



27 January 2012

The Wide Angle

Transportation versus Communications: What is Next?

Periodical

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Summary

- The history of the global economy can be seen a race between transportation and communications. Innovations in transportation allow supply chains to cheaply move larger quantities of goods. This tends to encourage standardization. In contrast, innovations in communications allow for better specification of design, quality, quantity and time of delivery. This tends to encourage customization. We argue in this report that production and distribution networks are ultimately the result of the relative evolution of transportation and communications technologies at each point in time.
- We also found that innovations are almost always adopted in the upstream production network and only later trickle down to the distribution end of the chain. Thus, mass production took off almost a century before mass consumerism. Similarly, lean production models were well established in Japan by the 1970s but the practices would be applied to distribution logistics only in the 1990s.
- The Communications Revolution has already caused many production networks to dissolve into a cloud – an evolving ecosystem where the distinction between competitor and collaborator is no longer clear. We are now beginning to see the same dynamics in the distribution end of the chain. In our view, this will not just lead to a world of mass customization but will also blur the distinction between customer and supplier. In many sectors, companies will no longer be able to compete merely by being a hyper-market that provides ever greater variety of standardized products. Emerging technologies like 3-D printing may go even further and turn the logic of mass manufacturing and distribution on its head.



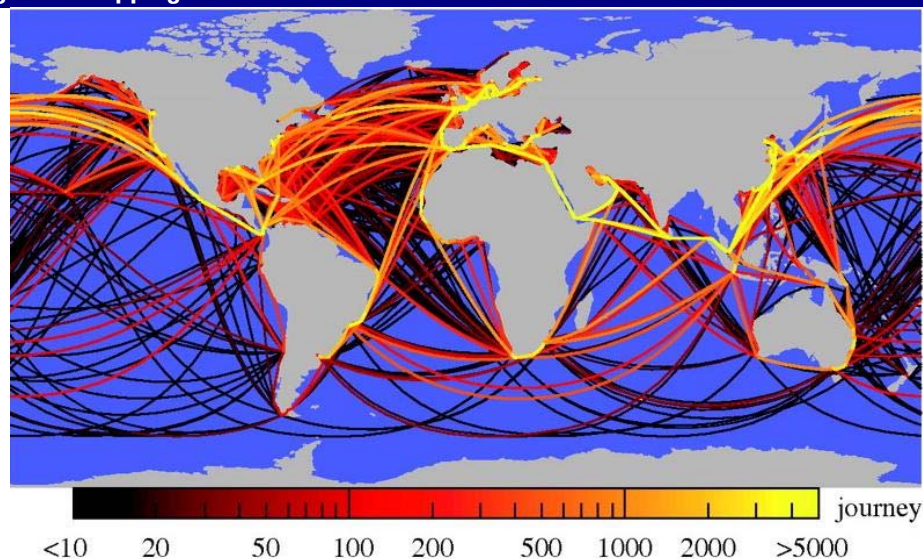
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Background

Today's global economy is all about goods and services whizzing around the world. Thus, the dynamics of the global economy is ultimately about the supply and distribution chains that allow this ever changing eco-system to function. In our daily lives, we routinely use goods that have reached us using multiple transport systems – by air, road, rail and most importantly, by ship. The image below shows the complex network of actual journeys made by container ships in 2007. The map not only illustrates the important shipping routes, but also the dense clusters in the North Atlantic and in East Asia.

Figure 1: Shipping Routes Charted over 2007



Notes: The trajectories of all cargo ships bigger than 10,000 GT during 2007. The colour scale indicates the number of journeys along each route. Ships are assumed to travel along the shortest (geodesic) paths on water. Source: "The complex network of global cargo ship movements," by Pablo Kaluza, Andrea Kolzsch, Michael T. Gastner, and Bernd Blasius. 19th January 2010 edition of *Interface*, *Journal of the Royal Society*. Reproduced with permission from The Royal Society.

Of course, the communications revolution of the last twenty years has also led to a boom in the trade of services. We now think little of talking to call-centers located thousands of kilometers away or of buying books, airline tickets and music over the internet. This report is itself a good example of the globalization of supply networks in the services industry. It was written in Singapore with inputs from Bangalore, formatted in Gurgaon, then whetted in the United Kingdom and finally distributed electronically worldwide (with physical copies printed in Hong Kong).

