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Mapping Fragmentation: Electronics and Automobiles in East Asia and Latin America

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'Fragmentation', the relocation of processes or functions across countries in response to cost and other differences, has important implications for development. We discuss the drivers of fragmentation and map it for electronics and automotives in East Asia and Latin America. For technical reasons, electronics is fragmenting faster worldwide than autos. Electronics networks are more advanced, widespread and integrated in EA than LAC, and are largely responsible for EA's rapid export growth. The auto network is more advanced in LAC but is slower growing and is not integrated into a regional system. Apart from Mexico, LAC lacks an electronics network, partly accounting for the region's weak export performance. We offer insights into the following: Why do industries fragment differently? How can fragmentation be measured? Why does fragmentation in developing countries concentrate on EA and LAC? Why has fragmentation evolved differently in these two regions? Can other developing regions attract and benefit from fragmentation?

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1. Introduction

Linsu Kim became increasingly interested over time in the international structure of production in his research on technology and industrial organisation. One of his last publications (Ernst and Kim, 2002) analysed technology diffusion and capability development within 'global production networks' (GPNs) in East Asia. GPNs are the international systems set up to optimise production, marketing and innovation by locating products, processes or functions in different countries to benefit from cost, technological, marketing, logistic and other differences. Trade theorists call the process 'fragmentation' (Arndt and Kierzkowski, 2001); others call it 'segmentation', 'production sharing', 'integrated production', 'outward processing', or 'vertical specialisation'.[2] Fragmentation plays a growing role in industrial activity in some developing countries, particularly in technologically advanced activities. For countries that participate in GPNs, the effects on production, employment, exports and technological upgrading have been fairly dramatic (UNIDO, 2002).

This paper maps electronics GPNs in East Asia (EA)[3] and Latin America and the Caribbean (LAC),[4] and compares them to automotive GPNs in both regions, in the process questioning the methodology now used to quantify GPNs. We choose these industries since they lead the setting of GPNs in complex industries; they are also among the largest and fastest growing industries in the developing world.[5] Both are scale-intensive activities with advanced technologies, dominated by oligopolistic firms with strong international presence and global brands (though electronics is less concentrated than autos because it covers a much wider range of products). Both have processes conducive to fragmentation (see below), but there are interesting differences in their fragmentation patterns. The auto industry, while more mature and longer established internationally, is less fragmented than electronics, which, despite rapid technical change (normally associated with concentration in advanced countries), is spreading rapidly in developing countries.

The spread of GPNs in developing countries is, however, highly uneven: we select EA and LAC because they account for the bulk of GPNs in the developing world. However, the two regions have evolved differently and these differences are interesting. The EA electronics network is larger, more widespread and better integrated than LAC's, providing the largest and fastest growing exports by the former. In LAC, the electronics GPN is largely confined to Mexico, which now accounts for some 90% of exports by the region. The automotive GPN,

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[2] Borrus *et al* (2000), Ernst (2000), Hobday (2001), Hummels *et al* (2001), Ng and Yeats (1999) and Sturgeon (2002). For an analysis of the causes of fragmentation in East Asia see Yusuf *et al* (2003). Best (2001) calls the fragmentation of functions like R&D horizontal rather than vertical integration.

[3] We focus on 'EA9': China, the mature Tigers (Hong Kong, Singapore, Korea and Taiwan), and the 'new Tigers' (Indonesia, Malaysia, Philippines and Thailand). The EA9 account for over 98 percent of electronics and automotive exports by developing East Asia.

[4] The LAC section focuses on 'LAC3': Argentina, Brazil and Mexico that account for the bulk of regional exports in both industries.

[5] Electronics was the fastest growing industry in production during the 1990s globally and in developing countries. According to UNIDO data, global value added in 'electrical machinery' (of which electronics is a major part) rose by 3.5 percent per year during 1990-2000, compared to 1.8 percent for all manufacturing. In the developing world, electrical machinery grew by 8.3 percent as compared to 4.4 percent for all manufacturing. In terms of size, electrical machinery was the largest industry in terms of value added in both developing countries and the world in 2000, up from sixth place in the former and fourth place in the latter in 1980. The transport equipment industry (of which automotives is a major component) grew at 2.6 percent in the world and at 6.4 percent in developing countries in the 1990s. In terms of size, it was the second largest industry in the world over 1980-2000, and rose from fifth to third place in the developing world.

by contrast, is more advanced, widespread and integrated in LAC and is the region's largest manufactured exporter. In EA, auto GPNs are less widespread and integrated.

GPNs raise many important issues. Why, for instance, do some industries fragment more than others? Why do GPNs in the developing world concentrate on EA and LAC? Why have GPNs evolved differently in these regions? Can other developing regions attract and benefit from fragmentation? We cannot address these questions fully but we offer some insights. Section 2 provides the analytical background to GPNs. Section 3 deals with problems in measuring fragmentation. Section 4 describes the evolution of global trade in the two industries. Section 5 deals with the electronics GPN and Section 6 with the auto GPN in EA and LAC. Section 7 concludes.

2. 'Fragmentation' and GPNs: analytical background

2.1. What drives fragmentation?

The drivers of fragmentation are new transport and communication technologies that cut the costs of international integration; the facilitators are trade and FDI liberalization (Ernst and Kim, 2002, Yusuf, 2003). Economic geographers see it as the manifestation of a 'global shift' in industrial activity (Dicken, 2003). While specialisation by process or product, the contracting out of particular functions, or the search for cheaper locations overseas, is not new, their current geographical reach, dynamism and mode of organisation are. Thus,

> "Recent years have witnessed the emergence of intra-product trade as an increasingly important form of intra-industry trade. Needless to say, intra-product specialisation can only take place where the various phases of a production process are physically separable, that is, where the manufacture of a product is amenable to *fragmentation*. Fragmentation is not a new phenomenon; nor is outsourcing. Both go back to the beginning of the Industrial Revolution or even predate it. In the modern era, however, both have acquired international dimension and complexity and probably represent one of the most important distinguishing features of contemporary globalization" (Arndt and Kierzkowski (2001), p. 2).

Fragmentation, the ability to competitively make not the whole product but selected segments, differs from traditional specialisation. In the relevant segments, production becomes part of a regional or global operation and reaches enormous scales. While the key players in GPNs are often multinational companies (MNCs), some GPNs are led by non-MNCs. In either case, networks generally include independent enterprises in host countries linked to the lead actors in various ways[6]. In simpler industries, with low technological demands, MNCs play a small role in networks relative to buyers, with production mainly in the hands of local firms (Gereffi, 1999). In complex industries, especially rapid technical change and valuable proprietary technology, MNCs remain the dominant players.

[6] Ties between lead firms and (first-tier) suppliers increasingly extend across national borders, with enterprises making location decisions together. This applies particularly to 'contract manufacturers' that increasingly undertake all production functions for lead firms, leaving them to specialise in high-value research, design and marketing activities (Sturgeon and Lester, 2002). The growth of contract manufacturers is one of the most dynamic components of the spread of GPNs (UNCTAD, 2002). Thus, while GPNs offer opportunities to local firms to enter globalised systems, they also pose threats to local competitors that cannot globalise as rapidly as industry leaders. It also threatens to relegate local suppliers to lower tiers of the value chain if they cannot match the global 'footprint' of the leaders.

The intensity of fragmentation differs by industry, depending on four factors:

- The *technical 'divisibility' of production processes*: Engineering activities like automobiles or electronics have discrete (separable) stages of production and components with differing scale, skill and technological needs whose production can be located in different sites and under different ownership. By contrast, continuous process industries like chemicals are difficult to break up economically (only service or R&D functions here can be dislocated).
- The *factor intensity of the process*: It is only economical to relocate processes if they are labour intensive and reduce costs significantly by shifting to low wage sites. The reduction in production cost must more than offset the rise in transport and coordination costs.
- The *technological complexity of each process*: Not all labour intensive processes (e.g. design and development) can be shifted to lower wage areas (with low skills and capabilities); only simpler and more stable ones can be efficiently relocated.
- The *value to weight ratio of the product*: Given the above conditions, the scope for fragmentation depends on the weight of the product relative to its value. Light, high value products can be shipped long distances to exploit cost differences while heavy, lower value ones can only be shipped to proximate areas.

In electronics all four factors lead to an extensive dispersal of production. It has separable processes, some of which are very labour-intensive and, at least to start with, have simple skill needs. The value-to-weight ratio of components is high, making distant locations economical. In autos, on the other hand, fragmentation is more constrained. While the industry has discrete processes, of which several are labour intensive, most require considerable local technological capabilities to be undertaken efficiently. Auto manufacturing (beyond simple assembly) also needs more components and services locally to be competitive. Many (though not all) components are heavy, making their processing suitable for relocation in proximate rather than in distant areas. These factors explain the greater and faster spread of electronics as compared to auto production in developing countries.

2.2 GPN location in developing countries

Political, social and economic stability, good infrastructure (or efficient EPZs[7]), suitable location for accessing markets and inputs and efficient bureaucratic procedures are obvious pre-conditions. As low cost is the main motive for relocating, wages matter – but wages for skilled rather than 'raw' labour: GPNs generally need high levels of worker, technical and managerial capabilities. As facilities mature and grow they need greater local content, calling for world-class local suppliers, service providers and institutions (training, quality testing, certification and the like). Large domestic markets are important factors in GPNs that sell products locally or that evolve from import-substituting activity.[8] Location is also influenced by fiscal incentives, but these count only when other factors are equal (tax holidays cannot substitute for high costs or poor quality in the medium to long term).

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[7] General trade openness is *not* a necessary pre-requisite so long as export operations can be insulated. Most early GPNs in East Asia were located in EPZs and functioned well as isolated operations in otherwise protected economies. In economies like Korea and Taiwan where local firms played a major role, selective protection, export subsidies and other industrial policies were used to build local capabilities (Lall, 2001, Westphal, 2002).

[8] Automotive GPNs in LAC3 grew out of import-substitution that fostered metal working, engineering and other capabilities.

This explains why GPNs tend to locate in medium rather than low wage economies.[9] The lowest wage economies (as in Africa) generally lack the skills, capabilities, infrastructure, institutions and markets to support GPNs, especially in complex industries.[10] Even in countries with industrial capabilities, GPNs avoid those (like India) with cumbersome trade and investment procedures, poor infrastructure, restrictive labour laws, inefficient EPZs, weak institutions and unfavourable policies to technology import.[11] Openness to FDI is not always necessary to tap GPNs, but access to foreign technology is: Korea and Taiwan restricted FDI but imported technology in other ways, built strong local capabilities and tapped GPNs by striking OEM (original equipment manufacture) contracts with lead companies (later establishing networks of their own).[12] This required complex industrial policies and efficient governments to administer them, conditions not met in most other industrialising economies (Lall, 2001). Economies like India that failed to build competitive capabilities and tap FDI missed the first wave of GPNs. Others with weak local capabilities (the 'new' Asian Tigers like Malaysia and Thailand) attracted GPNs by favourable FDI policies, good infrastructure and macro management, and efficient EPZs. They were also lucky in that they were located in a region that captured industrial spillovers from Japan and the mature Tigers. More recently, the new Tigers are mounting targeted strategies to upgrade GPNs and attract new ones.

