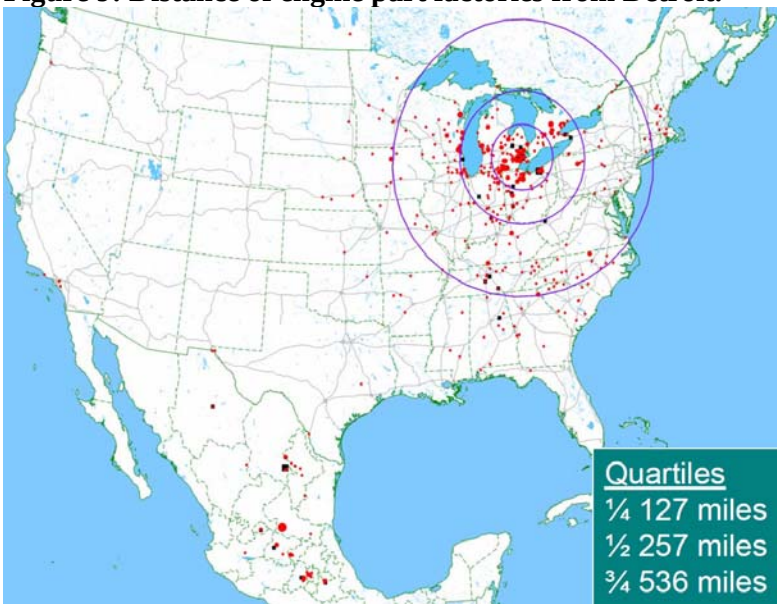
Why does the production of goods and services cluster within buildings and factories? Think of a stylized factory with the production stages as schematically illustrated in Figure 7. Coordinating the manufacturing process demands continuous, two-way flows among the bays of goods, people, training, investment, and information (double-headed arrows). As productivity-enhancing exchanges keep the process in flux, the flows never die down.

Plainly some of proximity's cost-savings are related to communications. As telecommunications became cheap, reliable, and widespread from the mid-1980s, the 'coordination glue' began to loosen. Telecom advances united with vast strides in computing power, transmission capacities, and software to create the information and communication technology (ICT) revolution.[xii]

- It became increasingly economical to geographically separate manufacturing stages – to unbundle the factories.
- Once the separation was feasible, scale economies and comparative advantage made it inevitable.

This is the globalization's 2nd unbundling; production stages previously performed in close proximity are dispersed to reduce production costs. Theories to understand its implications are only now emerging.[xiii]

Figure 9: Distance of engine part factories from Detroit.



Source: ww.chicagofed.org, 2005_aos_klier.pdf

The unbundling, however, is not global. It is regional. Take for example the North American auto industry. "During the 1950s, three-quarters of all auto parts were made in or near Michigan, whereas the state is now responsible for only one-quarter" (Klier and Rubenstein 2008). Figure 9 shows that today many parts plants are no longer in Michigan but they are clustered within a 1000 kilometres radius. The plants further afield, for example in Mexico,

are themselves clustered. This is one of the clues on why distance is so important in international supply chains.

The timing of the 2nd unbundling has not been definitively identified. The right panel of Figure 8 shows ICT indicators that suggest the shock that created it unrolled from say, 1985 to the late 1990s; I take 1985 to 1995 to be concrete. Transport costs jumped around a bit during this period (oil prices), but were on average unchanged since the mid 1970s (left panel, Figure 8).

2.2. Transformed international commerce

The 2nd unbundling transformed trade for a very simple reason. Production dispersion did not end the need to coordinate production stages – it internationalized it (rightmost illustration in Figure 7). This gave rise to 21st century trade – the heart of which might be called the trade-investment-services-intellectual property (IP) nexus (Baldwin 2011). Specifically, the nexus reflects the intertwining of: i) trade in parts and components, ii) international movement of investment in production facilities, personnel training, technology, and long-term business relationships, and iii) services to coordinate the dispersed production, especially infrastructure services such as telecoms, internet, express parcel delivery, air cargo, trade-related finance, customs clearance, etc.

The most radical change in terms of theory and outcomes was the way the 2nd unbundling made it easy for rich-nation firms to combine the high technology they developed at home with low-wage workers abroad. The first examples came in 1985 across the US-Mexico border (Hanson and Feenstra 1997) and within East Asia (Ando and Kimura 2005). This created an important distinction – what might be called 20th versus 21st century trade.

- 20th century trade is the selling of goods made in factories in one nation to customers in another; the trade system is largely about demand, i.e. selling things.

In this world, goods are 'packages' of a *single nation's* productive factors, technology, social capital, governance capacity, etc. Of course, 20th century trade is still with us.

- 21st century trade involves continuous, two-way flows of things, people, training, investment, and information that used to take place within factories and offices; the trade system is also about supply, i.e. making things.

Goods are 'packages' of a *many nations*' productive factors, technology, social capital, and governance capacity; a nation's trade pattern is inseparable from its position in the supply chain. Comparative advantage shifted from a very national concept to a much more regional concept as predicted by the analysis of Deardorff (2005).

2.3. Transformed industrialization

The 2nd unbundling also transformed industrialization. Before the ICT revolution and the 2nd unbundling, the nation needed all three Figure 7 production bays inside the country. After the 2nd unbundling, advanced-nation firms offshored labour-intensive segments of their supply chain to developing nations.

This completely changed the industrialization process in the developing nations that received these offshored stages. Stage B arrived with everything needed to export – world-class technology, management, quality control, a ready-made market, etc. All the developing nation had to add was reasonably reliable workers, a hospitable business environment, and proximity to an advanced technology nation willing to offshore some of its factories. Note that proximity matters greatly since key personnel must still visit the offshored factory, so

being within an easy day's travel is a tremendous advantage (Figure 9).

At first this was limited to export processing zones (EPZs) and 'triangle trade' (e.g. Japan ships computer parts for assembly to China which ships the final good to Europe). As cost pressure led to growing specialisation and scale, multiple developing nations were folded into the supply chain. This is clearest in East Asia where it can be seen in the 1985 versus 2000 Asian Input-Output tables constructed by Japan's IDE-JETRO (Table 1). Each element shows the column-nation's share of manufactured intermediates that is purchased from the corresponding row-nation.

Table 1: Evolution of Factory Asia, 1985 to 2000.

1985	Singapore	Malaysia	Indonesia	Philippines	Thailand	China	Korea	Taiwan	Japan
Singapore	20%	7%	3%						
Malaysia	10%	50%							
Indonesia	5%		63%						
Philippines				73%					
Thailand					73%				
China	9%			2%		90%			
Korea							78%		
Taiwan								79%	
Japan	8%	14%	11%	4%	9%	3%	9%	7%	94%
US	7%	7%	5%	6%	2%		5%	3%	
EU & RoW	36%	16%	15%	10%	11%	6%	7%	9%	3%

2000	Singapore	Malaysia	Indonesia	Philippines	Thailand	China	Korea	Taiwan	Japan
Singapore	37%	12%		5%	4%				
Malaysia	11%	36%		3%	3%			2%	
Indonesia	2%		73%						
Philippines				32%					
Thailand	3%	4%		2%	51%				
China	4%	2%			4%	88%			
Korea	3%	4%	3%	7%	3%		78%	4%	
Taiwan	3%	5%		5%	3%			61%	
Japan	17%	13%	6%	17%	15%	2%	7%	13%	93%
US	11%	11%	4%	12%	6%		5%	6%	
EU & RoW	8%	10%	7%	14%	10%	3%	4%	7%	

Source: Baldwin (2008). Notes: Share of manufactured inputs bought by column nation's manufacturing sector from the row nation. Numbers less than 2% are zeroed out. For details of the original tables, see Inomata and Uchida (2009).

In 1985, the matrix was simple. Most developing East Asian nations supplied most of their own intermediates (diagonal of top panel). The rest was imported from advanced nations (the shaded rows). By 2000, the diagonal elements were way down; cross-country reliance was way up. Countries like Thailand and China were supplying lots of intermediates to fellow developing nations. This is 'Factory Asia' (Baldwin 2008).

3. SUGGESTIVE CASE STUDY: THE AUTO INDUSTRY

To bring down the level of abstraction, this section turns to examine a case study: how the 2nd unbundling transformed trade and industrialization in East Asia's auto sector.

3.1. Import substitution in autos

Development economists' first big idea – import substitution – was commonly viewed as

having an easy bit and a hard bit. The easy bit was to generate production of 'light' manufactures, such as clothing and shoes. It was easy in the sense that Liebenstien's 'critical minimum effort' was low enough for even small nations to get past. The hard bit was moving up to 'heavy' industry like chemicals and machinery (Balassa 1981, Essay 1). Among the favourite second-stage import substitution targets was the automobile industry. This is odd.

Even in the 1970s, making an automobile required a massively complex network of suppliers, and a broad array of advanced technologies, advanced management capacities, and a skilled workforce – exactly the wrong entry-level industry one might think. Why then was it such a favourite among development planners?