The geographical distribution of the supply chain of each product is a complex result of many factors that range from the source of raw materials, the clustering of various grades of human capital, availability of physical and financial infrastructure, government policies and taxation, and sometimes the accidents of history. This report, however, is not directly concerned with the geographical distribution of today's supply chains but about the nature and structure of supply chains. Our study shows that production and distribution networks are ultimately the result of technological change – in particular, the relative evolution of transportation and communications technology, and the interactions between the two. We found that this analytical framework not only provides a good explanation of past trends but also has interesting implications for what to expect in the future.

A Brief History of Supply Chains

Transportation and communication are very closely related activities. Often, the same technological breakthrough allows improvements in both directions. Nevertheless, they are distinct activities and have different implications for supply chains. At its simplest, transportation improvements increase the quantity of goods that can be moved, and the reliability and speed at which this operation can be executed. In contrast, improvements in communications allow greater specification and customization.

In ancient times, transportation technology was basic and the cost of moving goods was an important determinant of the production and distribution of a product. Thus, goods were put together close to the source of raw materials. Then these products made their way in a largely linear chain to their end consumer. Ancient trade routes like the Silk Route through Central Asia and the Spice Route through the Indian Ocean were mostly linear chains that took a finished product to its ultimate destination. Moreover, given the high costs, long-distance trade was limited to high-value items such as spices, weapons and luxury goods. The production and consumption of most items was local. This meant that producer and consumer could directly communicate with each other and the customer could specify exactly what he/she wanted. This was the world of the village weaver, potter, black-smith and cobbler. The bulk of pre-industrial artisan manufacturing, therefore, was customized to the needs of the end consumer.

It was only in the 18th century that shipping technology improved enough to allow the large-scale functioning of an international production network. Interestingly, the first product to be put together with a truly global supply network was Rum. Slave labour was imported from West Africa to the Caribbean in order to grow sugarcane (a plant originally from India). Sugarcane molasses were then shipped to New England where distilleries in Massachusetts, Rhode Island and Staten Island turned it into Rum. Some of the drink was consumed locally but much of it was then sold in bottles and barrels in Europe and all over the Atlantic. It is said that the distillation of Rum was the single biggest industry in colonial America although its importance is now all but forgotten except in popular tales about 18th century pirates.

As the Industrial Revolution took shape in the late 18th century, production networks took on a totally different scale. The cotton industry was the center of this shift. Prior to the technological innovations of the Industrial Revolution, India was the cotton manufacturing center of the world and exported its textiles all over the world. Competition from imported cotton was a major cause of resentment for the traditional wool industry in Britain and we have records of heated debates in the Parliament in the 1600s and early 1700s about how to restrict the use of cotton. A law passed in 1699 stipulated that "all magistrates, judges, students of the Universities, and all professors of the common and civil law...[must] wear gowns made of woollen manufacture."¹ There were even laws that stipulated that corpses had to be buried wearing sheep's wool.

By the end of the 18th century, however, technological shifts dramatically changed the cotton industry. The spinning jenny patented by James Hargreaves in 1770 increased the amount of yarn spun by a worker by several orders of magnitude even as the flying shuttle revolutionized the speed of weaving the yarn into cloth. Meanwhile, the American inventor Eli Whitney invented the cotton gin that mechanized the process of separating cotton wool from the seeds. All these changes were complimented by improvements in ship design and, by the mid-19th century, the introduction of steam-ships. As a result of all these innovations, a global supply network emerged that involved shipping cotton grown in the southern United States (often using slave labour) to the cotton mills in England. The finished cloth was then shipped out to the rest of the world.