GPNs have cumulative advantages for first movers: they create capabilities incrementally and can have agglomeration effects.[13] When they enter, GPNs invest in worker training, technology upgrading of suppliers, improving the infrastructure and establishing links with institutions. Lead firms often induce complementary investment by suppliers. Competitors and related industries often follow successful leaders, creating industrial clusters. Scale economies in some segments mean that complex networks concentrate in a few sites (Yusuf *et al*, 2003). Even with rising wages, such cumulative benefits make complex GPNs fairly rooted, unlike 'footloose' low-end garment assembly. GPN growth, in other words, has considerable path dependence.

Cumulativeness, scale economies, externalities and first-mover advantages thus explain why GPNs are confined to a small number of countries (and why auto and electronics GPNs focus on EA and LAC, see below). Path dependence does not mean, however, that GPNs remain rooted in perpetuity – they are, after all, migrating from traditional bases in industrialized countries. The 'stay-or-move' decision depends how fast wages and other costs rise in incumbent locations and their ability to offset this by technological upgrading and increased local physical and technological content. 'Staying' means that incumbents build the necessary capabilities, 'moving' that rising costs are not offset by improved capabilities relative to

[9] We do not analyse data for Eastern Europe here, but a similar process is under way there, with European GPNs setting up facilities in the more advanced countries like Hungary, the Czech Republic and Poland, with smaller facilities in other countries in the Baltic.

[10] Even simple activities like clothing, with lower capability needs, have not moved significantly to Sub-Saharan Africa. Apparel exports by Africa to the US have grown recently under trade privileges offered by the African Growth and Opportunities Act, but the values are tiny and exports may not outlast trade privileges (see Lall, 2003).

[11] Indian IT-service exports – organised rather like GPNs in manufacturing – are booming because none of these constraints apply.

[12] On EA strategies to tap GPNs see Hobday (2001), Lall (2001) and Mathews and Cho (1999), and on OEM see Cyhn (2001).

[13] On capability building see Kim (1999), Lall (2001), Ernst, Ganiatsos and Mytelka (1995) and Westphal (2002).

lower cost competitors.[14] Improving local capabilities often needs policy interventions to create skills, upgrade capabilities and strengthen institutions – private actors cannot furnish the public goods required or coordinate the actions involved. There are, however, limits to such policies: they cannot change the basics of changing comparative advantage; high wage countries cannot, for instance, retain simple, labour-intensive processes whatever they do.

In sum, there are different ways to tap fragmentation, with different policy implications. Some can do so at arm's length but only with advanced local capabilities, unattainable for most developing countries. Thus, welcoming FDI regimes[15] are necessary – but they are not sufficient. Countries must offer (apart from stable macro economies) good industrial capabilities, efficient trade procedures, strong institutions and competitive infrastructure. Later aspirants must overcome incumbents' first-mover advantages with matching capabilities. Extracting greater benefits from and rooting GPNs needs capability deepening. All this means that policies matter, but policies constrained by the technological parameters of each activity and process. These parameters also mean that many GPNs will not spread much further in the developing world: scale and agglomeration economies may keep them confined to the lucky few that have entered them.

3. Mapping fragmentation: methodological issues

Analysts measure fragmentation by comparing trade in parts and components (P&C) with that in final products (Yeats, 2001, and Ng and Yeats, various).[16] Table 1 shows P&C and finished products at the four-digit SITC level[17] for electronics and automotives.[18] In line with conventional usage, only items termed 'parts and accessories' by SITC are counted as P&C; others are treated as finished products.

[14] There are also strategic considerations involved: enterprises may be reluctant to locate more than a certain share of core segment sourcing in a particular country, even if it is more cost-efficient, to minimise risk of disruption in that country.

[15] FDI attraction increasingly involves expert promotion and careful targeting (Lall, 2001).

[16] It would be ideal to complement trade with production data but the latter are not available at the detail needed. Hummels *et al.* (2001) use input-output data to measure 'vertical specialization' by calculating the use of imported inputs to produce an exported output for 14 (10 OECD and 4 developing) countries. We do not use this method partly for lack of data on the countries covered here and partly because the definition of fragmentation is too broad: it treats *all* imported inputs (direct and indirect) as part of fragmentation, whether or not the production system is organised as an integrated system.

[17] We use Standard International Trade Classification (SITC) Revision 2, as do Yeats *et al*. This classification provides the broadest country and time coverage, though the more recent Harmonised System has a more detailed breakdown of products

[18] Our classification differs slightly from that of Ng and Yeats and yields different results. Ng and Yeats include *finished* telecom products in their category of P&C (SITC 764): the correct item for parts and components, however, is SITC 7648, which is much smaller in value, leading them to overestimate the role of components trade in total trade and the composition of telecom trade in Asia. Another problem is that they take only 7599 to capture parts and components of office machines, when they should also include 7591.

Table 1: Finished products and parts & components in trade in electronics and automotive industries

Main products	Finished products	Parts and components
	Electronics	
Office machines	7511 Typewriters, cheque-writing machines 7512 Calculating machines, cash registers 7518 Office machines, n.e.s.	7591 Parts of and accessories suitable for 7511, 751.8 7599 Parts of and accessories suitable for 751.2, 752
Automatic data processing (ADP) machines	7521 Analogue & hybrid data processing machines 7522 Complete digital data processing machines 7523 Complete digital central processing units 7524 Digital central storage units, separately consigned 7525 Peripheral units, incl. control & adapting units 7528 Off-line data processing equipment n. e. s.	7599 Parts of and accessories suitable for 7512, 752
Television, radio-broadcast receivers, gramophones and telecom equipment	7611 Television receivers, colour 7612 Television receivers, monochrome 7621 Radio-broadcast receivers for motor vehicles 7622 Radio-broadcast receivers portable, incl. sound rec. 7628 Other radio-broadcast receivers 7631 Gramophones & record players, electric 7638 Other sound recorders and reproducers 7648 Telecommunications equipment	7649 Parts of apparatus of 76 (including TV, radio, gramophones and telecom equipment)
Thermionic, cold & photo-cathode valves (semiconductors)	7761 Television picture tubes, cathode ray 7762 Other electronic valves and tubes 7763 Diodes, transistors, similar semi-conductor devices 7764 Electronic microcircuits	7768 Piezo-electric crystals, mounted, parts of 776
	Automotive	
Automobiles	7810 Passenger motor cars, for transport of passengers & goods 7821 Motor vehicles for transport of goods/materials 7822 Special purpose motor lorries and vans 7831 Public-service type passenger motor vehicles etc. 7832 Road tractors and semi-trailers	7841 Chassis fitted with engines for motor vehicles 7842 Bodies for the motor vehicles of 722/ 781/ 782/ 783 7849 Other parts & accessories of motor vehicles
Car engines	7132 Internal combustion piston engines for propelling vehicles	7139 Parts of internal combustion piston engines

Source: UN Comtrade.
Note: The names of the items are taken directly, with some abbreviation, from SITC Rev 2.

However, there are problems in measuring fragmentation this way:

- It is difficult to *distinguish meaningfully 'final products'* from *'parts and components'* by using SITC categories. For instance, semiconductors, TV tubes or car engines appear as discrete products in the trade data and so are treated as finished products by Yeats *et al.*, when they could easily be classified as P&C for electronics or auto products. What SITC

labels as 'parts and accessories' (and Yeats only counts these as P&C) are a sub-set of all the P&C going into final assembly (see point three below).

- SITC data *combine parts and components of different p*roducts; for instance, in electronics they do not separate P&C for office machines from those for ADP equipment.
- *Many components are not included* under the SITC labels for the final products and come under different headings. For instance, auto products[19] do not include components like automotive electronics and instruments, batteries, tyres, plastics, paints and so on, which appear under separate headings. It would be possible track them all if one had the entire list of components for each product; however, this is not feasible. Moreover, in any case many components serve as inputs into different products and so would be difficult to distinguish. If second-stage inputs (like metals, plastic or chemicals) were included, the problems would multiply.
- Trade data do not show *different stages of manufacture of a given product* (under the same SITC heading) in different countries. This is a major gap, since fragmentation often involves the same product undergoing different processes in different locations.
- *Imports of P&C may be used for other purposes than fragmented production*, e.g. domestic-oriented industries or by firms outside integrated systems.

It is thus difficult to capture fragmentation with the available data. Separating finished products from P&C does give an indication, but it is partial and, as seen below, may be misleading. Intra-industry trade is another indicator, but it is broad, including differentiated products that fall under one heading but are not part of a production network. Trade handled by MNCs can provide another indication, but this is difficult to quantify and may involve traditional trade by MNCs not involving fragmentation. The broadest measure is total exports: where it is expected that a country is unlikely to export outside GPNs (a technologically backward country in a high technology activity), exports can indicate fragmentation. Again, this is very broad – an 'outside envelope' indicator. Given these inherent problems, we use a mixture of measures below.

4. Global trends in electronics and automotive fragmentation

4.1 Export performance

In 1990, world auto exports ($320.6 billion) were 22 percent larger than electronics ($261.6 billion). Over the decade, auto exports grew by 5.9% p.a. and electronics exports by 11.7%; by 2000 electronics exports ($788.9 billion) were 38% larger than auto exports ($570.4 billion). [20] The share of electronics in total exports rose from 8.7 to 13.8 percent over the decade, while that of auto products fell from 10.6 to 10.0 percent (total exports grew at 6.6%). Table 2 shows the values, growth rates and market shares of exports by developed and developing countries, and by EA and LAC separately, for the main product categories. Note

[19] In the SITC Rev 2 classification, automotive products appear explicitly under item 78 (road vehicles) and 713 (internal combustion piston engines and parts). Of the former, 781 is passenger motor cars, 782 motor vehicles for transporting goods, 783 other motor vehicles and 784 parts and components (chassis fitted with engines, bodies for motor vehicles and 'other parts and accessories'). Under 713 come engines for aircraft, marine propulsion and motor vehicles, as well as parts of all these (combined).

[20] We use data for 1990 to 2000 although data are available for 2001 because there was a trade recession in 2000-2001, with electronics exports declining by 15.4 percent and auto exports by 0.5 percent. Since this is likely to be a temporary dip, we use 2000 data to capture structural trends.

that EA here includes all 26 countries in the East and Southeast Asian region and LAC includes all 40 economies in Latin America and the Caribbean.