The answer is that the advanced-nation car producers helped them contrive the appearance of an auto industry. The trick is so-called complete knock-down kits, often shortened to CKD. "Nearly all kits come from home country plants, where the parts are taken off the assembly line and 'consolidated' in shipping containers for transport to CKD assembly plants," (Sturgeon 1998). The assembly plant then puts together the pieces and presto! The nation can pretend it has a car industry. The developing nation's assembler was almost always a joint venture with the advanced-nation kit producer.[xiv]

Figure 10: National car Proton Saga (left) vs Mitsubishi Lancer (right)

Source: Wikipedia public domain photos.

Assembly, of course, was only meant to be the first step. According to ISI theory, local assembly would create local demand for auto parts and this world create local parts suppliers. The developing nations would build the whole supply chain working from downstream to upstream. Local content requirements were designed to encourage this. Given the sophistication of the components and lack of local competency, firms typically met local content restrictions by repeating the charade for components (local content rules were typically defined in gross cost, not value added).

Importantly, the whole system was rigged to prevent the infant industry from growing up. The advance-nation partner companies had no interest in creating new competitors. Malaysia's first national car, the Proton Saga, bore a striking resemblance to the Mitsubishi Lancer Fiore (Figure 10), was built on the Lancer platform, and contained a Lancer engine (Rosli 2006). It is easy to see why Mitsubishi had little interest in the Saga becoming an export success.

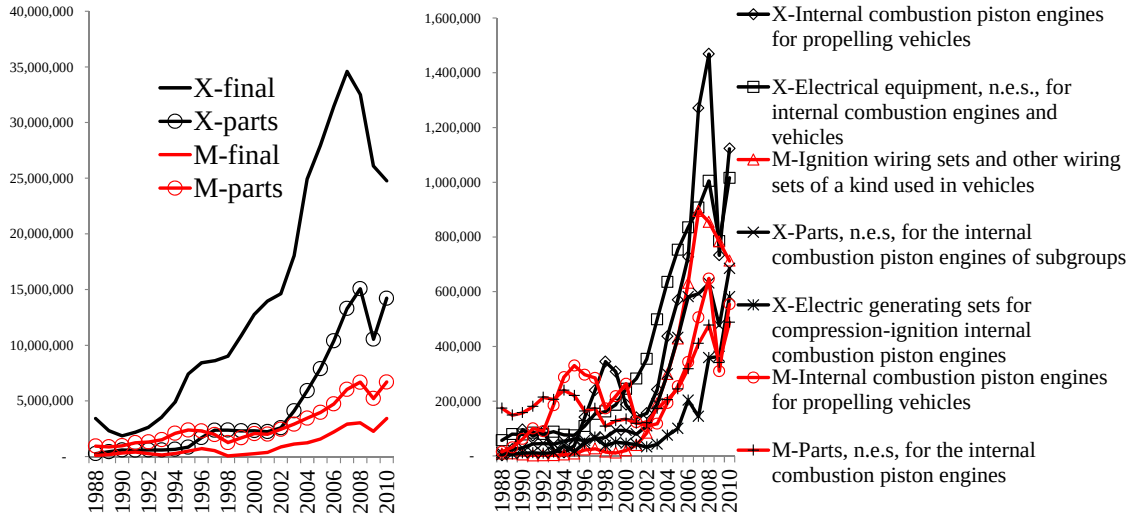
3.2. Korean success story

Of all the developing nations that played this game, only Korea managed to build its own supply chain, introduce original models, and become competitive in world markets. The story has been told many times.[xv] From 1962, the Ministry of Trade and Industry used all the tools of industrial policy – subsidised loans, tax breaks, distorted tariff schedules, import bans, etc. – to develop a car industry via import substitution.

Korea started with assembly, but multinationals were forced to accept weaker positions than usual; control was handed to chaebols – family-owned conglomerates (Amsden 2001). Four firms were established in the first big push: Shinjin, Hyundai, Asia Motors, and Kia. The second big push came as part of the Heavy and Chemical Industries Project (1973). This required the companies to submit plans for a low-cost car whose specifications, timetable, and costs were laid down by the government. The result was Korea's first home-designed car – Hyundai's Pony – and a Mazda-designed car by Kia called "Brisa". Local content of these reached 85%, but major components were still imported (Green 1992).

Hyundai's Pony enjoyed huge success at home, selling almost 300,000 units by 1982; it also achieved limited success abroad (about 15% of production was exported, Ravenhill 2001). Industry output rose more than tenfold by the end of the decade. On the back of this success, another big push came in 1978. Massively ambitious government-set production goals encouraged Korean firms to make big new investments, but the global 1980-83 recession hindered these plans and brought the companies near to bankruptcy. The Ministry of Trade and Industry led a restructuring and reorientation of the industry; scale was to be achieved by exporting to the US (the only market that was big enough and open enough). The Ministry also targeted quality upgrading and Korean companies invested heavily in new production facilities. They negotiated new alliances with major automobile and automobile parts makers for plant layout, body design, the supply of major components, and access to marketing channels. Hyundai also set up its own dealer network in the US and Canada. Most of this was debt financed.[xvi]

Figure 11: Korean exports of cars and parts, 1988 - 2010.



Note: Exports in black (vehicles solid lines, parts with circles); imports in red.

With this high-volume, Korean automakers pushed further up the supply chain. By the early 1990s, they were producing engines, transmissions, chassis, and brakes with their own technology. Two other highly sophisticated components where brought into the local supply chain in 1996 (the Engine Control Unit, and the Transmission Control Unit).

The nature of this success story was completely transformed by the 1997 Asian crisis. From the mid-1980s until the end of the 1990s, Korean exports were dominated by cars (left panel,

Figure 11). Now however the Korean auto industry is a full-fledged participant in the international supply chains. Yet because they built a supply chain *before* the 2nd unbundling, Korea is a headquarter economy rather than a factory economy. As Figure 11 shows, its exports of cars and car parts are booming, along with its imports of parts. For example, Korea is an important exporter of engines, but an important importer of the ignition wiring sets used in those engines (right panel).

3.3. Malaysia's failure and Thailand's success

Until 1982, Malaysian auto industrialization focused on kit assembly. The already small market was shared by more than a dozen assemblers. "The resulting market fragmentation made it difficult for components producers to achieve economies of scales, thus, the locally produced parts and components were expensive. This hindered the further localization;: in 1979, the average local content achieved was merely 8 per cent" (Fuangkajonsak 2006).

Policy became radically more state-directed under Prime Minister Mahathir bin Mohamed. In 1981, he established the government-owned Heavy Industries Corporation of Malaysia (HICOM) which aimed to establish a Japanese-like fully integrated automobile industry, i.e. to build the whole supply chain. A 'national car project' – Proton – was launched as joint venture with Mitsubishi (HICOM held 70% of the shares).

Unfortunately, the first fruit of this effort (the Saga, Figure 10) appeared in 1985 – the year the 2nd unbundling started to destroy the economic foundations of single-nation automobile production.[xvii] Tariffs and taxes meant that the Saga was 20-30% cheaper than similar models domestically (Fujita 1999); its market share rose to 73% (Uzir Mahidin and Kanageswary, 2004). Exports started in 1989, mostly to Britain under the GSP scheme which allowed in up to 14,000 units duty free; these were sold below the Malaysian domestic price (Wad and Chandra 2011 p.166).

Proton upgraded from assembling imported key components and parts to manufacturing them locally. Localization efforts, however, did not go smoothly. Saga continued to rely on Mitsubishi for technology and design. Despite its local and export success, Proton's sale-volumes remained small by industry standards (under 100,000 units per year for all models). A second big push came in the 1990s as Proton introduced new models and produced them with varying engine sizes;. Malaysian production more than doubled from 1990 to 1997. Proton's plans, however, were even more ambitious. It announced a new project, 'Proton City', which would become an integrated automobile manufacturing city with a production capacity rising to 250,000 units in 2003. During this Proton expansion, a second national car company was set up (Perodua a joint venture with Daihatsu that produced a modified Daihatsu Mira called the Kancil).

For many governments, the 1997 Crisis was the moment they realized that the ISI dream was over. Building a supply chain, like Japan and Korea had done, was not optimal and indeed not possible after the 2nd unbundling. Quite simply, offshoring had killed import substitution. The Malaysian government, however, persisted in pursuing its 1980-era strategy as far as possible. Perodua was sold to its Japanese partner, but Proton was re-nationalised in 2000 and the new, highly advanced plant was completed (Tanjung Malim, with a production capacity of 500,000 vehicles per year).

Proton introduced the first Malaysian-designed car – the Waja (Impian in Britain) – with the help of technology it acquired when it bought the British car company Lotus. Proton moved up the value chain to manufacturing its own engine in 2002. Given the high costs of parts production, Proton's domestic market share continues to fall into 2010. Much of its production capacity is idle. The government is looking for a foreign partner for Proton.