¹ Quoted in "The Travels of a T-Shirt in the Global Economy", Pietra Rivoli, Wiley 2009

In 1791, the American South produced only 2 million pounds of cotton compared to an estimated 400 million pounds produced by Asia (primarily India). Over the next ten years, American production rose 25 times and by the outbreak of the Civil War was producing a billion pounds a year, two-thirds of global production. The biggest losers from this change were the weavers and spinners of India and the country's artisan manufacturing sector collapsed. It is no coincidence, therefore, that Mahatma Gandhi would later choose the hand-turned spinning wheel as the symbol of protest against British colonial rule. Note that most of the changes at this stage were in the upstream production end of the supply chain. At the downstream end of the supply chain, we were still dealing with a world of tailors and hat-makers where there was face-to-face interaction with the end user and the final product was custom-made.

Over the next century, transportation technology witnessed major breakthroughs that included the railways, trams, bicycles and the Suez Canal. By the time of the First World War, we also had the Panama Canal, automobiles and even early airplanes. As a result, the cost of transporting goods dropped sharply. Ocean freight rates, for instance, fell 70% between 1840 and 1910². The improvements in transportation also improved communications – the steamships and railways could also carry letters – but there were few independent improvements in communications with the single exception of the telegraph. In other words, communications was the poor cousin of transportation till the First World War.

A world with good transportation but relatively underdeveloped communications strongly influenced the industrial structure and supply networks of the early 20th century. Production was centralized at major transportation hubs, and Fordist production lines were used to mass manufacture goods. Observe how vertically integrated industrial structures were needed to minimize communication gaps between various segments of the production process. As mass manufacturing was ramped up, it was no longer possible for individual customers to specify requirements. The supply chain responded by standardizing products. Ultimately, even downstream distribution networks succumbed to standardization. This shift is best summarized by Henry Ford's famous comment, "Any customer can have a car painted in any color that he wants so long as it is black." Retailing shifted in favor of large department stores that could house a large selection of standardized products with price and variety substituting for customization (for a longer discussion of the history of consumerism, read "Can Asian consumers replace the West?", Wide Angle report published 27th July 2011).

The Second World War witnessed the pinnacle of the Fordist production system. By 1950s, a new generation of technological changes began to alter the structure of global supply networks. As a break from the past, communications began to influence developments independently of transportation. The telephone was patented by Alexander Graham Bell in 1876 but it would be well into the 1920s by the time phones was commonplace in the US. The first trans-Atlantic call between London and New York took place in 1926 and another two decades would pass before long-distance telephony was common in the rest of the world.

The cost of making an international call was very high by today's standards. A call from New York to Havana in 1921 was USD13.65 for the first three minutes while that between Havana and San Francisco was USD22.35 for the same³. A call between New York and London cost USD75 for the first three minutes in 1927. Expressed in today's prices, these would be prohibitive rates but it was still a major improvement on the telegraph. Moreover, rates soon began to decline. By 1934, a three minute call on the newly launched service between Japan and the United States cost USD39. By the mid- 1950s, rates had fallen to USD12 for a three

² "The Box: How the shipping container made the world smaller and the world economy bigger ", Mark Levinson, Princeton University Press 2006.

³ <http://www.corp.att.com/history/nethistory/milestones.html>

minute trans-Atlantic call. At this level, international calls were becoming cheap enough for some businesses to use it for everyday work.

Table 1: Cost of Shipping One Truckload of Medicine from Chicago to Nancy, France (estimated ca. 1960)

	Cash outlay (USD)	Percent of cost
Freight to US port city	341	14.3%
Local freight in port vicinity	95	4.0%
Total port cost	1,163	48.7%
Ocean shipping	581	24.4%
European inland freight	206	8.6%
Total	2,386	100.0%

Source: American Association of Port Authority data as presented in "The Box: How the shipping container made the world smaller and the world economy bigger", Mark Levinson, Princeton University Press 2006.

Meanwhile, transportation also went through another major innovation – containerization. Most people tend to ignore the importance of this innovation but it was a radical idea. Till the 1950s, ships had to be manually loaded piece-by-piece. Industrial cables had to be carefully stacked next to boxes of delicate porcelain and perhaps a basket containing fruit. This was not just time consuming but also very expensive. As shown in Table 1, the cost of port handling accounted for almost half the transportation cost of shipping a truckload of medicine from Chicago to Nancy, France. Moreover, the system was very prone to breakage and theft. It was also not uncommon that the shipment got lost and it was very difficult to trace it.