Table 2: Electronics and automotive exports (1990 to 2000)

		Value (US$ billion)		World Market Share		Growth Rate
Main Products		**1990**	**2000**	**1990**	**2000**	**1990 - 2000**
		Electronics				
Office machines	World	18.2	23.8	100.0%	100.0%	2.7%
	Developed	14.7	17.8	80.5%	74.7%	1.9%
	Developing	3.4	5.9	18.8%	24.9%	5.7%
	EA	3.2	5.4	17.6%	22.5%	5.3%
	LAC	0.2	0.5	1.0%	2.2%	11.0%
Automatic data processing (ADP) machines	World	107.9	328.3	100.0%	100.0%	11.8%
	Developed	85.8	175.4	79.5%	53.4%	7.4%
	Developing	20.9	148.0	19.4%	45.1%	21.6%
	EA	20.1	134.1	18.7%	40.8%	20.9%
	LAC	0.7	13.4	0.6%	4.1%	34.9%
Television, radio-broadcast receivers, gramophones and telecom equipment	World	76.7	152.4	100.0%	100.0%	7.1%
	Developed	50.9	88.2	66.4%	57.8%	5.6%
	Developing	23.8	60.0	31.1%	39.3%	9.7%
	EA	23.0	46.2	30.0%	30.3%	7.2%
	LAC	0.5	12.6	0.6%	8.3%	39.5%
Thermionic, cold & photo cathode valves (semiconductors)	World	58.8	284.5	100.0%	100.0%	17.1%
	Developed	40.1	146.7	68.2%	51.6%	13.9%
	Developing	18.5	136.4	31.4%	48.0%	22.1%
	EA	17.8	130.9	30.2%	46.0%	22.1%
	LAC	0.1	3.4	0.2%	1.2%	38.5%
Total electronics	World	261.6	788.9	100.0%	100.0%	11.7%
	Developed	191.5	428.0	73.2%	54.3%	8.4%
	Developing	66.7	350.3	25.5%	44.4%	18.0%
	EA	64.1	316.5	24.5%	40.1%	17.3%
	LAC	1.4	30.0	0.6%	3.8%	35.5%
		Automotive				
Automobiles	World	290.9	512.4	100.0%	100.0%	5.8%
	Developed	259.4	438.0	89.2%	85.5%	5.4%
	Developing	12.5	60.9	4.3%	11.9%	17.2%
	EA	6.9	21.9	2.4%	4.3%	12.2%
	LAC	4.9	34.4	1.7%	6.7%	21.5%
Car Engines	World	29.7	58.0	100.0%	100.0%	6.9%

	Developed	26.8	47.1	90.0%	81.3%	5.8%
	Developing	2.7	6.5	9.1%	11.2%	9.2%
	EA	0.3	1.2	1.1%	2.1%	14.0%
	LAC	2.3	4.8	7.6%	8.3%	7.9%
Total automotive	World	320.6	570.4	100.0%	100.0%	5.9%
	Developed	286.2	485.2	89.3%	85.1%	5.4%
	Developing	15.2	67.5	4.7%	11.8%	16.1%
	EA	7.2	23.1	2.3%	4.1%	12.3%
	LAC	7.2	39.2	2.2%	6.9%	18.5%

Source: Calculated from UN Comtrade database.
Note: Exports by developed and developing countries do not add up to world exports because the latter include exports by transition economies, not shown separately. EA includes all 26 developing countries in East and Southeast Asia and LAC includes all 40 countries in Latin America and the Caribbean.

Developing country exports outpace the world in both industries, with electronics growing faster than autos. Developing countries raise their market share from 4.7 to 11.8 percent in automotive products and 25.5 to 44.4 percent in electronics.[21] Their dynamism is, however, due primarily to East Asia, which accounts for 90 percent of the developing world total in 2000. The decline in its share from 96 percent in 1990 is due to LAC's rise (from 2 to 9 percent); other regions provide only 1-2% of developing world electronics exports in both years.

In autos, complete automobiles account for the bulk of exports. Though engines grow faster, they comprise only 10.2 percent of auto exports in 2000 (9.3% in 1990). While EA and LAC exported similar values in 1990, the latter grew more rapidly and by 2000 exported nearly 70% more. Again, other developing regions were marginal, accounting for 5.2% of total developing world auto exports in 1990 and 7.7% in 2000 (LAC accounted for 58% by 2000).

These data cannot distinguish 'fragmented' from other exports but provide a useful 'envelope' indicator of electronics and auto GPNs. We know that MNC production networks account for the bulk of production and exports in both industries,[22] and it is likely that a significant portion of trade is fragmented. If this is so, the figures suggest that:

- The electronics industry globally is fragmenting more rapidly than automotives, though it is difficult to separate the effect of fragmentation from innovation and income elasticity of demand.
- In the developing world, fragmentation is also more rapid in electronics than in autos.[23] The most complex electronics products (ADP machines and semiconductors) have very high shares of developing country exports, suggesting that these high value products have fragmented most.

[21] Electronics provided 11.5 percent of the developing world's total manufactured exports in 1990 and 24.5 percent in 2000, and autos 2.5 and 4.3 percent, respectively.

[22] On autos, see Humphrey and Memedovic (2003) and Veloso (2000); on electronics see Ernst (2000) and Hobday (2001). Also see UNCTAD (2000 and 2003).

[23] This is an oversimplification for EA, where MNCs from Korea and Taiwan compete head-on with MNCs from industrialized countries.

- GPNs are highly concentrated within the developing world – electronics in EA and autos in LAC. Other developing regions are conspicuously absent.

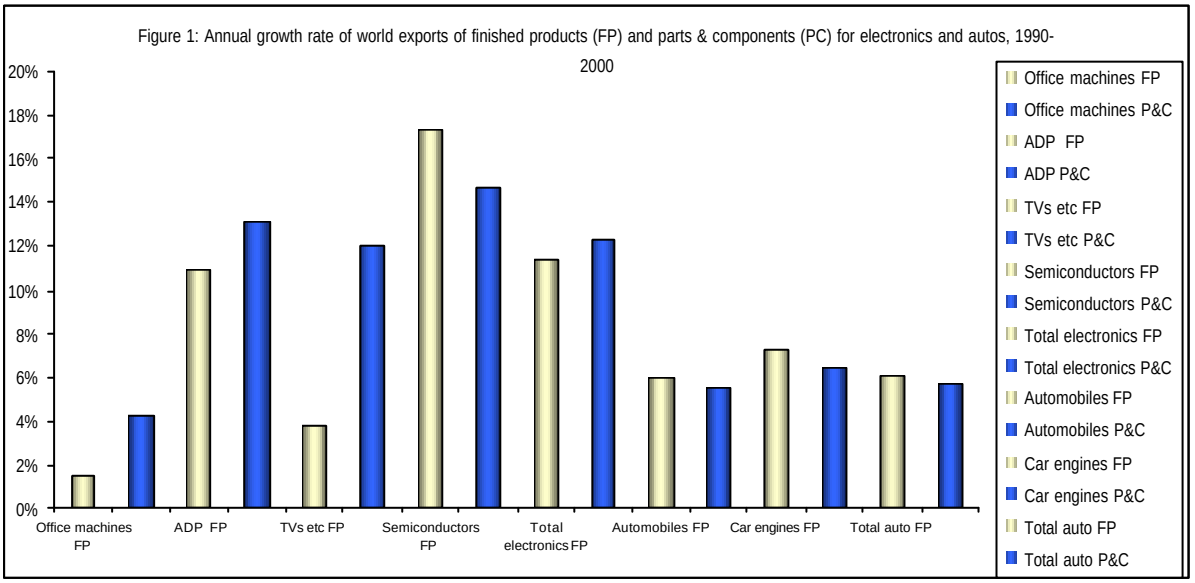
4.2 Exports of finished products vs. parts and components (P&C)

Annex Tables 1 and 2 show exports by electronics and autos broken down by finished products and P&C, for developed and developing countries and EA and LAC.

Electronics: The value of finished product exports worldwide was over double that of P&C in 2000, with similar distributions in industrial and developing countries. Global P&C exports grew slightly faster (12.3%) than finished products (11.4%), the pattern varying by category (Figure 1). There was a relatively small lead in the growth rate for P&C over finished products for ADP equipment and a large one for TV, audio and telecom equipment. By this measure, therefore, the latter segment was the one fragmenting the most. However, the semiconductor segment, which was growing faster and with a larger share for developing countries, saw more rapid growth in finished products than in P&C.

In the developing world, exports of P&C also grew faster than finished products (19.8% and 17.4%), but the reverse was true of office machines and semiconductors. By region, LAC generally had higher rates of growth than EA in almost all categories in both finished products and P&C, but it started from a much smaller base. Both regions had faster growth in P&C than in finished products, but in EA finished products grew faster than P&C for office machines and semiconductors. In LAC, finished products grew faster than P&C only for semiconductors.

Figure 1: Annual growth rate of world exports of finished products (FP) and parts & components (PC) for electronics and autos, 1990-2000



Automotives: Finished product exports were much larger than P&C but the pattern of growth was reverse of electronics – world P&C exports grew slower than finished products (5.7% and 6.1%, respectively) overall and in both sub-categories (Figure 1). In developing countries, P&C exports for engines grew faster than finished products, and by 2000 the value of the former exceeded the latter (though the values are relatively small). This suggests rapid fragmentation of engine production in the developing world but less so for automobiles.

As noted, however, this fragmentation measure is questionable, since it excludes processing of given products. While the P&C data confirm that electronics is fragmenting faster than automobiles, at the sub-category level they give misleading results. Semiconductors seem to be fragmenting slowly, when the rapid growth of finished semiconductor exports by

developing countries suggests that there is rapid fragmentation *within* the category. Evidently the P&C measure misses the full dimensions of fragmentation. For this reason, we use broader trade data below to map fragmentation.