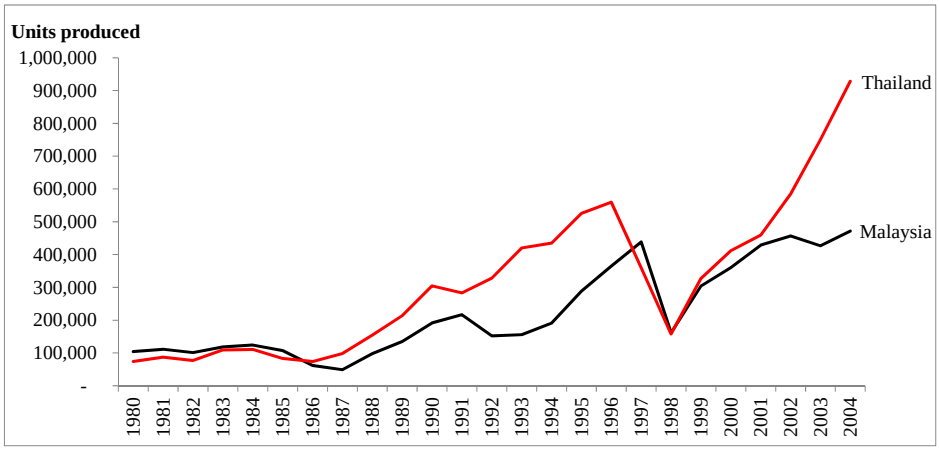
After four decades of import substitution, Malaysian auto sector employment was about 50,000 – 70% of whom are working for Proton or Perodua, and about 80% are unskilled labourers (Wad and Chandra 2011).

3.3.1. Thailand

Thailand's 1960s auto-industrialization plan also aimed for the whole supply chain, starting with CKD assembly. The Thai Board of Investment provided incentives that attracted automakers from the US, Japan, and Europe (Fujita 1999). Thailand raised local content requirements and effective rates of protection progressively. Japanese part suppliers established production in Thailand at the request of Japanese assemblers, thus recreating the close corporate ties that had long existed in Japan. Japanese assemblers also developed their own Thai supplier networks by helping local part firms raise their quality via technical assistance (Techakanont 2008).

The economic slowdown and the progressive raising of the local content led GM, Ford, and Fiat to withdraw in the early 1980s just before Thailand's GDP growth took off. The booming domestic vehicle sales from 1987 came just as Japanese auto companies embraced the 2nd unbundling. Unlike Malaysia, Thailand abandoned the old wave to ride the new wave.

Figure 12: Vehicles produced, Malaysia and Thailand, 1980-2004



Source: Fuangkajonsak (2006 Table 1).

Trade and ownership restrictions were relaxed, but some local content rules were tightened. For example, the Engine Production Promotion Scheme required engine assemblers to use only engine parts that had undergone specific local processing.[xviii] Given the small market for each producer compared to the minimum efficient scale, various Japanese joint ventures collaborated on the local production of the five compulsory parts (Techakanont 2008). The implementation of advanced technology in local factories enhanced Thai industrial capacities. Another unique policy move was the concentration on one market segment – light pickup trucks and vans. Domestic taxes shifted domestic demand heavily towards these (more than 60% sales inside in Thailand) and this was mirrored in Japanese FDI patterns, and later in export patterns.

The next step was exporting – a goal that the Thai government had embraced since the mid-1980s. However rather than intervening directly, the government sought to convince Japanese companies that it would avoid the sort of techno-nationalism policy that hindered FDI in Malaysia. The 1993 'Export Promotion Project' also provided incentives for assembling

automobiles for export (tariff exemptions on parts, an 8-year tax holiday, etc.). Local content restrictions were eliminated in 1998 and tariffs and excise taxes were liberalised in 1999. The Thaksin government introduced a bevy of incentives aimed at creating the 'Detroit of the East'. This worked.

3.4. Comparison of outcomes

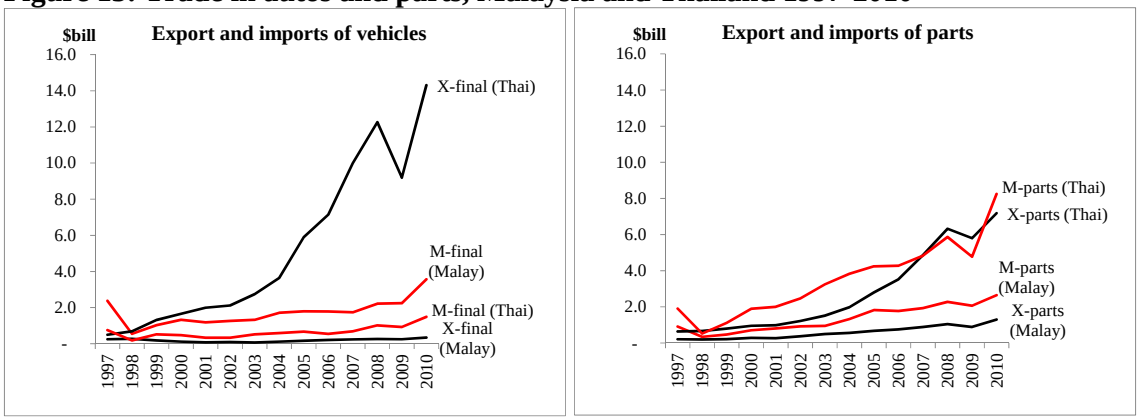
Differences in results only show up dramatically after the 1997 Crisis (Wad 2009); Figure 12.

- Thailand embraced the 2nd unbundling and strove to become part of the global supply chains of as many giant auto firms as it could;
- Malaysia persisted with its 1980s strategy of emulating what Korea did in the 1980s and Japan did in the 1970s.

Figure 12 and Figure 13 show which strategy worked best. Malaysia is running a wide and growing deficit in both vehicles and parts; Thailand has a large surplus in vehicles and approximate balance in parts (Figure 13).

The results in terms of employment are equally stark. By the mid-2000s, there were over 180,000 workers in the Thai auto industry compared to 47,000 in Malaysia (Wad and Chandra 2011).

Figure 13: Trade in autos and parts, Malaysia and Thailand 1997-2010



Source: WITS online database, SITC v.3.

4. TRADE, INDUSTRIALIZATION & THE 1ST UNBUNDLING

Having argued that trade and industrialization were transformed, it is time to be more specific, to lay out a model where the logical relationships can be understood in their entirety. The first step is to present a framework that captures the basic elements of traditional ISI thinking (this section). The framework is then extended to consider supply chains (Section 5).

4.1. Industrialization before the 2nd unbundling

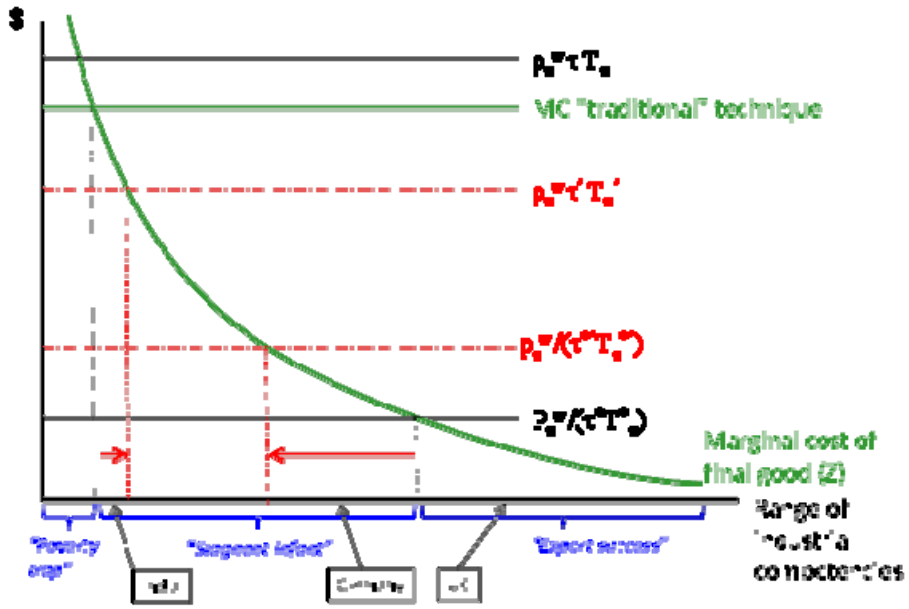
When coordination costs were high enough to keep manufacturing bundled into factories; theorists could safely ignore supply chains. The focus was on lumpiness and complexity (e.g. Clare-Rodriguez 1996, and Rodrik 1995). Their basic points can be made graphically.

4.1.1. Great Britain versus the rest

Lumpiness of industry comes with external economies of scale and we capture complexity by

assuming that the external economies are linked to the nation's range of industrial competencies.[xix] Nations are not endowed with competencies; creating a new competency requires a fixed investment of labour. The diagram (Figure 14) reflects these keystone assumptions. The salient points are: i) industry's marginal-cost curve is downward sloped (external economies mean that the broader is a nation's range of competencies the lower is its marginal cost); ii) traditional manufacturing techniques (cottage industry) are not subject to scale economies of any kind, so its marginal cost is flat (second to top line).

Figure 14: 20th century industrialization.



Source: Author's elaboration of first generation development theory ideas.