In the 1950s, entrepreneurs like Malcolm McLean began to revolutionize shipping – and logistics in general – by introducing standardized containers that could not merely be sealed and loaded into ships but also could be seamlessly passed on to the truck and rail network. Both ships and ports were redesigned to handle containers. Ships purchased in the early 1970s could carry four times the cargo capacity of traditional ships and their faster speeds and port turnaround time allowed them to make six round trips a year between Europe and the Far East compared to three-and-a-half for the older ships. Interestingly, western countries persisted with building old style ports well into the seventies. They already had large existing fleets and other infrastructure from the pre-container age and could not easily adopt full containerization. Bureaucratic persistence and political pressure from port workers' unions also slowed the shift. Thus, it was Asia that whole-heartedly adopted containerization and built large new facilities. Hong Kong and Singapore asserted themselves as major ports and clearing-houses for containerized shipping. As shown in Table 2, these two ports had established themselves as the world's largest container ports by 1990 and Asian ports continue to dominate to this day.

Table 2: The World's Largest Ports - ranked by volume in million TEUs (20-foot Equivalent Units)

	Port	Country	1990	2003	2010
1	Shanghai	China	0.5	11.5	29.1
2	Singapore	Singapore	5.2	18.4	28.4
3	Hong Kong	China	5.1	20.8	23.7
4	Shenzhen	China	0.0	10.7	22.5
5	Busan	Korea	2.3	10.4	14.2
6	Qingdao	China	0.1	4.2	12.0
7	Dubai	United Arab Emirates	1.1	5.1	11.6
8	Rotterdam	Netherlands	3.7	7.1	11.1
9	Kaoshung	Taiwan	3.5	8.8	9.2

Table 2: The World's Largest Ports - ranked by volume in million TEUs (20-foot Equivalent Units)...(cont'd)

10	Port Klang	Malaysia	0.5	4.8	8.9
11	Antwerp	Belgium	1.6	5.4	8.5
12	Hamburg	Germany	2.0	6.1	7.9
13	Tanjung Pelepas	Malaysia	0.0	3.5	6.5
14	Los Angeles	United States	2.6	6.6	6.5
15	Long Beach	United States	1.6	4.7	6.3
16	New York	United States	1.9	4.0	5.3
17	Laem Chabang	Thailand	0.1	3.2	5.2
18	Bremen/Bremerhaven	Germany	1.2	3.2	4.9
19	Tokyo	Japan	1.5	3.3	4.3
20	Gioia Tauro	Italy	0.0	3.0	2.9

Source: Containerisation International Yearbook and UN Economic and Social Commission for Asia and the Pacific, World Shipping Council

The combination of containerization and telephones (and related technologies like the fax) caused the next shift in supply networks. Improved communications meant that it was possible to exactly specify components and products. Containerization meant that these components could be transported cheaply and be delivered "just-in-time". In turn, this allowed the production process to be neatly modularized and contracted out⁴. Interestingly, one of the first products to take advantage of this was Mattel Corp that used it to produce the Barbie. Despite Barbie's All-American image, the doll was produced abroad from its very inception in 1959⁵. The earliest Barbie factories were in Japan and Taiwan and today it is put together by a complex network spanning the world. Although the technologies and practices related to the new supply chains originated in the US, it was Japan that leveraged them to fundamentally change production systems. Dubbed as "lean production", the Japanese production system was both more flexible as well as able to sharply reduce the need to carry inventory. It made the vertically-integrated Fordist assembly line obsolete.

Many of the elements of the new system evolved originally in the automobile industry, but they were soon being applied in other sectors too. The electronics industry turned out to be especially well-suited to the decentralized production process. By the late 1980s, the whole world was trying to copy the Japanese system. Nonetheless, it was East Asia that best internalized the network based production system. There were many reasons for this. First, much of the infrastructure in the region was new and did not have to carry the Fordist legacy. In many cases, the infrastructure was specifically created to support supply chains for Japanese companies. Second, geography helped since most of the key economic hubs could be linked by sea. This is a key advantage since shipping is much cheaper than rail or road. Singapore and Hong Kong, too, played an important role as super-efficient clearing houses for container traffic. Third, East Asia had a very heterogeneous mix of skills and wages. This meant that different countries could specialize into different parts of the modular production chain. The addition of South East Asia and China's special economic zones to the supply chain meant that the production network could remain within the region even when wages rose in turn in Japan, Hong Kong, Singapore, Taiwan and South Korea.