5. Electronics fragmentation in EA and LAC

Electronics drove EA export success in 1990-2000, raising its share in total exports from 17.8% to 31.7% and growing significantly faster (17.3% p.a.) than total exports (10.7%). In LAC, electronics played a much smaller role, accounting for 1.2% of total exports in 1990 and 8.7% in 2000. While LAC electronics exports grew much faster (35.5%) than EA's, LAC's base was tiny and over the 1990s its market share gain, 3 points, was much smaller than EA's 15 points. LAC exports were also more concentrated, with Mexico providing nearly 90% by 2000; EA exports were more dispersed, the leader (Singapore) accounting for 23.7% and the top four for 72.5%. [24]

Figure 2: Annual growth rates and world market share changes for electronic exports by main LAC and EA exporters (1990-2000)

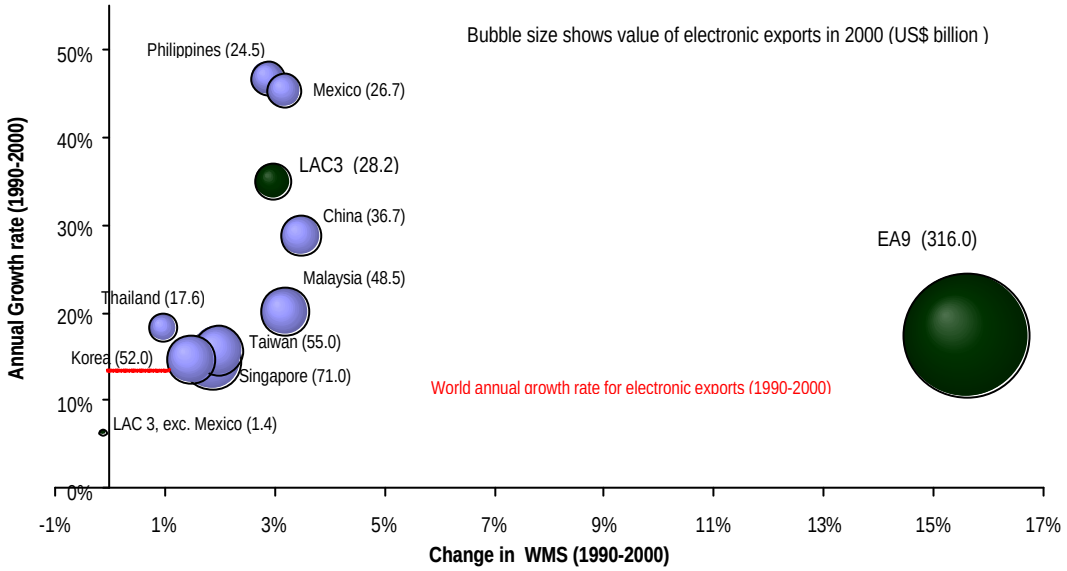


Figure 2 shows export growth rates and world market share changes for the main exporters in EA and LAC, export values in 2000, and the world export growth rate. It shows the striking lead of EA over LAC (the dark bubbles show regional totals). All the Asian countries in the figure grow faster than the world average, gaining market share. Brazil and Argentina (LAC3 without Mexico) lose market share, appearing as a tiny bubble on the bottom left.

To analyse regional GPNs, we examine electronics exports and imports by destination and origin. Annex Table 3 shows EA9 and Annex Table 4 LAC (LAC3 plus Costa Rica[25]). Table 3 below shows exports and imports for each country by destination and origin and the trade balance.

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[24] UN trade data show Singapore to be the largest electronics exporter in EA in 2000. However, this includes re-exports, which, according to Singapore data, account for about 40 percent of total merchandise exports. If we adjust its electronics exports by 40%, its 'own' exports come to $43 billion. This makes Singapore the fourth largest exporter in EA, after Taiwan, Korea and Malaysia. In 2001 China overtook all these countries to become the largest electronics exporter in East Asia (and the developing world). The only 'loser' in the region was Hong Kong, with electronics exports declining by 1.4% per annum.

[25] Costa Rica is a recent entrant to electronics, a consequence of winning, after highly targeted effort, the first Intel plant in LAC (Spar, 1998).

Table 3: Distribution of exports and imports by destination and origin (%) and trade balance (US $ billion) for electronic products

		EA9		Japan		ROW		World	
		1990	**2000**	**1990**	**2000**	**1990**	**2000**	**1990**	**2000**
EA9	Export destination	27.0%	38.3%	7.2%	11.5%	65.8%	50.2%	100.0%	100.0%
	Import origin	38.0%	50.5%	33.4%	20.2%	28.5%	29.3%	100.0%	100.0%
	Trade balance ($ b.)	-2.6	-14.2	-12.8	-17.5	27.3	80.6	12.0	48.9
China	Export destination	87.2%	36.6%	1.3%	12.5%	11.5%	50.9%	100.0%	100.0%
	Import origin	11.9%	62.0%	4.6%	30.2%	83.5%	7.8%	100.0%	100.0%
	Trade balance ($ b.)	0.4	-4.9	-0.8	-4.3	-14.7	16.4	-15.1	7.2
Singapore	Export destination	21.1%	42.2%	4.3%	7.0%	74.6%	50.8%	100.0%	100.0%
	Import origin	45.3%	57.2%	28.6%	17.3%	26.1%	25.5%	100.0%	100.0%
	Trade balance ($ b.)	-1.8	0.2	-2.8	-4.0	10.5	22.8	5.9	18.9
Hong Kong	Export destination	41.8%	49.7%	3.3%	5.6%	54.9%	44.7%	100.0%	100.0%
	Import origin	54.1%	67.4%	29.2%	16.4%	16.8%	16.2%	100.0%	100.0%
	Trade balance ($ b.)	-4.2	-32.8	-3.2	-8.2	0.6	-6.6	-6.8	-47.6
Taiwan	Export destination	18.4%	33.5%	6.3%	15.0%	75.3%	51.5%	100.0%	100.0%
	Import origin	34.0%	43.5%	29.6%	21.9%	36.4%	34.6%	100.0%	100.0%
	Trade balance ($ b.)	1.3	12.8	-0.1	5.4	8.6	23.9	9.8	42.0
Korea	Export destination	17.8%	35.7%	14.0%	12.3%	68.2%	52.0%	100.0%	100.0%
	Import origin	15.0%	38.9%	50.2%	22.7%	34.9%	38.4%	100.0%	100.0%
	Trade balance ($ b.)	1.3	6.4	-1.9	-0.7	6.5	15.0	5.8	20.7
Malaysia	Export destination	35.7%	39.4%	8.3%	11.5%	56.0%	49.2%	100.0%	100.0%
	Import origin	31.6%	42.0%	25.0%	19.3%	43.3%	38.7%	100.0%	100.0%
	Trade balance ($ b.)	1.0	5.9	-0.7	-0.5	2.0	11.7	2.3	17.0
Indonesia	Export destination	36.3%	42.3%	8.1%	14.5%	55.6%	43.2%	100.0%	100.0%
	Import origin	32.7%	50.1%	21.5%	13.9%	45.7%	36.0%	100.0%	100.0%
	Trade balance ($ b.)	-0.2	2.7	-0.1	0.9	-0.3	2.8	-0.6	6.4
Thailand	Export destination	34.4%	40.2%	7.9%	12.6%	57.7%	47.2%	100.0%	100.0%
	Import origin	34.0%	43.5%	29.6%	21.9%	36.4%	34.6%	100.0%	100.0%
	Trade balance ($ b.)	0.1	1.4	-0.7	-0.7	0.7	3.8	0.1	4.5
Philippines	Export destination	28.5%	39.1%	8.6%	12.8%	63.0%	48.1%	100.0%	100.0%
	Import origin	21.9%	33.9%	27.7%	22.4%	50.4%	43.8%	100.0%	100.0%
	Trade balance ($ b.)	0.0	5.7	-0.2	0.6	-0.1	6.8	-0.3	13.1
		LAC3		**USA**		**ROW**		**World**	
		1990	**2000**	**1990**	**2000**	**1990**	**2000**	**1990**	**2000**
LAC3	Export destination	7.4%	1.7%	52.8%	89.6%	39.8%	8.6%	100.0%	100.0%
	Import origin	2.2%	1.6%	52.0%	64.4%	45.8%	34.0%	100.0%	100.0%
	Trade balance ($ b.)	0.0	-0.1	-1.3	3.2	-1.3	-9.2	-2.5	-6.0
Argentina	Export destination	13.2%	17.8%	5.9%	45.5%	80.8%	36.7%	100.0%	100.0%

	Import origin	10.0%	19.9%	28.6%	25.7%	61.4%	54.4%	100.0%	100.0%
	Trade balance ($ b.)	0.0	-0.4	-0.1	-0.5	-0.1	-1.1	-0.2	-2.0
Brazil	Export destination	7.7%	29.1%	48.1%	35.7%	44.2%	35.2%	100.0%	100.0%
	Import origin	2.1%	1.7%	40.0%	40.9%	57.9%	57.3%	100.0%	100.0%
	Trade balance ($ b.)	0.0	0.3	-0.3	-2.2	-0.5	-3.3	-0.8	-5.2
Mexico	Export destination	5.9%	0.3%	66.2%	92.4%	27.8%	7.2%	100.0%	100.0%
	Import origin	1.2%	0.1%	62.7%	73.5%	36.1%	26.4%	100.0%	100.0%
	Trade balance ($ b.)	0.0	0.1	-1.0	6.0	-0.6	-4.8	-1.6	1.2
Costa Rica	Export destination	0.0%	0.9%	31.5%	54.9%	68.5%	44.2%	100.0%	100.0%
	Import origin	2.5%	1.9%	66.0%	89.7%	31.4%	8.4%	100.0%	100.0%
	Trade balance ($ b.)	0.0	0.0	0.0	0.1	0.0	0.7	0.0	0.8

Source: Calculated from UN Comtrade. ROW stands for 'rest of the world'.

The data for EA9 suggest:

- For EA9 as a whole, intra-regional exports grew much faster than exports to ROW, and by 2000 comprised 38% of total electronics exports (50% including Japan). Intra-regional imports grew even faster, and outpaced imports from ROW (EA9 providing over 50% and Japan another 20%). The regional trade balance consequently grew more negative over time, the deficit within EA9 growing faster than with Japan. The trade balance with ROW, on the other hand, was increasingly positive (the main partner being USA). This significant increase in intra-regional trade had a large 'fragmented' component: the region was being knit into a tight production network, partly to meet burgeoning regional needs but mainly to serve ROW. [26]
- China evolved differently from other countries, being the only one whose share of exports to EA9 fell (by 51 percentage points); like others, its imports from EA9 rose but the extent of the rise was startling (50 points). The share of Japan in exports rose but imports from Japan rose much more. Taking EA9 and Japan together, the regional share of Chinese exports fell by 39 points and its share of imports rose by 76 points. ROW took 51% of its exports and provided only 8% of its imports: China was acting as a base for neighbours to process exports to other regions. [27]
- Of the mature Tigers (Hong Kong aside), Singapore was most oriented to EA9 and least to Japan, in line with its emerging role as a regional hub for MNC operations in East Asia. Korea and Taiwan ran large surpluses within EA9; Taiwan also had a significant surplus with Japan.