The world price of industrial goods is shown as p_z^w, but this is not the price of imports inside the nation as two wedges intervene: the natural trade costs captured by τ (a mnemonic for transport costs), and the domestic tariff factor, T_z. (NB: when transport is costless $\tau = 1$; when tariffs are zero, $T_z = 1$.) The domestic price is thus the highest line (we assume the nation has tariffs high enough to make cottage industry profitable). Natural and manmade barriers also lessen the attractiveness of exporting, hence the net price received by exporters (the bottom line) shows the world price divided by τ and T_z^* (1 plus the foreign tariff).

The two price lines partition the horizontal axis three ways. From left to right:

- Poverty trap: here steady-state competencies are so low that domestic modern firms cannot compete with domestic cottage industries.
- Stagnant infant: The supply of competencies allows modern industry to out-compete handicrafts, but domestic industry cannot compete abroad.
- Export success: The supply of competencies is high enough to make exporting worthwhile.

Before the 1st unbundling really got going, only Britain was in the third box; Germany and India were in the middle range; many were in the poverty trap.

The question within the diagram – and a linchpin issue facing developing country policymakers – is: What determines a nation's steady-state range of competency? The market alone cannot answer this; lumpiness and complexity create multiple equilibriums.

Industrial competencies are demanded by industry, so if there is no industry, there is no demand, and thus no supply of competencies ("poverty trap"). In the second partition, demand for a nation's competencies is, so to speak, limited by the extent of the market – the domestic market that is. Big nations will have big protected industries and thus a wide range of competencies. Small nations will remain uncompetitive. In the third partition, the nation's industry has become "the workshop of the world". Demand for its competencies is large, almost boundless since it is linked to world consumption, not domestic consumption, and this, in turn, supports the large supply of competencies.

This means that there are two bifurcations that might require a big push to get past. No industry to some modern industry, and domestic sales only to exporting. A complete model will require a full description of the dynamic process that creates competencies, but here we stick with more informal analysis.

4.1.2. The 1st unbundling

The steam revolution shifts the two price lines toward each other (dashed red lines in Figure 14) by lower τ. This widens the first and third partitions at the expense of the second. Some of the nations, like Germany, become export-competitive.[xx] Others, like India, now found themselves in the poverty trap.

For the winners, like Germany, the extra demand for competencies generated by export sales boosted demand for and thus supply of competencies. The opposite happened to India. This was the beginning of the big divergence (see Krugman and Venables 1995 for the static economic geography version; Baldwin, Martin and Ottaviano 2001 for a formal growth model of take-off and divergence).

4.1.3. Big Push, failed ISI, outward orientation, Dutch Disease, etc.

Trade policy's role in traditional development thinking jumps right out of the diagram. Getting from the first partition to the second requires i) investment in competencies starting without demand, ii) demand without any local capacity to satisfy it, or iii) coordinated appearance of the two. Getting past this was the focus of so-called Big Push development strategies. When the world was like this, import-substitution industrialization could make sense for sufficiently large nations. Indeed, in the 1960s and 1970s, it often worked for light industries. Colonialism (captive markets), and the push of the 1960s for South-South free trade agreements can be seen as trying to boost domestic market size for nations in the middle partition.

First generation Big-Push-ISI theorists wrongly assumed that moving from the first partition to the second would launch a self-sustaining dynamo of rising output and accumulating competencies that would eventually lead to the third partition (export competitiveness). Revelation of this fallacy accounted for much of the dissatisfaction with the theory. Second generation theorists turned their focus to the second bifurcation (transition from second to third partition).

Getting over the second bifurcation required a second big-push that involves: i) exporting at a loss initially, ii) investment in competencies for which there is not yet any demand, or iii) the coordination appearance of export demand and extra competencies.[xxi] The Korean and Malaysian auto experiences – as well as many others – embodied efforts to select option iii).

The diagram is useful for organising thinking on many development chestnuts. The Dutch Disease can be seen here. The marginal cost curve depends upon local wages. For nations in the second partition (modern, but uncompetitive industry), the non-industrial sector will

typically set the reservation wage and this, plus some industrial premium, determines the modern-sector wage. A boom in commodity prices, or improved productivity in the non-industrial sector would raise the industrial marginal cost curve and thus harm the competitiveness of the national industry for any given range of competencies. Depending upon the nation's initial position and shock size, the nation may de-industrialize (shift into partition one from two, or two from three).

Big exchange rate devaluations are like the Dutch Disease in reverse and thus can potentially shift a nation from partition one to two, or two to three. Of course, it need not work this way. If the nation's initial comparative advantage is poor (it is far from the second bifurcation), the devaluation may only produce a transitory boost in sales but no permanent increase in industrial competency.

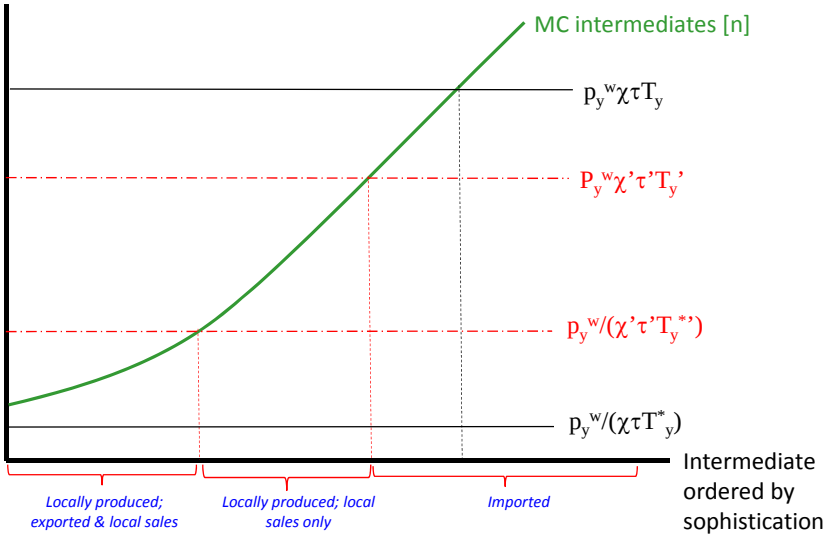
5. TRADE, INDUSTRIALIZATION & THE 2ND UNBUNDLING

To think carefully about things like Malaysia's versus Thailand's autos policies, we need to get away from the black box view of industry – the 20th century view that a nation's output is made only with its own factors employing its own technology. We introduce the framework assuming 2nd unbundling has not yet happened.

5.1. Industry with a supply chain

The key assumptions of the expanded framework are: i) production of the final good requires intermediate inputs (parts); ii) the parts range from simple to highly sophisticated – the more sophisticated ones are more intensive in their use of competencies; and iii) to reflect developing nation realities, Home is least competitive in the most sophisticated parts. More sophisticated parts are more expensive for Home (the developing nation) to make (Figure 15). A judicious choice of units let us compare marginal costs and prices across intermediates.[xxii] Finally, we assume trade in parts is costly; in addition to transportation and tariffs, coordination costs are added when parts and final goods are manufactured in different nations.

Figure 15: A simple supply chain.



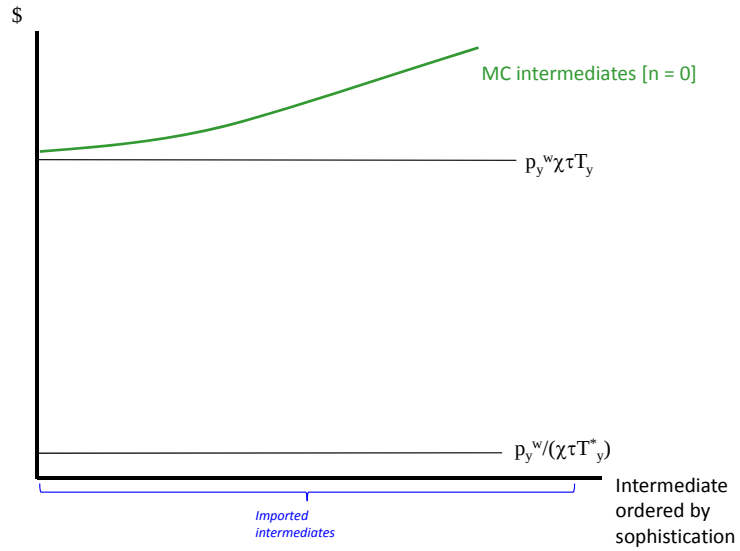
Source: Author's elaboration.

These costs add a new wedge, χ (a mnemonic for coordination), to the separation of the two price lines – the domestic price (top) and net export price (bottom). The range of competencies – denoted by 'n' (competencies range from zero to n) – is embedded in the position of the marginal cost curve for intermediates (MC Intermediates in the diagram). A nation with a wider range of competencies would, all else equal, have a lower MC Intermediates curve. Observe that final-good production is pushed into the background to focus on the supply chain.

Figure 15 is drawn assuming that the final good is produced in Home (without downstream production there would be no demand for Home intermediates and thus no production or importation of intermediates). Although it does not appear directly, the chicken-and the-egg lumpiness of industry is still here. If Home does not produce a sufficiently broad array of intermediates, it will not be competitive in the downstream good. Given prices, the nation produces all parts up to a threshold level of sophistication (left partition of the x-axis); it imports the rest (right partition). ICT costs are high to start with, so no parts are exported.