⁴ "Global Shift", Peter Dicken, Guilford Press, 2011

⁵ "The Box: How the shipping container made the world smaller and the world economy bigger", Mark Levinson, Princeton University Press 2006

By the 1990s, much of the world's manufacturing had shifted to the new system but the decade will be remembered for what is best described as the "Communications Revolution". Within a few short years, technologies such as mobile telephony and the internet went from being barely known to being ubiquitous. The efficiency of transportation networks also improved but, in a role reversal, these gains were now driven mostly by improvements in communications technology.

The cost of real-time international communications had been prohibitive in the 1930s and barely affordable in the 1960s, but became irrelevant by the end of the 1990s. This not only made lean manufacturing ever more efficient but allowed the creation of international production networks in a completely new area – services. Around 1993, the management of American Express noticed that the cost of running their credit card operations in India was significantly lower than that for comparable businesses elsewhere⁶. So when the bank decided a year later to consolidate their finance functions in three locations around the world, India was chosen to anchor the Asia-Pacific operations. Very soon companies like British Airways and GE Capital were setting up large outsourcing units in India. Thus was born the global services outsourcing business.

Meanwhile, the efficiency gains of "just-in-time" and lean production were making their way downstream and being applied to distribution networks. One of the results of this change was the rise of hyper-markets like Walmart and Carrefour. By leveraging scale, logistics and lean inventories, they were able to bring down retail prices as well as provide consumers with unprecedented choice. The distinction between the wholesaler and the retailer had been blurred during the age of department stores but now it disappeared altogether. Nevertheless, note that customer needs were still being met by providing a wide variety of standardized products and not through customization. Could this paradigm be undergoing a radical shift?

The Supply Chain as a Cloud

The historical account of the supply chain discussed in the previous section provides two important insights. First, the structure of global supply networks at a point in time, to a large extent, is the result of the relative evolution of transportation and communications technologies and the symbiotic relationship between the two. In general, transportation innovations allow supply chains to cheaply move larger quantities of goods. This tends to encourage standardization. In contrast, innovations in communications allow for better specification of design, quality, quantity and time of delivery. This tends to encourage customization.

Second, innovations are usually adopted earlier in the upstream production network and only later make its way down to the distribution end of the chain. Thus, we saw how mass production took off in the early nineteenth century but it would be the end of the century when mass consumerism took off (even later in developing countries). Similarly, lean production models emerged in Japan by the 1970s but the idea would be applied to distribution logistics as recently as the 1990s.

As already discussed, the lean production model was the result of innovations in containerization and fixed-line telephony. Although production was decentralized, we were still dealing with a pyramid of rigid industrial relationships (such as the Japanese Keiretsu). The Communications Revolution fundamentally changed this environment by making it possible for everyone to contact everyone, specify a requirement and negotiate a price. This retained most of the advantages of lean production but was far more flexible and adaptable. The supply chain was no longer a chain but a cloud – an evolving ecosystem where economic agents could collaborate in one sphere and compete in another. The distinction between supplier and

⁶ "The Indian Renaissance", Sanjeev Sanyal, Penguin, 2008

customer dissolved. A product now belongs to a company or individual who can think of a good idea and then orchestrate its production without necessarily participating in the actual manufacturing process.

The production of Apple's iPhone and iPad are good examples of this new production network. As illustrated in the table, the iPhone is made up of inputs sourced from around the world that are then assembled together by Foxconn in China. The product never passes through an Apple facility during its production. Yet, Apple receives 66% of the price of an iPhone while Foxconn, the final assembler, receives a paltry 2.5%. Moreover, note that Samsung is a major supplier of components even though it competes directly with Apple in the mobile phone and tablet space.

