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Technological or trade competitiveness: chicken or egg?

Which comes first – success in international trade or competitiveness in technology? Does innovation in technology help a country's exports become more competitive in international trade? Or does success in international markets provide the incentive for technological advance? And how does domestic competition affect a country's performance in both technology and international trade?

Does technological advance drive international trade or is it the other way round? In recent years much research on the OECD countries certainly suggests that, for them, success in trade is strongly influenced by their technological competitiveness. And indeed, in our East Asian research, we found this was also the case in Hong Kong, South Korea and Singapore. But the relationship between trade and technology is likely to be more complex than this, since, for instance, being export-orientated itself generates incentives for technological advance. Therefore we might expect a two-way relationship between trade and technology. And in fact our results show that the situation in 'catching-up' economies in general is not the same as in OECD countries.

Befriending the market or stimulating it?

How does a country come to specialise in a particular export i.e. become competitive in a particular industrial sector? It seems reasonable to suppose that this is the result of a learning process within the country and sector involved which has increased the necessary technological capabilities.

Opinion is sharply divided however on the role of the state in this learning process. The supporters of a 'market friendly' approach, such as the World Bank, believe that rapid trade liberalisation is the driver of economic success. They argue that the state should aim for 'policy neutrality' in order to fully benefit from unconstrained market forces. In contrast the 'market stimulating' approach sees the state as a dynamic complement to the market and considers technology a more complex issue, being developed not merely through acquisition and innovation, but also through struggles in the risky, real world of imperfect information and understanding where the future is always unclear. Technological upgrading and deepening is seen as the result of a long cumulative process of learning, agglomeration, institution building and business culture rather than sharp policy shocks. Confusingly, both sides tend to claim East Asian economic success as a vindication of their theories!

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Predicting how countries will perform over time

Some countries have strong learning systems in place which help them absorb technologies quickly and react well to changing conditions. They will tend to be able to hold on to their competitive positions even when they have lost their initial advantage. We would expect specialisation to be fairly stable in industrialised economies because they have had longer to learn by doing and because their size means they benefit from economies of scale. In contrast, in 'catching-up' economies where specialisation has been achieved over a shorter time, such achievements are likely to be more vulnerable to changes in the business environment.

The role of competition

Much theory and research in recent years has emphasised the important role that competition plays in increasing productive and dynamic efficiency. The discipline of the market encourages enterprises both to cut costs and to speed up their innovation and technological progress. This competitive process also leads to weaker enterprises giving way or being replaced by stronger ones. But the strength of competition does not depend solely on how enterprises behave – the environment in which they compete is also very important. For example physical infrastructures, legal frameworks and financial systems all play important roles in determining whether and how competition will work effectively.

In this dynamic setting, new entrants to the market experiment with new technologies. They become a driving force for innovation, forcing existing enterprises to innovate or collapse. Where an industry, such as telecommunications, is characterised by rapid technological change, competition through innovation is likely to be more significant than competition through cost-reduction.

Investigations into the relationship between competition and this sort of dynamic, innovatory efficiency tend to look at the relationship between market structure and technical change. In other words the number of enterprises in a market and their size or market power is taken as a measure of how competitive that market is. If there are few enterprises then the market is judged not very competitive. But this state of affairs might have been the result of vigorous competition which eliminated the less efficient and therefore could also be an example of competition working well. So measuring competition accurately is not easy.

Our research into technological and trade competitiveness

We wanted to look at how both technological and trade competitiveness had developed over time to see if we could detect any patterns that would show how they were related. We looked at data from 29 different manufacturing industries in three industrialised countries (Germany, Japan and the US) and ten developing countries (Hong Kong, South Korea, Singapore, Indonesia, Malaysia, Philippines, Thailand, Argentina, Brazil and Mexico).

How did we measure these industries' technological and trade competitiveness? Full details are available in the working papers listed on the back page of this policy brief. But, roughly speaking, measuring technological competitiveness involved working out a country's share of the number of patents issued worldwide for a particular industry and then considering what share that industry itself had of all worldwide patents. Trade competitiveness was measured similarly but using figures for exports rather than patents. By using some respectable mathematical sleight of hand we managed to make the final measure of both types of competitiveness (technological and trade) range between minus1 and 1. For each country we calculated these measures over two periods (1978 to 1982 and 1993 to 1997). By then comparing the results for the two time periods we could identify changes that had taken place.