Where are our three cases from Figure 14? For example, suppose Home protects the downstream industry in order to create a demand for upstream intermediates, hoping that their supply would be forthcoming. If this works, the nation gets modern industry, which here means downstream production and production of some intermediates but no exports. The third possibility is that the domestic market is so small that nothing works. Protection of the downstream goods creates no modern production of parts or final goods (poverty trap). Such a situation is depicted in Figure 16; Home's marginal cost of producing intermediates is everywhere above the import price; there is no modern production downstream or upstream.

Figure 16: A simple supply chain: Poverty trap case



Source: Author's elaboration.

5.2. 2nd unbundling without multinationals

Now the ICT revolution happens and this brings down coordination costs, χ. How does this change the diagram? To answer this, we have to address the role of multinationals.

Multinational corporations have been thoroughly involved in the internationalization of supply chains, often playing a dominant role. However, before considering the implications

of multinationals' involvement, it is instructive to think about a 'pure' 2nd unbundling – one without MNCs. This allows us to motivate the rather obvious observation that the 2nd unbundling makes industry less 'lumpy' and thus makes industrialization easier and quicker, even without multinationals. This distinction also helps separate out two very different implications of the ICT revolution. It facilitates geographical separation of production stages, and it heightens the rewards to and need for combining rich-nation high-tech with poor-nation low wages.

Starting from the Figure 15 case (only domestic sales), we lower χ so the price lines get closer together as shown (just as falling transport costs narrow the gap Figure 14). The new, dashed price-lines now partition the range of intermediates into three segments. The rightmost segment represents the intermediates Home imports (Home marginal cost is above the import price). The middle segment defines the intermediates Home produces but does not export (Home marginal cost is low enough to beat imports but not low enough to be competitive abroad). The leftmost segment is new. It depicts a range of intermediates where Home is now competitive in world markets.

We immediately see two first-order effects of the ICT revolution: 1) the range of intermediates produced at Home shrinks, and 2) trade in intermediates rises – both imports and exports (as in Figure 11 and Figure 13).

The first effect stems from the fact that at the high end of the range, imports displace domestic production of intermediates. While bad news for any specific factors involved in the newly uncompetitive intermediates, this is good news for downstream competitiveness. Since the imports are cheaper, downstream competitiveness is improved. More local downstream production is good news for intermediate producers in the middle segment. The second effect stems from the way that lower coordination costs allow Home to export the parts where it has the greatest comparative advantage (leftmost segment).

5.2.1. Informal dynamics: Existing industry case

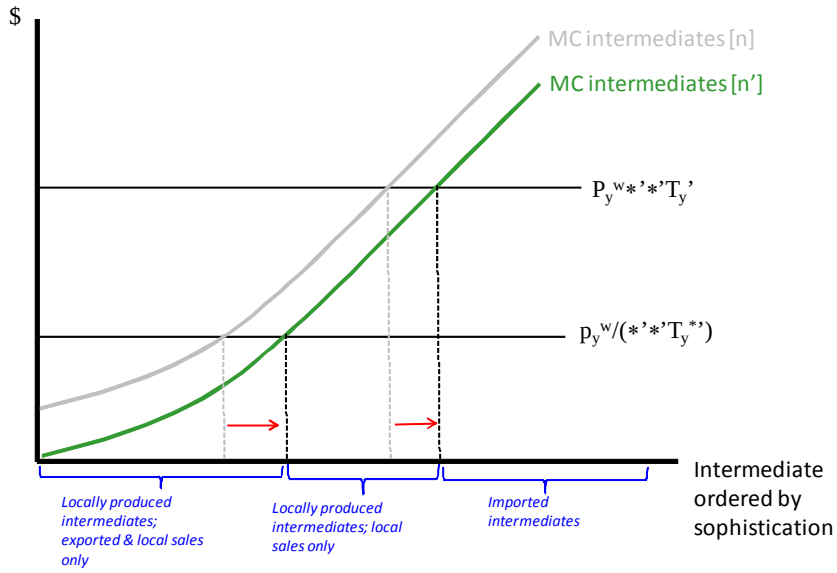
We can use this framework to think about the impact of the 2nd unbundling on a nation, say Korea, which had a broad and deep industrial base before the 2nd unbundling. As far as total demand for competencies is concerned, there are two positive effects and one negative effect. The negative channel is the displacement of locally produced high-end intermediates with imports. The positive channel is the extra production of low-end parts for export, and the improved competitiveness of the downstream product which may promote additional domestic and/or export sales.

If the overall effect is positive and large enough, overall demand for competencies will rise – it is due to the new demand arising from the newly export-competitive intermediates, but also possibly from the extra final-good exports caused by the lower cost of intermediates.[xxiii] As usual, this will induce fresh investment in competencies. The knock-on effect of expanding the competency range will be a lowering of the MC Intermediates curve as shown in Figure 17. This in turn induces what could be called "moving up the value chain". Both thresholds – the one for domestic production and the one for exporting – shift to the right implying that the nation exports more sophisticated goods. This would create something like the famous 'flying geese' development pattern.[xxiv]

Notice that something like New Economic Geography's cost-linked circular causality, i.e. cluster economics – is going on here. The new exports create a demand and thus supply of competencies that lower the nation's marginal cost and thus lead to a second round of new exports which in turn create new demand/supply of competencies. The process eventually

arrives as a steady state as 'n' stops rising and the thresholds stabilise. In the meantime, however, it would look like export-led growth involving an above-normal rate of savings/investment and a rapid expansion of production and employment in industry. Moreover, the nation would be expanding the range of products it exports.

Figure 17: Moving up the value chain: Geese in formation.



Source: Author's elaboration.

The framework can also be used to think about development of a nation that initially has no domestic production of the final good – say, the Philippines in autos. In this case, there is no local demand for intermediates and the top price line in Figure 17 is irrelevant (as is the corresponding threshold). After the 2nd unbundling, the nation starts to export industrial goods but only intermediates (those in the leftmost segment). The cost-linked circular causality starts as before and the nation "moves up the value chain", exporting increasingly sophisticated parts as its range of competencies widens.

5.3. Multinationals and the 2nd unbundling

A critical aspect of global value chains is the cross-border application of advanced know-how (product and process technologies, finance, management, marketing, design, etc.). There is a good reason for this. As manufacturers from advanced economies seek to produce certain parts, or complete certain manufacturing stages more cheaply, they move production facilities abroad. However the output of these new factories must continue to mesh seamlessly with the continually evolving production processes located in other nations. The factories are thus often owned, controlled, or in long-term relations with the parent company. What's more, combing high technology and low wages is profitable – or at least very cost effective and essential to maintaining competitiveness if everyone else is doing it.

This suggests that the analysis so far missed a critical element of the 2nd unbundling – the application of firm-specific, advanced-nation technology in developing nation factories. This has important implications for the connections between trade and industrialization – the sort of thing that explains how Thailand or Vietnam could so rapidly expand its exports of vehicles and parts.

To study these new implications, we modify the workhorse diagram to allow for very specific forms of cross-border movement of technology. We do not use the standard moniker – technology transfer – since it is entirely inadequate to today's realities in at least two ways. First, the internationalization of supply chains involves cross-border applications of very specific slices of the parent company's know-how. This is not the diffusion of a broad range of productivity enhancing techniques that is typically assumed in a growth model. A Japanese auto maker, for example, might help a Philippine company learn to sew leather seats onto a frame made in Japan, so they can sell Lexus's for less. There would be little or no Filipino learning, however, about the design and construction of the seat frames and embedded electronics. Second, if the company can manage it, there will be no transfer of technology at all. Corporations take great care to reduce the dissemination of know-how to the local economy.

As such, this cross-border deployment of technology should be thought of more as 'technology lending'. If the multinational decides to switch the production of the particular part from, say China to Vietnam, the producer in China may not be able to continue producing the same part.

To capture these aspects in the framework, we start from a situation where the developing nation is not making the downstream product (say, cars). We begin, in other words, from the situation depicted in Figure 15 where there is no intermediates production initially. From this initial condition, the multinational 'lends' a narrow range of technology to a producer located in the developing nation with the aim of getting the offshoring part produced at the lowest possible cost for the requisite quality. An example would be Nokia teaching a Malaysian firm to produce and fasten the plastic screen cover to one of its handsets.

In the diagram, this shows up as downward jump in Home's marginal costs but only for the particular part that is offshored. This is illustrated in Figure 18. The key is that with the help of the technology-lending, Home switches from a zero-indigenous-industry situation to being a globally competitive exporter of a particular part.

Two implications follow immediately from the case at hand.