[26] Most electronics trade in EA is handled by MNCs, but some major MNCs are regional (from Korea and Taiwan) and use the same fragmentation strategies as other MNCs. In the rest of EA9, most electronics exports are managed by foreign MNCs; this is also true of China, despite the growth of some large national electronics firms. In 2000, according to UNCTAD (2002), 91% of Chinese semiconductor exports, 85% of ADP exports and 96% of mobile telephone exports came from MNCs.

[27] Within EA9, the bulk of China's electronics imports are from Korea and Taiwan. China runs a huge surplus with Hong Kong; if this is excluded, its deficit with the rest of EA9 rises to $11.7 billion, of which nearly $7 billion is with Korea and Taiwan. The 'new Tigers' account for a Chinese trade deficit of around $3 billion; most of this is with Malaysia and Thailand, which have much more advanced electronics industries than Indonesia and Philippines (Lall and Albaladejo, 2003).

- Of the new Tigers, EA9 assumed greater importance as both a destination for exports and a source of imports (Philippines was the least oriented to EA9). Japan was a major trading partner for all countries, particularly as a source of imports, but not as significant as EA9.

Thus, a tight network is emerging in EA9, with Japan playing an important but not dominant role and Chinese entry strengthening regional competitiveness.[28] MNCs (local and other) are fitting locations into complex specialisation patterns that allow each to retain facilities and expand exports, though the trade data cannot show *how* specialisation patterns are changing. There is still competition for exports and high-value functions between the locations, but so far GPNs have helped relatively high-wage incumbents like Singapore (even Malaysia) retain export competitiveness.

LAC patterns are very different. Mexico succeeds because of NAFTA trade privileges rather than (in contrast to EA) sheer efficiency, and consequently remains vulnerable.[29] Other players are small or marginal. Regional trade patterns show that:

- Mexico exports primarily to the US, which provides nearly three-quarters of its imports: this is the main electronics network. Mexico also imports significantly from ROW (mainly from Asia, with Japanese and Korean firms dominating the consumer electronics segments[30]) to feed exports to the US, but practically nothing from LAC3.
- Costa Rica has a small GPN, primarily the Intel plant that uses US imports to export to the US and ROW.

The main electronics GPN in LAC is a constricted North American network delinked from the rest of the region, with no signs of the intra-regional links that characterise EA9. The specialisation pattern is far simpler (Mexico does low-level assembly with low local physical and technological content) and local capabilities and enterprises far weaker.

Given LAC's long history of industrialization and location advantages *vis a vis* the US (the main electronics export market), the question is *why it lags so badly* in the world's most dynamic export industry. While we cannot explore them in depth, the reasons may be as follows. When electronics GPNs entered developing countries in the late 1960s, LAC was richer (and so higher wage) than EA. Its trade regime was protectionist and inward-looking and many countries had restrictive FDI regimes. LAC industrial policies lacked the selectivity and effectiveness of Korea or Taiwan, which used FDI restrictions, credit allocation and infant industry protection combined with strong export incentives to build world-class local capabilities. Attempts to develop local electronics industries (as in Brazil) failed. Import substituting policies were not offset by efficient EPZs (these came later, mainly in Central America), nor were high wages offset by skill or capability advantages over EA. In

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[28] Lall and Albaladejo (2003) show that in electronics China is complementing rather than taking market share from its neighbours (though particular firms may suffer as activities move to China). There is nevertheless a significant potential threat to Malaysian electronics exports, as in the segments in which it specialises China is gaining share more rapidly. In textiles and clothing, by contrast, China poses a direct threat, taking market share from its neighbours.

[29] *Maquila* provisions have existed for decades but did not allow Mexico to compete with EA: only NAFTA's additional privileges stimulated Mexican exports (Dussel Peters, 2000). There has, however, recently been significant relocation of electronics from Mexican *maquiladoras* to China, reflecting lower wages and higher productivity in the latter, and low local content in Mexico (much lower than in East Asia, according to UNCTAD, 2000, and Dussel Peters, 2000). According to *The International Herald Tribune* (2003), some 500 of 3,700 plants in the Mexican *maquilas*, mainly in electronics and apparel, shifted to China, with 218,000 job losses.

[30] Some Asian consumer electronics firms bring in components into Mexico via the US; this shows up as US inputs in the trade data. We are grateful to Michael Mortimore for this insight.

the early years LAC suffered bouts of macro and political instability that deterred export-oriented FDI. At the start, therefore, LAC could not use its location and historic links to attract US GPNs.

As LAC macro and political conditions improved and economies were liberalised, the speed and unselective nature of liberalization damaged rather than strengthened industrial capabilities.[31] In the 1990s LAC did receive large amounts of FDI – more per capita than EA – but this did not go into high technology GPNs, suggesting that its structural handicaps (low capabilities, high costs and so on) persisted. Moreover, EA established first-mover capability, agglomeration and network advantages, also pulling further ahead in skill development and technological effort. LAC's penchant for non-selectivity meant that it could not target FDI in ways that led Singapore, and later Malaysia, to tap electronics GPNs effectively (Costa Rica is the exception that proves the rule).

Mexico broke the mould in the late 1990s through NAFTA privileges that overcame regional handicaps. However, its competitive base is shallow relative to EA and remains vulnerable to Chinese competition; the lack of regional networks is another weakness. China's rise in electronics shows that first mover advantages are not inviolable but this may not hold many lessons for LAC: few other countries can match Chinese advantages in low-cost and productive labour, stock of technical skills, good EPZ infrastructure, gigantic domestic market, capable local suppliers and targeted policies to raise capabilities. Moreover, China's participation in a complex regional network strengthens its location advantages. For LAC to overcome these advantages would demand policy interventions of a complexity and intensity that seem impossible today.

6. Auto fragmentation in EA and LAC

In the 1990s, the auto industry shifted significant facilities from developed to developing countries. While the industry had many operations in developing countries, most served protected domestic markets and were uncompetitive. With liberalization, there was a move to create cost-efficient plants aimed at global markets. Many inefficient operations were wound down; a few were upgraded as regional or global platforms after massively restructuring plants and supply chains. The process went furthest in LAC3 under the aegis of developed country MNCs (Mortimore, 1998, 2000, 2004). EA followed a different pattern: Western MNCs played a small role – Japan dominated, with a growing role of some domestic players (particularly in Korea, but also in Malaysia) – but the region was not knit into a coherent network. Auto exports accounted for 2.8% of total exports in EA in 1990 and 3.1% in 2000; for LAC the figures are 6.1% and 11.7%.

LAC and EA together accounted for 92.3% (58.1% and 34.2% respectively) of developing world auto exports in 2000, gaining 4.5 and 1.8 points of world market share since 1990. Figure 3 shows the performance of the main exporters in these regions (the dark bubbles showing regional totals). Mexico is by far the largest player, accounting for 45.6% of developing world, and 89.5% of LAC, auto exports. Korea is next, with 22.4% of developing world and 65.4% of EA exports. Then come Brazil (7.9% of developing world exports), Thailand (3.4%) and Taiwan (0.3%). China is relatively small, and, in contrast to its record in other industries, does badly in the 1990s. Argentina and Singapore are even smaller, the former gaining market share and the latter losing.[32] Annex Tables 5 and 6 show country values and geographical distributions of exports and imports for EA9 and LAC3.

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[31] For a comparison of export competitiveness in LAC and EA see Lall, Albaladejo and Moreira (2004).

[32] Note that Malaysia, while well-known for its national auto industry, remains marginal as an exporter.

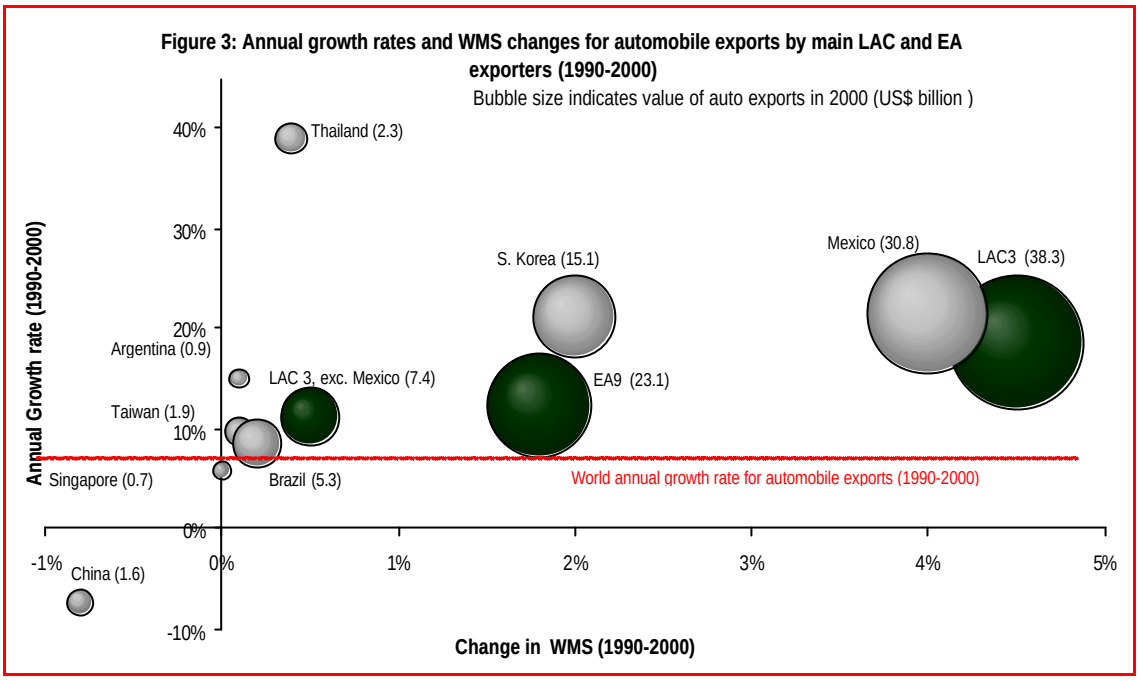

Table 4 shows distribution of exports and imports and trade balance for EA and LAC in autos.