Table 3: The Supply Network of the iPhone (GSM version)

Manufacturer	Country	Component/ service	USD	Per cent
Samsung	S. Korea	Flash memory, DRAM memory and Applications processor	45.7	8.2%
Infineon	Taiwan	Baseband	10.3	1.8%
Murata	Japan and Taiwan	Bluetooth and Wi-Fi	8.0	1.4%
Skyworks; TriQuint	USA	Baseband	6.2	1.1%
Micron	USA	Flash memory	2.5	0.4%
ST Microelectronics	Italy	Accel. and gyroscope	2.3	0.4%
Dialog Semiconductors	Taiwan	Power management	1.5	0.3%
Texas Instruments	USA	Audio	1.0	0.2%
Cirrus Logic	USA	Touchscreen control	0.9	0.2%
AKM Semiconductor	Japan	E-compass	0.7	0.1%
Others	Other	Display, touchscreens, camera, battery and other parts	99.0	17.7%
Foxconn	China (Shenzhen)	Assembly	14.0	2.5%
Apple	USA	Ideas, design and brand	368.0	65.7%
Price of i-phone (16GB GSM version)			560.0	100.0%

Source: The Economist "Slicing an Apple", Aug 10th 2011, Apple, IHS iSuppli, IDC Worldwide Mobile Phone Tracker, Aug 4th 2011

Implications for the Future of Supply Chains

The transformation of the production network into a cloud is well underway and very visible. However, the shift at the distribution end of the supply chain is still at a nascent stage. Of course, retail e-commerce has already made its presence felt. As the bookstore industry discovered, the entry of Amazon changed the game completely by offering almost infinite choice combined with large discounts. By mid-2011, books retailers like Borders were going out of business. By the beginning of 2012, large hyper-market chains like Carrefour are having to revisit expansion plans⁷.

Still, first generation retail e-commerce feels like a large hypermarket located on the internet. This is a big shift from the brick-and-mortar form of retailing but it is still mostly about dealing with standardized products. In our view, this does not fully exploit the ability of even existing

⁷ "Carrefour trims hypermarket expansion plan", by Scheherzade Deneshkhu, Financial Times, 20th January 2012.

communications technology to specify and customize. Nevertheless, we have been witnessing several efforts in this direction in recent years.

One of the first to experiment with such customization is Dell that allows the end consumer to “build” a device to his/her requirement. We also have clothes brands that allow the buyer to customize clothes to his/her exact dimensions. A number of means are being devised to mimic the trail-room experience. In other words, we are entering a world where we will order a shirt by specifying the exact size and design and it will be custom-made in Bangladesh. Similarly, YouTube is investing USD100mn to create dozens of specialized television-like channels that cater to audiences with very narrowly defined interests. Obviously, not every experiment will work but the overall direction is clear⁸.

Meanwhile, Amazon is shifting away from being an internet-hypermarket to becoming more like an exchange or clearing house that matches different customized requests with products or services. In many cases, these are products that Amazon does not hold in inventory but merely provides a payments gateway and presumed certificate of reliability. In other cases, it is a customized service. For instance, it is now possible to self-publish a book on Amazon and completely bypass the whole publishing industry. In 2011, 26-year old Amanda Hocking made history as the first person to have become a millionaire by self-publishing on the internet. Perhaps this will lead to a world where a book-reader may ask for a non-existent book and some writer will write it for him/her (sort of like how medieval monarchs used to commission art). Notice that the same supply chain works in reverse as well. We can now sell back second-hand books to Amazon.

The implication of these trends is not just mass customization but a blurring of the distinction between a supplier and customer (analogous to the blurring of distinction between competitors and collaborator that has already happened in the production network). Is the self-published author a customer or a supplier for Amazon? Are we suppliers or customers when we sell second-hand books back to Amazon? Indeed, this blurring now exists in many places. Is the person using Google search a customer for Google or a supplier of eyeballs that Google sells to advertisers? There are no clear answers to these questions. Instead we are witnessing the conversion of the distribution network into a cloud. In turn, this is fundamentally changing the nature of supply chains as well as that of the products we buy. For instance, one could argue that devices like the iPhone or iPad are not end-products but supply-logistics infrastructure that allow us to access end products (music, phone calls, books and various other applications).

So what may disrupt this hyper-connected, globalized world?