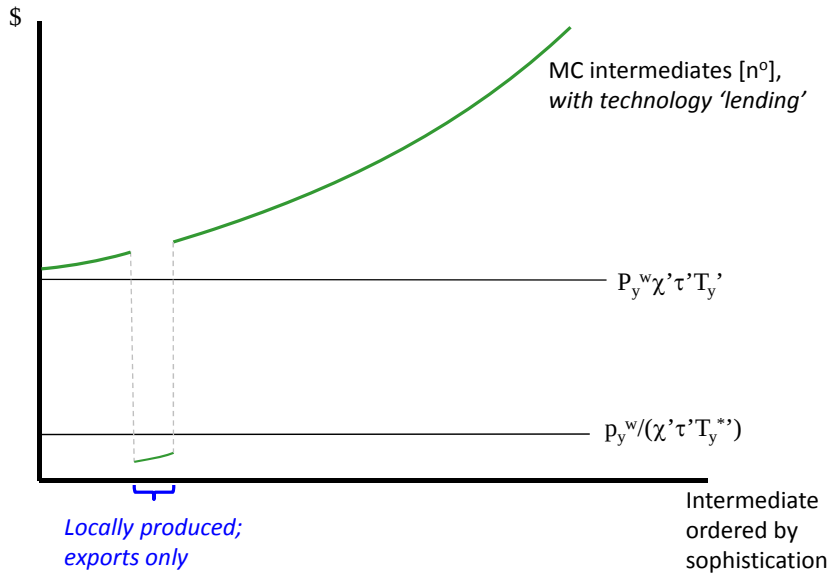
- First, industry can appear extremely quickly.

There is no need for the time-consuming nurturing of an industrial base and investment in a broad range of technical competencies. The multinational arrives and production starts in little more than the time it takes to build the factory.

- Second, this industrialization process bears very little resemblance to the successful import substitution policies followed by, say, the US, or even Korea and Taiwan.

This industrialization looks like a big success from the perspective of exporting. After all, the nation is now exporting what shows up as advanced industry goods in the trade statistics. If the analyst is still viewing the world with 20th century industrialization theory in mind, this is a very good sign. By the time Korea and Taiwan got to the stage of exporting such things, they were firmly on the road to being rich nations. However from the perspective of 21st century trade and industry, exporting a good tells us much less about the exporting nation's capacities. There may be only one factory in the whole country that resembles modern industry. This is sometimes call enclave industrialization.

Figure 18: A supply chain with multinationals and 'technology lending'.



Source: Author's elaboration.

The preceding example is akin to the 'trade in tasks' discussed by Grossman and Rossi-Hansberg (2008) where offshoring involves no two-way trade in goods. While such forms of production sharing do exist, they are not the only kind. In many industries, so-called reexporting trade is prevalent. This is where the developing nation imports sophisticated parts, adds some value, and reexports the output. This is also called outward processing trade. We can easily capture this type of trade by re-interpreting Figure 18.

The diagram focuses on the intermediates; the downstream good is in the background. To capture outward processing trade, we assume that the downstream good (typically a component rather than a final consumer good) is being produced in the developing nation under consideration (in this case an intermediate good itself rather than a final good.

As a consequence, production of the downstream good requires the full range of intermediates arranged along the horizontal axes of Figure 18. Home production is competitive only in a narrow range of intermediates – the range where technology lending occurred. All other intermediates are imported.

In this case, the industrialization becomes associated with the rapid emergence of both imports and exports of parts. All this would be associated with long-term foreign involvement with the newly created industry. Here the story has been told in a way that makes it look very much like the sort of industry that grew rapidly in export-processing zones in the 1990s.

5.4. How the 2nd unbundling killed import substitution

Before moving to policy issues, it is worth pointing out that the demise of 20th century industrialization strategies may have been caused by 2nd unbundling industrialization.

We start by noting that import substitution seems to have disappeared as a viable development strategy at approximately the same time as the 2nd unbundling got going in manufacturing. For example, countries in East Asia followed dual-track industrialization strategies since the 1970s. On one hand, they pursued import substitution in an effort to create industries via import protection. On the other hand, they encouraged export platforms that employed their workers to produce goods (usually components) for export – often employed directly or indirectly by multinationals.

As the 1980s and 1990s proceeded, the classic import substitution track failed increasingly while the export-oriented track increasingly succeeded. Eventually, many of these nations embraced policies that turned their whole country into what can be thought of as one great big export processing zone.

An unintended result of all this offshore-friendly policy was that it boosted the competitiveness of advanced-nation manufacturing firms. Before offshoring, expensive Japanese labour had to be used for almost all aspects of making Toyotas. In this way, high labour costs partly offset Japan's technology edge making it easy for, say, Malaysian-made Proton cars to compete with Japanese cars inside Malaysia. By allowing, say, Toyota, to combine its high-technology with cheap East Asian labour, offshoring enhanced Toyota's cost edge over Proton. The key point is that offshoring does not allow Proton to borrow Japan's technology when making Protons, but it does allow Toyota to borrow developing nations' low-wage labour.

Note the important distinction here between the competitiveness of advanced-nation manufacturing firms and competitiveness of advanced-nation industry workers. The offshoring allows the combination of advanced-nation technology with developing nation labour. This clearly makes the offshoring company's products more competitive, but it tells us nothing directly about how it changes incentives to create jobs in the advanced nation.

6. WHY DOES IT MATTER?

The Lindauer-Prichett first two generations of 'high development theory' disagreed on how best to overcome the chicken-and-egg lumpiness of 20th century industry. They share, however, the goal of building the whole domestic supply chain.[xxv] What Lindauer and Prichett (2002) call third generation theories stress diversity, but they continue to use a 20th century view of trade and industry.[xxvi] There are at least two issues that arise when the third-generation development models ignore the supply chain.

- Misinterpretation of the data, and
- Inattention to certain policy questions.

6.1. Misinterpreting the data

Using a 20th century view of industry to interpret 21st century data can lead to incorrect inferences. The 20th century view is that a nation's exports embody the nation's technology, labour, capital, etc. – the inclusion of foreign factors or technology is a second order issue. As such, a nation's exports tell us something about that nation's technology, labour, capital, etc. This approach fails, however, for products and nations where international supply chains are important. Product characteristics may tell us something about the embodied factors and technology, but very little about the nationality of those factors and technologies. To take a well-known example, China's IPod exports tell us more about the US industry than it does about Chinese industry. The factor and technology content of a nation's exports will depend upon the nation's position in the international supply chain as well as upon its own supply of factors and technology.

The same problem becomes more severe when the considering periods, countries, and producers where the 2nd unbundling has advanced rapidly. As we saw in Table 1, the local content in 'Factory Asia' shifted massively from 1985 to 2000.

To make the point more precisely, consider the widely cited Hausmann, Hwang and Rodrik (2007) model (HHR henceforth). The message-in-the model is that nations should search for

their own nation-specific comparative advantage and modify this comparative advantage by shifting into more sophisticated goods. The 20th century concept of industry is baked into their model when they assume industry can be modelled as a black box linking national factors and technology to national output; the nation's production contains *only* its own productive factors and technology. Nothing like Thailand's export of pickup trucks and engine parts, or China's processing trade is possible.

When they get to empirics, they use the 20th century view of industry to link country characteristics to goods; exports of poor nations must be technology-poor in the sense of being products where a nation's labour is especially low. With our simple framework in mind, we can immediately see a problem with this. The good exported may embody a large amount of foreign-nation factors and technology, so the product-country link is tenuous. In the Figure 18 case of 'technology lending', the product-country link may be entirely spurious as the developing nation is using advance-nation technology even in the segment of the value chain it has.

The growth implications could also be misinterpreted. We suppose a particular camera is made in Japan and thus associated with a high measured productivity – what HHR call PRODY – and then Sony offshores assembly to China. However suppose that in contrast to the HHR model, the productivity of Chinese assembly workers is the same in cameras, cotton shirts, or anything else. In this world, we might see an association between China's exports of things Japan used to export and Chinese growth, but it would have nothing to do with the HHR message-in-the-model. The creation of any assembly job that draws a worker out of agriculture raises Chinese output since labour productivity is higher in assembly than agriculture. Thus we would see an association between a rise in China's export sophistication index and its growth, but it has nothing to do with the sophistication of its export mix. If HHR are right, nations might want to target the production of high-tech goods. If the alternative view is right, all that matters is getting more assembly jobs.

6.2. Different policy questions

High development theory generally ignores or skips over the changed nature of industrialization. For example, Rodrik (2011a) argues that: "continued rapid growth in the developing world will require pro-active policies that foster structural transformation and spawn new industries - the kind of policies that today's advanced economies employed themselves on the way to becoming rich." This, of course, assumes that building a supply chain – which is what advanced economies did – is the same as joining a supply chain – which is the main option faced by a growing number of developing nations today.

With the lack of focus on supply chains, one may also miss policy issues raised by the new path to industrialization. There are really two sets of questions. The first concerns issues faced by nations that are trying to join a supply chain. The second concerns issues faced by nations like Korea – who industrialized in the old fashioned way and now are facing a 'hollowing out' of their industry.