Table 4: Distribution of exports and imports by destination and origin (%) and trade balance (US$ billion) for automotive products

		EA9		Japan		ROW		World	
		1990	**2000**	**1990**	**2000**	**1990**	**2000**	**1990**	**2000**
EA9	Export destination	49.6%	12.3%	4.3%	4.3%	46.1%	83.4%	100.0%	100.0%
	Import origin	17.9%	9.5%	50.4%	52.5%	31.7%	38.0%	100.0%	100.0%
	Trade Balance ($ b.)	0.5	0.8	-8.2	-10.2	-2.0	11.1	-9.7	1.7
China	Export destination	86.8%	12.9%	4.4%	15.1%	8.7%	72.0%	100.0%	100.0%
	Import origin	10.5%	7.0%	32.1%	39.8%	57.4%	53.2%	100.0%	100.0%
	Trade Balance ($ b.)	2.8	-0.1	-0.5	-1.4	-0.8	-1.0	1.6	-2.5
Singapore	Export destination	57.3%	61.0%	2.8%	3.9%	39.9%	35.1%	100.0%	100.0%
	Import origin	5.0%	9.6%	45.8%	48.2%	49.2%	42.2%	100.0%	100.0%
	Trade Balance ($ b.)	0.2	0.2	-0.7	-1.3	-0.6	-0.9	-1.2	-1.9
Hong Kong	Export destination	1.6%	2.4%	10.7%	41.3%	87.7%	56.3%	100.0%	100.0%
	Import origin	8.2%	11.0%	57.2%	44.2%	34.5%	44.8%	100.0%	100.0%
	Trade Balance ($ b.)	-0.1	-0.3	-0.6	-1.1	-0.3	-1.1	-1.0	-2.4
Taiwan	Export destination	9.9%	24.7%	8.5%	8.6%	81.6%	66.7%	100.0%	100.0%
	Import origin	2.9%	7.3%	36.6%	53.4%	60.5%	39.2%	100.0%	100.0%
	Trade Balance ($ b.)	0.0	0.3	-0.9	-1.3	-1.0	0.2	-1.8	-0.9
Korea	Export destination	6.1%	5.8%	2.5%	1.2%	91.4%	93.0%	100.0%	100.0%
	Import origin	0.3%	3.2%	58.6%	42.0%	41.0%	54.7%	100.0%	100.0%
	Trade Balance ($ b.)	0.1	0.8	-0.6	-0.6	1.6	13.1	1.2	13.2
Malaysia	Export destination	21.4%	42.4%	2.2%	5.4%	76.5%	52.3%	100.0%	100.0%
	Import origin	1.6%	7.7%	76.4%	75.1%	22.0%	17.2%	100.0%	100.0%
	Trade Balance ($ b.)	0.0	0.0	-1.0	-1.4	-0.2	-0.2	-1.2	-1.6
Indonesia	Export destination	83.2%	51.5%	6.5%	20.0%	10.4%	28.6%	100.0%	100.0%
	Import origin	2.6%	17.4%	78.9%	60.2%	18.5%	22.4%	100.0%	100.0%
	Trade Balance ($ b.)	0.0	-0.2	-1.2	-1.1	-0.3	-0.4	-1.5	-1.7
Thailand	Export destination	26.5%	13.2%	7.9%	7.6%	65.6%	79.2%	100.0%	100.0%

	Import origin	1.3%	8.4%	84.9%	71.9%	13.9%	19.7%	100.0%	100.0%
	Trade Balance ($ b.)	0.0	0.1	-2.3	-1.5	-0.3	1.4	-2.6	0.0
Philippines	Export destination	53.0%	33.4%	31.6%	18.9%	15.5%	47.7%	100.0%	100.0%
	Import origin	6.8%	26.7%	81.5%	60.4%	11.7%	12.9%	100.0%	100.0%
	Trade Balance ($ b.)	0.0	-0.1	-0.4	-0.5	-0.1	0.1	-0.5	-0.4
		LAC3		**USA**		**ROW**		**World**	
		1990	**2000**	**1990**	**2000**	**1990**	**2000**	**1990**	**2000**
LAC3	Export destination	4.8%	10.6%	69.5%	74.2%	25.8%	15.3%	100.0%	100.0%
	Import origin	5.1%	12.9%	60.4%	58.3%	34.5%	28.8%	100.0%	100.0%
	Trade Balance ($ b.)	0.1	0.2	2.2	11.1	0.3	-2.7	2.6	8.5
Argentina	Export destination	35.2%	55.5%	12.0%	6.1%	52.8%	38.4%	100.0%	100.0%
	Import origin	34.5%	47.3%	10.9%	6.6%	54.6%	46.1%	100.0%	100.0%
	Trade Balance ($ b.)	0.0	-0.8	0.0	-0.1	0.0	-0.9	0.0	-1.8
Brazil	Export destination	10.5%	41.0%	35.5%	20.0%	54.0%	39.0%	100.0%	100.0%
	Import origin	12.5%	37.1%	19.1%	9.0%	68.4%	53.9%	100.0%	100.0%
	Trade Balance ($ b.)	0.2	0.5	0.7	0.7	0.9	-0.4	1.7	0.8
Mexico	Export destination	0.1%	0.4%	90.5%	88.5%	9.4%	11.1%	100.0%	100.0%
	Import origin	32.6%	30.6%	34.5%	37.3%	32.9%	32.2%	100.0%	100.0%
	Trade Balance ($ b.)	-2.4	-13.7	1.5	10.6	-2.0	-11.1	-3.0	-14.2

Source: Calculated from UN Comtrade. ROW stands for 'rest of the world'. In LAC, ROW includes Canada.

The table suggests a weak regional network in EA. The share of EA9 in its own exports and imports is low and is declining over time. Japan has a minor role in exports but a dominant one in imports: Japanese MNCs clearly use EA9 to assemble Japanese components for domestic markets and for exports to ROW. Korea, the leading exporter, sells mainly to ROW, using significant Japanese imports. Thailand, the next largest, is similar but depends far more on Japanese imports. Philippines is the only country that trades significantly within EA9, but it is a small player.

The data suggest three networks in LAC: Mexico with the US, within LAC3, and LAC3 with ROW. The first clearly dominates, with Mexico's enormous volume of exports to the US. While Mexico also imports about equally from the US, Brazil & Argentina, and ROW, a significant part of Mexican auto ROW imports are parts and components from Canada (an integral part of US auto GPNs), and most imports from LAC3 are finished autos (small models of Ford and VW) from Brazil.[33] Thus, Mexico is effectively integrating into the North American system but not with that in Brazil and Argentina. The latter two countries trade increasingly with each other; Argentina trades little with USA and Brazil more (particularly in exporting finished autos) but the US role is declining. ROW is significant for both, with significant trade with Europe, but is losing share.

What explains LAC's lead over EA in auto GPNs? Both regions started with import substitution (though EA9 developed stronger indigenous enterprises); their evolution differed mainly when they liberalised and globalised. In EA9 the dominant foreign player, Japan, did not build regional networks to serve its home market but used production bases to export to other destinations. US auto majors, unlike counterparts in electronics, did not invest in EA to serve their home market (products were too heavy). Attempts to build regional systems (e.g. ASEAN) largely failed. Korea became a significant auto exporter and invested in the region, but not to develop integrated production systems. Only Thailand (called the 'Detroit of the

[33] We are grateful to Michael Mortimore for this information.

East') is becoming a large production base for global MNCs and is now the second largest exporter from EA9. However, this history does not mean that auto GPNs will not grow in EA9; with freer regional trade, upgrading and expansion of China's auto industry and rapid demand growth in the region, integrated production is likely to increase. Korea, China and Thailand may be the hub of future GPNs (Japanese MNCs remaining major players), with other countries contributing (in particular Taiwan as a major supplier of complex components).

Auto MNCs restructured operations in LAC3 countries differently in response to different competitive pressures. In Mexico, US majors GM and Ford acted mainly to meet Japanese competition in the US market (Mortimore, 1998, 2000), while in Brazil and Argentina, European MNCs (VW and Fiat), with US MNCs following, responded largely to preserve markets in South America. Trade policies, with special provisions for autos, were important in fostering integration: Mercosur for Brazil with Argentina, and NAFTA for Mexico with US. Other integration evolved naturally, but the Mexico-US network dominates because of the size and needs of the US.

Auto GPNs in LAC seem secure from direct EA competition for logistical (value-to-weight) reasons. However, EA auto exports may well grow more rapidly in the future, given the pace of growth of its main market within the region, with faster formation of GPNs as trade liberalises.

7. Conclusions

Fragmentation is an important feature of the world economy and, in its present form, has important development implications, at least for the countries that can participate in it. It is, however, difficult to measure, and far more research is needed to capture is true nature and dimensions. The two industries here spearhead fragmented production in complex industries in developing countries, but their evolution shows interesting differences.

The electronics industry is fragmenting faster than autos, largely for technical reasons: high value-to-weight ratios and lower capability needs for 'fragmentable' processes. While export growth in electronics is also due to faster innovation and demand growth, fragmentation (as shown by the share of developing world exports) has been a major factor. Given the size and dynamism of electronics markets, countries entering GPNs have transformed their export and industrial structures. There are few signs of electronics growth slowing down (though technical trends are inherently unpredictable). The auto industry, a more mature industry, is growing more slowly though it may prove a large and dynamic export product for some countries.

Fragmentation in the developing world concentrates in EA and LAC for several reasons, including location, wages, skills, trade and FDI policies and infrastructure. However, industrial policies and serendipity have also played important roles. EA did much better than LAC in the more dynamic electronics industry, even to serve US markets, partly because of strategies to build local capabilities, partly because of targeted FDI strategies and partly because the 'new Tigers' were in the right place at the right time (offering efficient export processing sites when GPNs started). EA then developed strong first-mover advantages, strengthening them as GPNs became regional. China's massive recent expansion shows that newcomers can still enter – but only if they offer the constellation of advantages it provides and if they fit into existing networks. Mexico's growth is entirely due to NAFTA privileges and is already proving vulnerable; its success will last only if it can raise local content and sophistication rapidly enough to offset wage and productivity disadvantages *vis a vis* China.

In the auto industry, GPNs are more advanced in LAC because of logistic factors (the weight of the product) and trade agreements (paradoxically, with Asian competition forcing the search for cheaper locations). NAFTA again dominates but in this case its benefits are more lasting because EA cannot pose a direct threat. In EA, regional networks have not formed but may emerge in the medium term as trade liberalises. LAC's lead in auto fragmentation does not hold the promise for rapid export growth in the way that the East Asian lead in electronics does.

What of other developing regions, presently marginal to complex GPNs? Liberalization, skill formation, infrastructure improvement and competitive pressures on MNCs should lead to the spread of GPNs to them. This is starting in autos (e.g. in South Africa, Turkey and India, countries with large markets and long import-substituting experience), though the scales are small compared to LAC. By contrast, there are few signs of major new electronics GPN sites in other regions. This may reflect the cumulative capability and agglomeration advantages of incumbents; it may also show that other regions cannot meet the current capability needs of global electronics production (much the minimum entry levels today are much more stringent than in the 1960s and 1970s). If there is another burst of fragmentation that reaches other regions, it will only benefit countries with advanced skills, established industrial capabilities and sophisticated infrastructure. The prospects for the rest of the developing world, particularly the least-developed countries that look to FDI to drive industrial and export growth (and have renounced traditional tools of fostering capability development), are not promising. For development analysts who look for lessons in industrial and exports success from EA, particularly the new Tigers that grew mainly by attracting GPNs, it calls for a sombre reassessment of policies and prospects.