During the course of this study, we found many people who expressed the opinion that energy prices posed a major threat to the globalized supply chain because rising fuel prices could cause transportation prices to become prohibitive. In turn, this could lead to more localized supply chains and production. Our investigations into this issue, however, have led us to very different conclusions.

As shown in Table 4, the cost of transporting a container across the world remains very cheap despite persistently high energy prices in recent years. Our survey in December 2011 showed that it would have cost just USD500 to send a 20-foot container from Shanghai to Hamburg and a mere USD300 to have it sent back. This is less than what it costs to send the same container the short distance by road from Hamburg to Munich. Similarly, it costs USD1440 to send the 20-foot container from Shanghai to Long Beach, California but USD2305 to send it from Long Beach to Denver.

⁸ “Streaming Dreams”, John Seabrook, The New Yorker, 16th Jan 2012

Even for cheap bulk items, the cost of transporting a product to the market is a tiny fraction of its end price. It is roughly 1-2% for cheap t-shirts and is almost irrelevant for non-bulky, high-value goods and for most services. So, it would require an almost catastrophic increase in energy prices to unwind the globalised supply cloud. Higher energy costs, however, will have an impact on the mode of transport. As one can see from Table 4, the cost of transportation over land (truck or rail) is an order of magnitude higher than by ship. Container ships are now so large, some carry more than 10,000 Twenty-foot Equivalent Units, that it takes hundreds or even thousands of trucks to deliver the load of a single ship. This gap will widen as ever larger ships are built and infrastructure such as the Panama Canal are expanded. The point is that higher fuel costs would not undo the international supply cloud but would mainly skew incentives in favour of sea-side locations against inland locations (and to a lesser extent for rail transport against road based system). Air transport would probably suffer the most but even now it is used mainly for light, high-value items.

Table 4: Transport Costs on select Routes and Modes as in December 2011

Origin	Destination	Mode	20 foot container (USD)	40 foot container (USD)
China - Germany				
Shanghai	Hamburg	Sea	500	1,000
Hamburg	Shanghai	Sea	300	450
Hamburg	Munich	Road	550	750
Hamburg	Munich	Rail	550	750
Shanghai	Munich	Air	27,000	54,000
China - US (East Coast)				
Shanghai	New York	Sea	1,950	2,438
New York	Shanghai	Sea	1,400	1,600
New York	Denver	Road	3,558	4,000
Shanghai	New York	Air	35,000	70,000
China - US (West Coast)				
Shanghai	Long Beach	Sea	1,440	1,800
Long Beach	Denver	Road	2,305	2,591
Germany - US (East Coast)				
Hamburg	New York	Sea	1,150	1,500
New York	Hamburg	Sea	1,050	1,400
Hamburg	New York	Air	10,411	20,821

Source: China Wellfast Logistics Co Ltd, e-freightline.com, www.freight-calculator.com and Deutsche Bank estimates

The real threat to current structure of the global supply network, in our view, comes not from energy costs but, as we have seen throughout history, from future innovations in communications and transportation. One possibility is already knocking at our door – 3-D Printing – which allows a fabricator to “print” a three-dimensional object from a digital file. Observe how this technology would turn the logic of mass production on its head by making it as cheap to produce one piece as to produce many. This technology already exists even if its impact on the global supply chain is difficult to predict at this stage. As the Economist magazine put it, “Just as nobody could have predicted the impact of the steam engine in 1750—or the printing press in 1450, or the transistor in 1950—it is impossible to foresee the long-term impact of 3D printing. But the technology is coming, and it is likely to disrupt every field it touches.”⁹ So, will supply logistics of the future be reduced to downloading a digital design and printing out the required object? Will this be the ultimate victory of communications over transportation? Or, does transportation have something up its sleeve?