6.2.1. New industrializers

New policy issues that arise can be highlighted with an example. The Sinos Valley in southern Brazil had a cluster of small shoe-manufacturers in the 1960s producing for the domestic market. In the 1980s, buyers from the US arrived and integrated Brazilian firms into the US footwear value chain (Humphrey and Schmitz 2002). This facilitated upgrading as the "US buyers studied the market, developed models and specified product, helped producers in the choice of technology, and organized production, inspected quality on site, and organized

transport and payment. (Humphrey and Schmitz 2002)" Process efficiency and product quality rose. The author also noted: "the danger of this strategy became evident when Chinese producers undercut Brazilian products in the US market in the early 1990s, and Brazilian producers were faced with sharply declining prices."

The largest local firms upgraded in terms of production process but not in terms of design and marketing. Local business associations promulgated plans for raising the image of Brazil's footwear and reinforcing design capabilities, but these came to nought. Should the Brazilian government have been active in encouraging a diversification of buyers, or an upgrading to more niche products? Should it have encouraged firms to do more design and marketing in Brazil?

This touches on a whole set of issues concerning the most appropriate complementary policies. Once new industrial jobs start appearing, what should be done to ensure raising productivity and sustainability of the production? Should a government activity diversify the nationality of the supply chains its workers are joining? What sort of implications does this sort of fast-and-easy industrialization have for education and training policies? Should foreign language skills be emphasised more? If so, which languages? Is the encouragement of labour unions a good idea for the development strategy?

Of course, these questions are not entirely new – they are related to the localization struggle of ISI polices in the 1970s and the early 1980s. However, as the Thai versus Malay auto sector experiences showed, thinking about localization policies without putting global value chains at the heart of the economic logic can lead to some very misguided policies. Today's nations might do better to look at Thailand starting from the late 1980s, rather than Korea and Taiwan from 1970 to 1997.

Another example concerns the contrast between Thailand's and the Philippine's joining "strategies". Thailand has very successfully attracted a great deal of industry activity in the automobile sector. The Philippines, by contrast, engages in outward processing production in a wide range of products and few final vehicles. How should we evaluate these outcomes and the policy choices that fostered them? What should we recommend to the next supply-chain joiner, say Vietnam or Cambodia?

Some nations, such as China, have explicit policies of encouraging the replacement of imported intermediates with local production. They also actively encourage local manufacturers to imitate foreign producers who are selling to the local market. This is plainly a twist on the old import-substitution policies, and it seems to be working. But is it the right policy? Should other developing nations try to emulate them, or is it only working because of China's enormous internal market?

Consider the Figure 18 example where the developing nation gets a narrow slice of intermediate production. Should its policy makers try to expand this range? If yes, should they try to fill in below (produce less sophisticated products), or try to build up (produce more sophisticated products)?

Issues of geography are clearly more important for joining a supply chain, but they are not well understood - in part because high-level development theory ignores supply chains. One hypothesis is that geography matters because 21st century trade – the trade-investment-services nexus – requires technicians and managers to travel among production facilities. While the price of air tickets has fall, the opportunity cost of time has not. This is probably why supply chains are regionalised rather than globalized: Factory Asia, Factory North America, and Factory Europe, for example.

These considerations give rise to additional sets of policy concerns. As geography seems to be so important, it would seem critical to distinguish between policies that might work in the neighbourhood of an existing supply chain and policies that might be needed in faraway nations. Surely, we should develop a different set of policy advice for, say, Vietnam, and, say, South Africa, or Argentina.

A much larger question concerns the ultimate destination of offshoring-led industrialization. Right now, the world seems is dividing into headquarter economies and factory economies (Baldwin 2006). The factory economies have lots of industry and rapidly growing exports of manufactured goods, but how to they ensure their place in the supply chain is not supplanted by the next low-wage country to get its governance problems under control? Ultimately, how do factory economies become headquarter economies, or is that whole notion an anachronism?

The development nations that industrialized before the 2nd unbundling (e.g. Korea, Taiwan, and India, South Africa and Brazil to a certain extent) face a very different set of policy challenges. Should they encourage their industrial companies to join the supply chains of US and Japanese companies? Should they encourage or discourage their manufacturing firms from offshoring certain segments of the production? If so, which segments? Should their governments institute complementary policies that help their firms continue up the value chain? Should they try to prevent nations like China from moving up the value chain?

7. WHAT IT MEANS FOR MULTILATERAL COOPERATION

Since globalization's 2nd unbundling, international commerce involves a richer, more complex, more interconnected set of cross-border flows. This changed nature of trade transformed policy making globally, first by creating new supply and new demand for deeper disciplines, and second by creating a bond among various strands of policy making – some of which were always viewed as international but many are traditionally viewed as domestic policy issues. This section, which draws on Baldwin (2012), considers the implications for multilateral trade cooperation.

7.1. The nexus: More interconnected policy

The complexity and interconnectedness of supply-chain trade shifted world trade governance towards regionalism. As is so often the case, there is nothing really new here. The basic challenge of supply-chain trade and the basic response of deeper, regional disciplines has been a feature of global governance for a half century.

Before the 2nd unbundling, most trade was simple and could be governed by the simple rules of GATT 1947. GATT rules, however, were not sufficient to underpin the complex cross-border relations implied by supply chains that arose among rich nations in the 1960s and 1970s. To fill this governance gap, North Atlantic nations set up deeper disciplines. Since the trade was regional rather than multilateral, the deeper disciplines were placed in regional trade agreements. One important example was the 1965 US-Canada Auto Pact, which regulated trade and investment in the auto sector.[xxvii]

The history lesson here is simple. Complex cross-border flows demand complex rules. Since most supply-chain trade is regional, there is a strong tendency to establish the necessary complex rules at a regional rather than multilateral level. Multilateral rules would almost surely have been more efficient, but negotiating them in the GATT would have been too cumbersome and slow; most GATT members were not involved in this type of international commerce.

7.1.1. Which new disciplines are needed?

21st century trade creates a need for two new types of disciplines. These correspond to the two new elements of the associated international commerce.

- Supply-chain trade often involves producing abroad, either directly or via long-term relationships with independent suppliers.

This is basically the investment and intellectual property part – setting up business abroad is an essential part of 21st century trade. This means that barriers to doing business abroad are now trade barriers. Likewise, much of the internationalization of supply chains involves overseas application of a firm's advanced know-how. A lack of IP protection therefore becomes a barrier to trade. International supply chains in the 1960s and 1970s were mostly among developed nations whose domestic laws provided reasonable guarantees. As supply chains spread to developing nations with weaker domestic institutions, embedding such disciplines in international agreements became more important.

- Production among the facilities must be coordinated and this involves the two-way flow of goods, services, people, capital, and training.

Barriers to these flows are now barriers to trade. Note that traditional trade barriers are part of this, but the list is much longer as the cross-border flows are more complex (express mail, air cargo, trade financing and insurance, business mobility, etc.). One good source listing the necessary disciplines are the deep regional trade agreements that have been signed among nations where the trade-investment-services-IP nexus trade is important.[xxviii]

7.2. The 2nd unbundling and erosion of WTO centricity

Globalization's 2nd unbundling created a new type of win-win situation in international commerce. The old type was 'my market for yours'; the new type is 'my factories for your reform'. This spawned massive demand for new disciplines from 'headquarter economy' firms and a massive supply of new disciplines from 'factory economy' governments (i.e. developing nations seeking industrialize by joining international supply chains).

As the WTO was occupied with the Doha Round and its emphasis on 20th century issues (tariffs and agriculture), supply met demand in regional trade agreements – just as it did in the 1960s. More precisely, the supply-chain governance gap was filled by uncoordinated developments in deep regional trade agreements, bilateral investment treaties, and autonomous reforms in emerging economies. The resulting package of deeper disciplines is what I have called 21st century regionalism (Baldwin 2011) – a theme taken up in the WTO's 2011 World Trade Report (WTO 2011).

7.2.1. Going forward

When it comes to 20th century trade and 20th trade issues, the WTO is in rude health. The basic WTO rules are almost universal respected, WTO's court decisions are almost universally accepted, and nations – even big nations like Russia – seem willing to pay a high political price to join the organisation. In short, the WTO is alive and well when it comes to the types of trade and trade barriers it was designed to govern (the sale of goods made in factories in one nation to customers in another).

The 21st century regionalism that has arisen from developing nations' quest for offshored factories and jobs is a threat to the WTO's centrality in multilateral trade governance, but not in the way that 20th century bilateralism was. It is not useful to think of 21st century regionalism using the analytic frameworks established by last-century thinkers like Jagdish Bhagwati when regionalism was mostly about tariff preferences (Baldwin 2011). 21st century

regionalism is not primarily about preferential market access as WTO (2011 Chapter B) demonstrated convincingly. 21st century regionalism is about disciplines that underpin the supply-chain industrialization.

Where the WTO's future seems cloudy is on the 21st century trade front. The demands for new rules and disciplines governing the trade-investment-services-IP nexus are being formulated outside the WTO. Developing nations are rushing to unilaterally lower their tariffs (especially on intermediate goods) and unilaterally reduce behind the border barriers to the trade-investment-services-IP nexus. All of this has markedly eroded the WTO centrality in the global trade system.