Annex tables

Annex Table 1: Electronics and automotive exports by finished products and parts and components, developed and developing countries (1990 to 2000)

			Value (US$ billion)		World Market Share		Growth Rate
Main Products			**1990**	**2000**	**1990**	**2000**	**1990 - 2000**
Electronics							
Office machines	Finished products	World	11.1	12.9	100%	100%	1.5%
		Developed	9.5	9.3	85.6%	71.8%	-0.2%
		Developing	1.5	3.6	13.9%	27.8%	8.8%
	Parts & Components	World	7.2	10.9	100%	100%	4.3%
		Developed	5.2	8.5	72.7%	78.1%	5.0%
		Developing	1.9	2.3	26.2%	21.5%	2.2%
Automatic data processing (ADP) machines	Finished products	World	67.2	188.7	100%	100%	10.9%
		Developed	52.1	105.3	77.6%	55.8%	7.3%
		Developing	14.4	80.5	21.5%	42.7%	18.8%
	Parts & Components	World	40.8	139.6	100%	100%	13.1%
		Developed	33.7	70.1	82.7%	50.2%	7.6%
		Developing	6.5	67.5	16.0%	48.4%	26.3%
Television, radio-broadcast receivers, gramophones and telecom equipment	Finished products	World	52.1	75.9	100%	100%	3.8%
		Developed	33.7	35.8	64.7%	47.2%	0.6%
		Developing	17.2	37.3	32.9%	49.2%	8.1%
	Parts & Components	World	24.6	76.5	100%	100%	12.0%
		Developed	17.2	52.3	70.1%	68.4%	11.8%
		Developing	6.7	22.6	27.2%	29.6%	13.0%
Thermionic, cold & photo cathode valves (semiconductors)	Finished products	World	53.3	263.0	100%	100%	17.3%
		Developed	36.4	134.9	68.3%	51.3%	14.0%
		Developing	16.8	126.9	31.4%	48.2%	22.4%
	Parts & Components	World	5.4	21.5	100%	100%	14.7%
		Developed	3.7	11.8	67.6%	54.9%	12.3%
		Developing	1.7	9.6	31.7%	44.5%	18.7%
Total electronics	Finished products	World	183.7	540.5	100%	100%	11.4%
		Developed	131.7	285.3	71.7%	52.8%	8.0%
		Developing	49.9	248.3	27.2%	45.9%	17.4%
	Parts & Components	World	77.9	248.4	100%	100%	12.3%
		Developed	59.8	142.7	76.8%	57.4%	9.1%
		Developing	16.8	102.0	21.6%	41.1%	19.8%
Automotive							
Automobiles	Finished products	World	208.5	371.4	100%	100%	5.9%
		Developed	185.8	317.3	89.1%	85.4%	5.5%
		Developing	6.3	44.7	3.0%	12.0%	21.7%

	Parts & Components	World	82.4	141.0	100%	100%	5.5%
		Developed	73.7	120.7	89.5%	85.6%	5.1%
		Developing	6.2	16.3	7.5%	11.5%	10.1%
Car engines	Finished products	World	16.5	33.2	100%	100%	7.3%
		Developed	14.6	26.6	88.3%	80.0%	6.2%
		Developing	1.9	3.0	11.3%	9.0%	4.9%
	Parts & Components	World	13.2	24.8	100%	100%	6.5%
		Developed	12.2	20.5	92.0%	82.9%	5.4%
		Developing	0.8	3.5	6.4%	14.1%	15.3%
Total automotive	Finished products	World	225.0	404.6	100%	100%	6.1%
		Developed	200.3	343.9	89.0%	85.0%	5.6%
		Developing	8.1	47.7	3.6%	11.8%	19.4%
	Parts & Components	World	95.6	165.8	100%	100%	5.7%
		Developed	85.9	141.3	89.8%	85.2%	5.1%
		Developing	7.1	19.8	7.4%	11.9%	10.8%

Source: Calculated from UN Comtrade database.
Note: Exports by developed and developing countries do not add up to world exports because the latter include exports by transition economies, not shown separately.

Annex Table 2: Electronics and automotive exports by finished products and parts and components by East Asia and Latin America (1990 to 2000)

Main Products			Value (US$ 'billion)		World Market Share		Growth Rate
			1990	2000	1990	2000	1990 - 2000
Electronics							
Office machines	Finished products	EA	1.4	3.2	12.5%	25.2%	8.9%
		LAC	0.1	0.3	1.2%	2.5%	8.7%
	Parts & Components	EA	1.8	2.1	25.5%	19.4%	1.5%
		LAC	0.0	0.2	0.6%	1.9%	16.2%
Automatic data processing (ADP) machines	Finished products	EA	13.8	71.8	20.6%	38.0%	17.9%
		LAC	0.5	8.5	0.8%	4.5%	32.7%
	Parts & Components	EA	6.3	62.3	15.5%	44.6%	25.7%
		LAC	0.2	4.9	0.4%	3.5%	40.2%
Television, radio-broadcast receivers, gramophones and telecom equipment	Finished products	EA	16.5	27.0	31.6%	35.6%	5.1%
		LAC	0.4	9.3	0.7%	12.3%	38.2%
	Parts & Components	EA	6.6	19.1	26.7%	25.0%	11.3%
		LAC	0.1	3.3	0.3%	4.3%	44.0%
Thermionic, cold & photo cathode valves (semiconductors)	Finished products	EA	16.1	121.6	30.2%	46.2%	22.4%
		LAC	0.1	3.1	0.2%	1.2%	42.8%
	Parts & Components	EA	1.7	9.3	30.8%	43.3%	18.7%
		LAC	0.0	0.2	0.8%	1.1%	19.4%
Total electronics	Finished products	EA	47.8	223.6	26.0%	41.4%	16.7%
		LAC	1.1	21.3	0.6%	3.9%	34.5%
	Parts & Components	EA	16.4	92.9	21.0%	37.4%	19.0%
		LAC	0.3	8.7	0.4%	3.5%	38.2%
Automotive							
Automobiles	Finished products	EA	2.2	15.4	1.1%	4.1%	21.3%
		LAC	3.7	26.2	1.8%	7.1%	21.8%
	Parts & Components	EA	4.7	6.5	5.7%	4.6%	3.4%
		LAC	1.2	8.2	1.5%	5.8%	20.7%
Car engines	Finished products	EA	0.1	0.4	0.5%	1.2%	16.0%
		LAC	1.7	2.6	10.6%	7.7%	3.9%
	Parts & Components	EA	0.2	0.8	1.8%	3.4%	13.1%
		LAC	0.5	2.3	3.9%	9.1%	15.9%
Total automotive	Finished products	EA	2.3	15.8	1.0%	3.9%	21.1%
		LAC	5.4	28.8	2.4%	7.1%	18.2%
	Parts & Components	EA	4.9	7.4	5.2%	4.4%	4.1%
		LAC	1.8	10.5	1.8%	6.3%	19.5%

Source: Calculated from UN Comtrade database.

Annex Table 3: Electronics exports and imports by EA 9, by destination and origin (US$ billion)

Country of origin	Products	Exports to								Imports from							
		EA9		Japan		ROW		World		EA9		Japan		ROW		World	
		1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
EA9	Finished	10.2	81.0	3.4	25.9	34.2	116.7	47.8	223.6	13.2	93.3	11.5	33.2	8.5	43.3	33.1	169.7
	P&C	7.1	40.0	1.2	10.6	8.1	42.2	16.4	92.9	6.7	42.0	5.9	20.7	6.4	35.2	19.1	97.9
	Total	17.3	121.1	4.6	36.5	42.2	159.0	64.1	316.5	19.9	135.3	17.4	53.9	14.9	78.4	52.2	267.6
China	Finished	2.1	7.0	0.0	2.6	0.3	14.7	2.4	24.3	1.2	12.8	0.4	5.4	7.5	1.1	9.2	19.2
	P&C	0.4	6.5	0.0	2.0	0.1	4.0	0.5	12.4	0.9	5.6	0.4	3.5	7.6	1.2	8.9	10.3
	Total	2.6	13.4	0.0	4.6	0.3	18.7	3.0	36.7	2.1	18.3	0.8	8.9	15.1	2.3	18.1	29.5
Singapore	Finished	2.4	21.4	0.6	3.7	11.7	27.7	14.7	52.9	3.5	21.2	2.7	6.2	2.2	9.1	8.4	36.5
	P&C	1.5	8.5	0.2	1.3	2.1	8.4	3.8	18.1	2.3	8.6	0.9	2.8	1.1	4.2	4.3	15.6
	Total	3.9	29.9	0.8	5.0	13.8	36.1	18.5	71.0	5.7	29.8	3.6	9.0	3.3	13.3	12.7	52.1
Hong Kong	Finished	0.2	1.0	0.1	0.1	1.7	1.4	1.9	2.5	4.8	21.8	2.4	5.0	1.3	4.0	8.5	30.8
	P&C	1.7	1.0	0.1	0.1	0.9	0.3	2.6	1.4	1.3	13.0	0.9	3.5	0.6	4.3	2.8	20.8
	Total	1.9	2.0	0.1	0.2	2.5	1.8	4.6	4.0	6.1	34.7	3.3	8.5	1.9	8.3	11.4	51.5
Taiwan	Finished	1.4	14.1	0.6	6.6	6.9	18.8	8.9	39.6	0.4	3.1	0.4	1.3	0.2	1.0	1.0	5.5
	P&C	1.0	4.3	0.2	1.7	2.8	9.5	4.0	15.6	0.7	2.6	0.6	1.5	1.0	3.5	2.2	7.7
	Total	2.4	18.5	0.8	8.3	9.7	28.4	12.9	55.1	1.1	5.7	0.9	2.9	1.2	4.5	3.2	13.1
Korea	Finished	2.0	13.8	1.5	4.6	8.3	19.2	11.8	37.6	0.9	9.0	2.5	4.6	1.7	10.3	5.1	23.9
	P&C	0.4	4.8	0.4	1.8	0.8	7.8	1.6	14.5	0.3	3.2	1.3	2.5	0.9	1.8	2.5	7.5
	Total	2.4	18.6	1.9	6.4	9.1	27.0	13.4	52.0	1.1	12.2	3.8	7.1	2.6	12.1	7.5	31.4
Malaysia	Finished	1.7	11.9	0.5	3.8	3.9	16.3	6.1	32.1	0.9	8.5	0.5	2.9	0.6	3.1	2.1	14.5
	P&C	1.1	7.2	0.2	1.7	0.5	7.6	1.7	16.5	0.8	4.7	0.9	3.2	1.8	9.1	3.5	17.0
	Total	2.8	19.1	0.7	5.6	4.4	23.9	7.8	48.6	1.8	13.3	1.4	6.1	2.4	12.2	5.6	31.6
Indonesia	Finished	0.0	1.5	0.0	0.5	0.0	2.4	0.1	4.4	0.1	0.2	0.1	0.1	0.2	0.1	0.5	0.4
	P&C	0.0	1.4	0.0	0.5	0.0	0.6	0.0	2.5	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.1
	Total	0.0	2.9	0.0	1.0	0.1	3.0	0.1	6.9	0.2	0.2	0.1	0.1	0.3	0.2	0.7	0.5
Thailand	Finished	0.2	2.7	0.1	1.3	1.0	5.3	1.3	9.3	0.4	3.1	0.4	1.3	0.2	1.0	1.0	5.5
	P&C	0.9	4.3	0.2	0.9	0.9	3.0	2.0	8.3	0.7	2.6	0.6	1.5	1.0	3.5	2.2	7.7
	Total	1.1	7.1	0.3	2.2	1.9	8.3	3.3	17.6	1.1	5.7	0.9	2.9	1.2	4.5	3.2	13.1
Philippines	Finished	0.1	7.6	0.0	2.5	0.3	10.8	0.5	21.0	0.0	1.4	0.0	0.3	0.0	0.4	0.1	2.2
	P&C	0.0	2.0	0.0	0.6	0.0	1.0	0.1	3.6	0.1	2.5	0.2	2.2	0.4	4.6	0.7	9.3
	Total	0.2	9.6	0.0	3.1	0.3	11.8	0.5	24.6	0.2	3.9	0.2	2.6	0.4	5.0	0.8	11.5