As expected we found little change in the three industrialised countries. But this was not true elsewhere. Diagram 1 shows South Korea as an example. The x-axis represents the level of technological competitiveness; the y-axis represents the level of trade competitiveness. When we look at the results for the first time period and then compare them with the later results we can follow the changes industry by industry.

Here we see some traditional industries – textiles (2), shipbuilding (25) and toys (28) moving from upper right to upper left, retaining some of their trade advantage but no longer being as competitive technologically as they were. But we can also see three industries which have moved from left to right – electronics (22), nonferrous metals (14) and computers (20). These have gained in technological competitiveness.

Which comes first – trade or technological success?

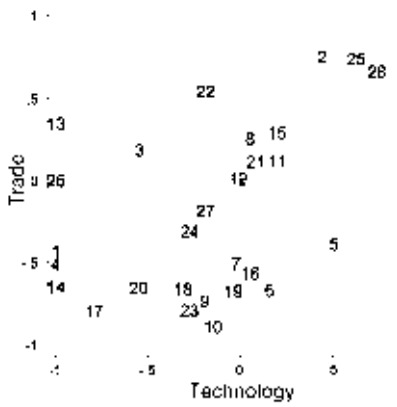
Improvements in competitiveness can theoretically happen in several ways as shown in diagram 2. Arrow 1 shows an industry maintaining a good trade performance while also becoming more competitive technologically, suggesting the outcome of a successful process of learning by doing. We found a significant amount of this sort of movement in East Asian industries including electronics (South Korea, Singapore, Malaysia), wood (Indonesia), the electrical industry (Malaysia) and textiles (Philippines). Here we see success in exporting happening first and being followed by technological success.

We did not find any industries which had followed arrow 2. Arrow 3 could represent an industry in the early stages of a technological push, where its exports have greatly increased but it is no longer at the technological cutting edge. This sort of movement was seen only in synthetic resins (South Korea), agricultural chemicals (Philippines) and electronics (Thailand). How these industries will move in the future is not easy to predict.

Arrow 4 shows an industry which has made gains in both trade and technology, possibly having received a substantial internal or external shock.

Diagram 1

Technology and trade competitiveness 1978-1982: South Korea



Technology and trade competitiveness 1993-1997: South Korea

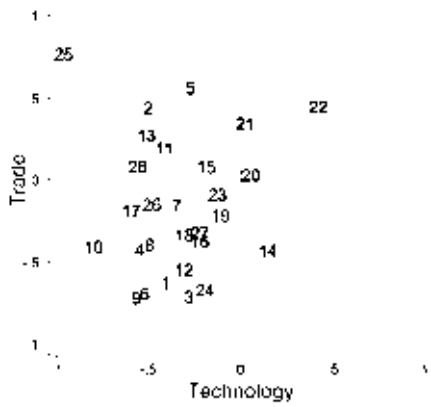
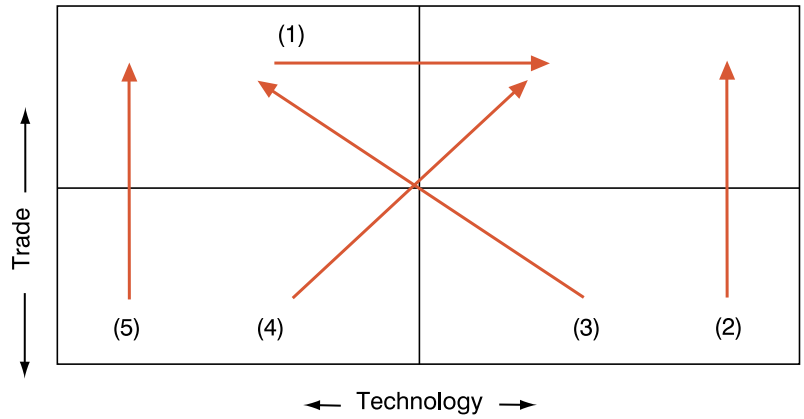


Diagram 2 **Movement of Industries**



We found eight industries that had behaved like this – printing (Hong Kong), computers (Singapore), textiles (Indonesia), the food and toy industries (Malaysia) the electrical industry (Philippines) and the rubber and toy industries in Thailand. In these cases foreign direct investment (FDI) and the actions of multinational corporations are probably highly significant especially in the 'catching up' economies.