⁹ “Print me a Stradivarius”, The Economist, 10th February 2011

Appendix 1

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Risks to Fixed Income Positions

Macroeconomic fluctuations often account for most of the risks associated with exposures to instruments that promise to pay fixed or variable interest rates. For an investor that is long fixed rate instruments (thus receiving these cash flows), increases in interest rates naturally lift the discount factors applied to the expected cash flows and thus cause a loss. The longer the maturity of a certain cash flow and the higher the move in the discount factor, the higher will be the loss. Upside surprises in inflation, fiscal funding needs, and FX depreciation rates are among the most common adverse macroeconomic shocks to receivers. But counterparty exposure, issuer creditworthiness, client segmentation, regulation (including changes in assets holding limits for different types of investors), changes in tax policies, currency convertibility (which may constrain currency conversion, repatriation of profits and/or the liquidation of positions), and settlement issues related to local clearing houses are also important risk factors to be considered. The sensitivity of fixed income instruments to macroeconomic shocks may be mitigated by indexing the contracted cash flows to inflation, to FX depreciation, or to specified interest rates – these are common in emerging markets. It is important to note that the index fixings may – by construction – lag or mis-measure the actual move in the underlying variables they are intended to track. The choice of the proper fixing (or metric) is particularly important in swaps markets, where floating coupon rates (i.e., coupons indexed to a typically short-dated interest rate reference index) are exchanged for fixed coupons. It is also important to acknowledge that funding in a currency that differs from the currency in which the coupons to be received are denominated carries FX risk. Naturally, options on swaps (swaptions) also bear the risks typical to options in addition to the risks related to rates movements.


The Wide Angle series

13 June 2011
The Wide Angle
The End of Population Growth

Periodical
Deutsche Bank
Research
Global Markets Research

Summary

- Latest estimates that suggest the world suggests that fertility rates will fall to below replacement levels in the next 20 years. Population may have grown for a few more decades before declining. This will have significant implications for the global economy.
- Most people believe that the world will be a different place in 20 years but this is not always the case. The United States and Europe are the only countries that are projected to have a growing population. This is due to immigration and higher birth rates.
- Aging workers will mean a growing reliance on the younger generation to support the costs of health care and retirement.



Deutsche Bank Research

Research by Anthony King


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20 June 2011
The Wide Angle
Is Outsourcing History?

Periodical
Deutsche Bank
Research
Global Markets Research

Summary

- The debate surrounding manufacturing and loss of services to Asia has shifted the narrative of global production. This has led to a re-evaluation of the impact of outsourcing on the global economy.
- The focus on the American manufacturing sector is not the main competition in the developed world. The main challenge is the loss of jobs to emerging economies.
- China's manufacturing sector is not the main competition in the developed world. The main challenge is the loss of jobs to emerging economies.



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27 July 2011
The Wide Angle
Can Asian consumers replace the West?

Periodical
Deutsche Bank
Research
Global Markets Research

Summary

- There is a growing debate about whether Asian consumers can replace the West. This is due to the rapid growth of the Asian economy.
- The Asian market is growing rapidly, but it is still a long way from being a replacement for the West.
- The Asian market is growing rapidly, but it is still a long way from being a replacement for the West.



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27 August 2011
The Wide Angle
The Future of Our Cities

Periodical
Deutsche Bank
Research
Global Markets Research

Summary

- The global economy is slowly recovering from the recession, and this is leading to a growing interest in the future of our cities.
- The future of our cities is a topic that is becoming increasingly important. This is due to the rapid growth of the global economy.
- The future of our cities is a topic that is becoming increasingly important. This is due to the rapid growth of the global economy.



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3 November 2011
The Wide Angle
Are We Entering a Post Dollar World?

Periodical
Deutsche Bank
Research
Global Markets Research

Summary

- The global economy is slowly recovering from the recession, and this is leading to a growing interest in the future of our cities.
- The future of our cities is a topic that is becoming increasingly important. This is due to the rapid growth of the global economy.
- The future of our cities is a topic that is becoming increasingly important. This is due to the rapid growth of the global economy.



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27 January 2012
The Wide Angle
Transportation versus Communications: What is Next?

Periodical
Deutsche Bank
Research
Global Markets Research

Summary

- The global economy is slowly recovering from the recession, and this is leading to a growing interest in the future of our cities.
- The future of our cities is a topic that is becoming increasingly important. This is due to the rapid growth of the global economy.
- The future of our cities is a topic that is becoming increasingly important. This is due to the rapid growth of the global economy.



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