Source: Calculated from UN Comtrade database.

Note: P&C stands for parts and components.

Annex Table 4: Electronics exports and imports by LAC 3 and Costa Rica, by destination and origin ($ billion)

Country of origin	Product	Exports to								Imports from							
		LAC-3		USA		ROW		World		LAC-3		USA		ROW		World	
		1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
LAC-3	Finished	0.1	0.4	0.6	19.4	0.4	1.4	1.1	21.2	0.1	0.4	1.3	16.9	0.9	7.1	2.3	24.5
	P&C	0.0	0.1	0.2	5.9	0.1	1.0	0.3	7.0	0.0	0.1	0.8	5.1	0.9	4.6	1.7	9.8
	Total	0.1	0.5	0.7	25.3	0.6	2.4	1.4	28.2	0.1	0.5	2.1	22.0	1.8	11.6	4.0	34.2
Argentina	Finished	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.4	0.0	0.3	0.1	0.6	0.2	1.3
	P&C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.5	0.1	0.8
	Total	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.4	0.1	0.5	0.2	1.1	0.3	2.1
Brazil	Finished	0.0	0.4	0.3	0.3	0.2	0.3	0.5	0.9	0.0	0.1	0.4	1.8	0.5	1.9	0.8	3.8
	P&C	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.4	0.0	0.0	0.2	0.9	0.4	1.8	0.6	2.8
	Total	0.1	0.4	0.3	0.5	0.3	0.5	0.7	1.3	0.0	0.1	0.6	2.7	0.8	3.8	1.4	6.6
Mexico	Finished	0.0	0.1	0.3	19.0	0.1	1.1	0.5	20.2	0.0	0.0	0.9	14.9	0.4	4.5	1.3	19.4
	P&C	0.0	0.0	0.1	5.7	0.0	0.8	0.2	6.6	0.0	0.0	0.5	3.9	0.4	2.3	1.0	6.2
	Total	0.0	0.1	0.4	24.8	0.2	1.9	0.6	26.8	0.0	0.0	1.4	18.8	0.8	6.8	2.2	25.6
Costa Rica	Finished	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.1	0.0	0.8
	P&C	0.0	0.0	0.0	0.9	0.0	0.7	0.0	1.6	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
	Total	0.0	0.0	0.0	0.9	0.0	0.7	0.0	1.7	0.0	0.0	0.0	0.8	0.0	0.1	0.0	0.9

Source: Calculated from UN Comtrade database.
Note: P&C stands for parts and components.

Annex Table 5: Automotive exports and imports by East Asia 9, by destination and origin (US$ billion)

Country of origin	Products	Exports to								Imports from							
		EA9		Japan		ROW		World		EA9		Japan		ROW		World	
		1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
EA9	Finished	0.2	1.1	0.0	0.0	2.1	14.6	2.3	15.8	0.2	0.9	4.0	5.1	3.4	4.0	7.6	9.9
	P&C	3.4	1.7	0.3	1.0	1.3	4.7	4.9	7.4	2.9	1.1	4.5	6.2	2.0	4.2	9.4	11.5
	Total	3.6	2.8	0.3	1.0	3.3	19.3	7.2	23.1	3.0	2.0	8.5	11.2	5.4	8.1	17.0	21.4
China	Finished	0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.3	0.1	0.1	0.2	0.8	0.5	0.6	0.9	1.5
	P&C	3.0	0.2	0.2	0.2	0.3	1.0	3.5	1.4	0.1	0.2	0.4	0.9	0.6	1.6	1.0	2.7
	Total	3.0	0.2	0.2	0.2	0.3	1.2	3.5	1.6	0.2	0.3	0.6	1.7	1.1	2.2	1.9	4.2
Singapore	Finished	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.2	0.4	1.0	0.3	0.5	0.7	1.6
	P&C	0.2	0.4	0.0	0.0	0.1	0.2	0.3	0.6	0.1	0.1	0.3	0.3	0.5	0.6	0.9	1.0
	Total	0.3	0.5	0.0	0.0	0.2	0.3	0.4	0.8	0.1	0.3	0.7	1.3	0.8	1.1	1.6	2.7
Hong Kong	Finished	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.8	0.2	0.8	0.7	1.7
	P&C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.1	0.3	0.3	0.7
	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.6	1.1	0.4	1.1	1.1	2.4
Taiwan	Finished	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.1	0.3	0.3	1.4	0.9	1.7	1.4
	P&C	0.1	0.4	0.1	0.2	0.6	1.2	0.7	1.8	0.0	0.1	0.7	1.2	0.2	0.2	0.9	1.4
	Total	0.1	0.5	0.1	0.2	0.6	1.3	0.8	2.0	0.1	0.2	1.0	1.5	1.6	1.1	2.6	2.8
Korea	Finished	0.1	0.7	0.0	0.0	1.9	12.5	2.0	13.2	0.0	0.0	0.1	0.1	0.2	0.4	0.4	0.5
	P&C	0.0	0.2	0.0	0.2	0.2	1.6	0.3	2.0	0.0	0.0	0.5	0.7	0.2	0.7	0.7	1.5
	Total	0.1	0.9	0.1	0.2	2.1	14.1	2.2	15.2	0.0	0.1	0.6	0.8	0.4	1.1	1.0	1.9
Malaysia	Finished	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.9	1.2	0.2	0.2	1.1	1.4
	P&C	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.1	0.1	0.2	0.1	0.1	0.2	0.4
	Total	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.3	0.0	0.1	1.0	1.4	0.3	0.3	1.3	1.8
Indonesia	Finished	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.6	0.2	0.2	0.2	0.8	0.6
	P&C	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.3	0.0	0.2	0.7	1.0	0.1	0.2	0.8	1.4
	Total	0.0	0.2	0.0	0.1	0.0	0.1	0.0	0.3	0.0	0.4	1.2	1.2	0.3	0.5	1.6	2.0
Thailand	Finished	0.0	0.2	0.0	0.0	0.0	1.6	0.1	1.8	0.0	0.0	0.8	0.3	0.2	0.2	1.0	0.5
	P&C	0.0	0.1	0.0	0.2	0.0	0.3	0.0	0.6	0.0	0.2	1.6	1.4	0.2	0.3	1.7	1.8
	Total	0.0	0.3	0.0	0.2	0.1	1.9	0.1	2.4	0.0	0.2	2.3	1.7	0.4	0.5	2.7	2.4
Philippines	Finished	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.0	0.1	0.3	0.7
	P&C	0.0	0.2	0.0	0.1	0.0	0.3	0.0	0.6	0.0	0.1	0.2	0.2	0.0	0.0	0.2	0.3
	Total	0.0	0.2	0.0	0.1	0.0	0.3	0.0	0.6	0.0	0.3	0.5	0.6	0.1	0.1	0.6	1.0

Source: Calculated from UN Comtrade database.
Note: P&C stands for parts and components.

Annex Table 6: Automotive exports and imports by LAC-3, by destination and origin (US$ billion)

Country of origin	Products	Exports to								Imports from							
		LAC3		USA		ROW		World		LAC3		USA		ROW		World	
		1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
LAC3	Finished	0.1	2.9	4.0	21.0	1.3	4.3	5.4	28.2	0.0	2.9	0.4	6.5	0.1	3.4	0.6	12.8
	P&C	0.3	1.1	0.8	7.5	0.5	1.6	1.6	10.1	0.2	1.0	2.3	10.9	1.4	5.2	3.9	17.0
	Total	0.3	4.0	4.9	28.5	1.8	5.9	7.0	38.4	0.2	3.9	2.7	17.4	1.5	8.6	4.5	29.8
Argentina	Finished	0.1	0.5	0.0	0.0	0.0	0.2	0.1	0.6	0.0	0.9	0.0	0.1	0.0	0.6	0.0	1.5
	P&C	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.3	0.1	0.4	0.0	0.1	0.1	0.7	0.2	1.2
	Total	0.1	0.5	0.0	0.1	0.1	0.3	0.2	0.9	0.1	1.3	0.0	0.2	0.1	1.3	0.2	2.7
Brazil	Finished	0.0	1.5	0.4	0.3	0.9	1.2	1.4	3.0	0.0	1.3	0.0	0.1	0.0	1.0	0.1	2.4
	P&C	0.2	0.7	0.4	0.7	0.4	0.9	1.0	2.3	0.1	0.3	0.1	0.4	0.4	1.5	0.5	2.2
	Total	0.2	2.2	0.8	1.1	1.3	2.1	2.4	5.3	0.1	1.7	0.1	0.4	0.4	2.4	0.6	4.5
Mexico	Finished	0.0	0.1	3.6	20.7	0.3	3.0	4.0	23.7	0.0	0.7	0.4	6.4	0.0	1.9	0.4	9.0
	P&C	0.0	0.0	0.4	6.7	0.1	0.5	0.5	7.2	2.0	9.2	2.2	10.4	2.1	9.6	6.3	29.2
	Total	0.0	0.1	4.0	27.3	0.4	3.4	4.4	30.9	2.4	13.8	2.6	16.8	2.4	14.5	7.4	45.1

Source: Calculated from UN Comtrade database.
Note: P&C stands for parts and components.

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