Finally, Arrow 5 might indicate that an initial stage of learning by doing is showing results. This movement was characteristic of many industries in the 'catching-up' countries including paper and printing, agricultural chemicals and non-ferrous products (Indonesia), computers (Malaysia), toys (Philippines) and food, synthetic resins, computer and electrical industries (Thailand). Here too some initial success in trade (but not technology) seems to be linked to learning by working with multinationals and FDI. Whether these industries will go on to develop technological competitiveness remains to be seen.

In summary, the two directions which we found many industries had followed are those shown by arrows 1 and 5. Both of these suggest that, in order to become technologically competitive, industries in 'catching-up' countries tend to first achieve export success. A successful period of learning by doing in trading seems to be critically important in achieving technological competitiveness. And there can be no doubt that exposure to international markets and the resulting competitive pressures encourages technological development.

Does domestic competition make a difference?

We looked at how domestic competition had changed in nine countries (as above but not including Indonesia, Malaysia, Philippines and Thailand) and asked whether such changes had affected trade and technological competitiveness. We found, not surprisingly, that markets in the industrialised countries were relatively highly competitive (though less so in Germany) and here domestic competition was increasing among the relatively low-tech industries. In contrast, within East Asian countries, competition was increasing among the medium and high tech industries and in Brazil and Mexico, among a range of industries. (Although the electronics industry in Mexico had not become more competitive.) Only in Argentina did markets remain quite concentrated for most industries.

Our results showed that, in South Korea and Singapore, domestic competition played an important role in both trade and technological competitiveness. In contrast, in Latin America, Argentina and Mexico we found no clear connection between domestic competition and changes in trade or technological competitiveness.

Industrial policy has played an important role in stimulating both technological and trade competitiveness. But increased levels of domestic competition have also emerged from these industrial policies and we can now see, in the high-tech industries of successful East Asian economies, that domestic competition is contributing to their economic success.

Lessons from Malaysian electronics

Malaysia's electronic sector has consistently accounted for over half of the country's gross exports, reaching 71.4% by 1999, and foreign direct investment (FDI) has played a vitally important role in achieving this. But our research suggests Malaysia's success in building local-global linkages has been overstated, the beneficial effects of FDI over-generalised and the industry's failure to move up the global value chain ignored. We found that local politics had been unhelpful but also that changes in global production networks had further impeded Malaysian development in electronics. There are certainly lessons to be drawn from the Malaysian experience but our research suggests they may be rather different from what is popularly assumed.

Developing through FDI

To attract FDI the government introduced the usual incentives – tax allowances and holidays, cheap export credit, Free Trade Zones, outlawing unions, tight control over potential labour unrest and so on. But FDI policy was also affected by what was an important social policy for the government - the redistribution of wealth away from the relatively wealthy Chinese Malaysian community and towards the indigenous Malays or Bumiputera. Therefore at federal level attention was focused on heavy industries like petrochemicals and iron and steel – industries which, unlike electronics, had substantial Bumiputera participation. FDI for electronics would depend much more on regional institutions at state level. And only in Penang would an effective state-level government agency emerge to deal with electronics, the Penang Development Corporation (PDC).

In the mid 90s, Malaysia's second Industrial Master Plan aimed to transform the country into an advanced industrial nation by 2020. The plan was to move into higher-value activity such as R&D and marketing, through increasing productivity and value-added per employee. Following the Asian economic crisis yet more incentives were offered to FDI.

The low skilled labour trap

Yet, despite its pro-active industrial policies, Malaysia has not succeeded in channelling a critical mass of FDI into upgrading the indigenous SME electronics sector. We found widespread agreement among the people we interviewed, from both federal and state agencies, that Malaysia's SMEs remain

disproportionately involved with goods that rely on the same sort of low-skilled assembly work as they did in the 80s. Indeed, some estimated that about half of all employment in electronics was of this type.

Currently there is much talk about the threat from the Chinese electronics industry. But China has been following a similar path to Malaysia for some years now and a more interesting question is: what has insulated the labour intensive Malaysian electronics industry for so long from the lower labour costs elsewhere in the region? In fact the industry has excelled in the import of unskilled, foreign (migrant) workers who, by 1996, accounted for over 10% of its workforce, making it the biggest importer of migrant labour in the Malaysian economy. Regulatory limits on the import of migrant labour are negotiable and anyway foiled through subcontracting arrangements.