The implication of this is clear. The WTO's future will either be to stay on the 20th century side-track on to which it has been shunted, or to engage constructively and creatively in the new range of disciplines necessary to underpin 21st century trade.

8. CONCLUDING REMARKS

Some nations got rich without industrializing – but not many. This is why 'high development theory' – as Paul Krugman calls it – focuses on industrial development and trade's roles in fostering it. Recent empirical explorations led by Dani Rodrik continue to find evidence that manufacturing is critical. The current generation of high-development thinking, however, eschews big ideas since yesteryear's big ideas fail to account for the facts. Some nations are booming while others are stagnating, but there seems to be little correlation between outcomes and the old Big Ideas (ISI), or their replacement (Washington Consensus).

One part of the weak correlation might be due to the revolutionary transformation of industry and trade that occurred from 1985 to the late-1990s but which has not been incorporated into development theory. Starting in 1985, with an important acceleration in the late 1990s, most successful developing-nation industrializers joined the supply chains of firms from high-tech nations, especially the manufacturing giants of the 1980s – the US, Japan and Germany. As mentioned in the introduction, joining a supply chain made industrialization radically less complex and radically faster because supply-chain industry is less lumpy and less interconnected domestically.

The ICT revolution lowered the cost of coordinating complex activities at distance and this made the geographical dispersion of supply chains feasible and profitable. Rich-nation firms offshored segments of their value chains to developing nations. As the output had to mesh seamlessly with continually evolving production processes in other nations, the multinational typically deployed its firm-specific technology in the foreign factory – especially since this combination of rich-nation technology and low-wage labour could be very profitable.

This 'technology lending' could revolutionize the output of a developing nation's industry almost overnight. Offshored factories arrived with everything needed to export. Much of this was regional as key personnel still had to travel among factories. Oversimplifying to make the point, all the developing nation had to do was be located near the US, Japan or Germany, provide reliable workers, and establish a hospitable business environment.

But easier and faster does not necessarily mean better. As mentioned in the introduction, the 2nd unbundling made industrialization less meaningful. Before the 2nd unbundling, a nation had to have a deep and wide industrial base before it could export, e.g. car engines. Exporting engines was a sign of victory. Now it is a sign that the nation is located along a particular segment of an international value chain.

The key development struggle is to continue to reach new equilibriums, thus deepening the exploitation of external economies. Large developing nations like China and India can use their massive internal markets as both carrot and stick in forcing advance technology firms to transfer more technology. The lessons from China in particular have little relevance for smaller developing nations. Thailand's success in becoming the Detroit of Southeast Asia shows supply-chain industrialization can work even without muscular technology transfer policies.

In closing, I am not sure that a full understanding of the 2nd unbundling's development implications will eventually lead to new Big Ideas. I am sure, however, that ignoring such implications will guarantee continuing puzzlement. Global supply chains are now a fixed point in the typology of developing-nation industrial planners; no winning industrialization effort in the past 20 years has been able to ignore them. The goal of this paper is to make the prima facie argument that incorporation of such considerations into development theory may yield important insights.

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The Netherlands: North-Holland, 2010, pp. 4039-4214.

[i] For details see Baldwin (2006, 2008, 2011).

[ii] New Economic Geography forces probably explains much this. As Krugman and Venables (1995) argued, the Home Market Effect – reinforced by expenditure shifting – meant that lower trade costs favoured location in economically large nations.

[iii] The rise in export growth in the 2000s was largely due to trade created by internationalised supply chains; see Yi (2003).

[iv] Although most G7 manufacturing sectors grew in absolute terms, the output of 7 emerging markets grew much faster – especially China's whose global share rose from 2% to 19% between 1985 and 2010.

[v] Taiwan is not in the UN data used for the calculation but would almost surely qualify if it were.

[vi] China, Czech, Korea, Bangladesh, Philippines, Turkey, Hungary, Poland, Romania, Pakistan, Thailand, Ukraine, Mexico, Malaysia, Sri Lanka, Morocco, India, Vietnam, South Africa, Brazil, Indonesia, Colombia, Kenya, Argentina, Tanzania, Uganda, Ghana, Egypt, Russia, Kazakhstan, Peru, Ethiopia, Chile, Mozambique, Nigeria, Algeria, Iraq, Sudan, Venezuela, Nepal, Afghanistan, Congo, Iran, Korea, Myanmar, Uzbekistan

[vii] China, Czech Republic, Bangladesh, Philippines, Turkey, Hungary, Poland, Romania, Thailand, Ukraine, Mexico, Malaysia, Sri Lanka, Morocco, Vietnam, South Africa.

[viii] The Lopez-Gonzales and Holmes (2011) measures indicate the share of gross exports accounted for by intermediate imported (sourcing), and the share of exports used as inputs into other nations' exports (sales). The measures are bilateral and direction-specific, so each point in the graph corresponds to a single bilateral measure of sales or sourcing supply-chain trade for each year from 1995 to 2007.

[ix] Of course, supply chains are mentioned, but one reads analysis such as: "It should also be said that the global supply chains that run through countries like China and India represent a significant opportunity and not just a threat" (p.94). No systemic lessons are drawn.

x See for example, Hausmann, Hwang and Rodrik (2007), Hausmann, and Klinger (2007), Lederman and Maloney (2007), Klinger and Lederman (2007), and Brambilla, Ledermann and Porto (2010). Rodrik (2011a, b) continue the tradition.

xi The section draws on Baldwin (2006, 2008).

xii Email, editable files (*.xls, *.doc, etc), and more specialised web-based coordination software packages revolutionized peoples' ability to manage multifaceted procedures across great distances. Working methods and product designs shifted to make production more modular.

xiii Blinder (2006), Grossman and Rossi-Hansberg (2006, 2008), Markusen (2005), Baldwin and Robert-Nicoud (2007) are recent contributions. See Jones and Kierzkowski (1988), Deardorff (2001a,b), and Venables (1999 for the seminal work.

xiv Consolidating and shipping are expensive. Sturgeon (1998) writes that "one automaker manager in Vietnam said that the cars assembled in Vietnam cost the parent company twice what they cost in the home country (because of low plant and equipment utilization rates; assembly costs were said to be five times that of the home country)." Sturgeon reports that a Toyota Corolla that went for $14,000 in the US cost $26,000 in Vietnam.

xv See e.g. Amdensen (1989), Amdensen and Kim (1989), Ravenhill (2005), Amsden (2001), or Green (1992).

xvi Timing was fortuitous. The US imposed Voluntary Export Restrictions on Japanese cars in 1981, cutting out Korea's main competitor in its chosen segment.

xvii Moreover much of the experience gained in the 1960s and 1970s was lost when the government excluded the Chinese-Malaysian firms that had done most of the assembly.

xviii "Engine manufacturers had to increase local content every year from 20% in 1989 to 70% in 1998. From 1994, engine manufacturers had to use local cylinder blocks (casting), and local connecting rods (forging) and camshaft (casting)from 1996, cylinder head (casting) from 1997, and crank shaft (forging) from 1998" Techakanont (2008).

xix We think of these as specialised training, producer services, etc. For example, Amsden (2001 p.4) lists 3 generic capabilities needed for industry: production capabilities (e.g. production management, production engineering, logistics, finance, etc.), project execution capabilities (personnel training, undertaking feasibility studies, project execution, project engineering, procurement, etc.), and innovation capabilities (pure science,

basic research, applied research, advanced development, etc.)

xx Irwin (2003), for example, notes that the US became a net exporter of manufactures in 1910.

xxi Of course, the steady state range of competencies will be the collective outcome of investment decisions, so for some nations, the multiple equilibrium analysis is not relevant – their cost of creating competencies is so high that even with the whole world as their market, the steady state would be in the first partition.

xxii For example if intermediate good number 1 has a price of $1 per kilogram, and good 12 has a price of $1000 per kilogram, we measure 1 in kilos and 12 in grams, so both have a price of $1. This makes marginal costs comparable across intermediates.

xxiii Technically, the opening shifts the production mix towards a less competency intensive range of intermediates, so a simple rise in total production may not raise overall demand for competencies.

xxiv The original ideas are in Akamatsu (1962); the model in Kojima (2000).

xxv The simple framework skipped over all the bread-and-butter of development advice that Lindauer and Pritchett (2007) say define the first and second generation – things like, the role of governments, capital accumulation, trade, etc. This omission is not meant to suggest that these are unimportant – they are important. The omission was intended to illustrate common foundations of traditional thinking on industrialisation, and to show that this thinking is rooted in 19th and 20th century experiences where supply chains could only be internationalised to a limited extent and then only between advanced nations like the US and Canada, or Germany and France.

xxvi See for example, Hausmann, Hwang and Rodrik (2007), Hausmann, and Klinger (2007), Lederman and Maloney (2007), Klinger and Lederman (2007), Brambilla, Ledermann and Porto (2010) which stress the importance of the composition of a nation's export portfolio.

xxvii For details, see Patterson (1966).

xxviii Following a procedure established by Horn, Mavroidis and Sapir (2009), the WTO recently created a database of deeper disciplines in all the RTAs announced to the WTO by 2010 (WTO 2011).