Exploiting insecure, migrant workers, who face well-known pressures to repay expenses and remit as much money as possible for as long as possible, has helped keep labour costs down and enabled foreign firms to continue using Malaysia as a regional hub for low cost labour intensive work well past its 'sell by date'. Obviously this offers little scope for the sort of skills transfer and upgrading of local enterprises that many earlier East Asian industries experienced from FDI.

Changing global production networks

Why has Malaysian electronics largely failed to escape the low skilled labour trap? In a nutshell, important changes in the way electronics global production networks were organised impacted on Malaysia by the early 90s. These new competitive dynamics changed the rules of the game for Southeast Asia upgrading and strongly encouraged the rapid import of unskilled labour, damaging Malaysia's prospects of moving higher up the value chain.

One of the major problems the electronics industry has always faced is the massive fixed costs of production facilities together with equally high costs of in-house product development. Originally US consumer electronics dealt with this by creating a system of Original Equipment Manufacturing (OEM) in Asia. Under this system OEM buyers (the leading 'brand name' firms) contracted out manufacturing to suppliers who made the products to their requirements. By the late 60s most East Asian electronics exports were of this type. As the manufacturers moved from supply positions into higher value own-design and even own-brand manufacture they competed increasingly successfully with major US brands. With consumer electronics increasingly dominated by East Asian firms, US electronics focused on the computer industry which, to limit the leakage of critical technologies, preferred to manufacture through equity controlled subsidiaries. But in the 80s, under pressure from an appreciating US dollar and Asian competition, they too began outsourcing more activities to Asian suppliers – a situation which helped some of Malaysia's leading local suppliers to emerge.

Again Asian OEM firms began to pose a competitive threat and now the stage was set for another change in the global production system. CEM (contract electronic manufacturing) emerged as the US's new solution. CEM firms operate by further divorcing ownership of design and innovation activities from production. They buy up the increasingly unviable production facilities of firms specialising in supplying particular parts of the computer industry and then supply components back to the original owners. They provide comprehensive global supply chain management for their major OEM customers and succeed by operating on very low margins, standardising assembly, warehousing and logistics procedures, and using low skilled foreign workers where possible.

The impact of the CEM revolution should not be overstated. For example many of Malaysia's electronics SMEs also use migrant labour as do even the most advanced electronics nations. But the problem for Malaysian upgrading was that this major change in global production happened when Malaysia had only just started to actively target SME development and promote linkages aimed at helping firms move away from low skilled assembly operations.

Lessons

Two major lessons emerge from the Malaysian experience. Firstly, social policies such as anti-poverty affirmative action efforts and immigration policies have impacted on Malaysian industrial development. Therefore 'industrial policy' i.e. policy which relates to industry, is actually much more wide-ranging than often assumed. The full range of government policymaking needs more careful integration.

Secondly, the timing of efforts to upgrade through global production networks is crucial. Changes occur in the global production system, over which individual countries like Malaysia can have no control. The only way to succeed in timing interventions better is to develop a better understanding and judgment of such changes through monitoring and forecasting global production dynamics. For developing countries this means a significant capacity building effort to build and link the necessary institutions.

This CRC Policy Brief draws heavily on the CRC Working Papers below:

No. 36 Metcalfe, J.S., Ramlogan, R. and Uyarra, E. *Economic Development and the Competitive Process* 2002

No. 63 Uchida, Y. and Cook, P. *The Transformation of Competitive Advantage in East Asia: an Analysis of Technological and Trade Specialisation* 2004

No. 72 Uchida, Y. and Cook, P. *The Effects of Competition on Technological and Trade Competitiveness: a Preliminary Examination* 2004

which are available on the CRC web site at:

http://www.competition-regulation.org.uk/publications/working_papers/

And the CRC Conference Paper:

Henderson, J. and Phillips, R. *The Unintended consequences of anti-Poverty Policy: Globalisation, Local Politics and the Underdevelopment of SMEs in the Malaysian Electronics Industry* 2004

at http://www.competition-regulation.org.uk/conferences/southafrica04/index.shtml

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