

DPR Debate

Should Industrial Policy in Developing Countries Conform to Comparative Advantage or Defy it? A Debate Between Justin Lin and Ha-Joon Chang

Justin Lin and Ha-Joon Chang

This is the first in an occasional series of DPR Debates, designed to illuminate specific issues of international development policy. Each debate will bring together two well-known researchers or practitioners, giving them the opportunity, over three rounds, to test and challenge each other's ideas. The debates are intended to be robust but accessible, rooted in rigorous research but useful to the wide readership of Development Policy Review.

The first debate focuses on the question of whether policies to encourage industrialisation and industrial upgrading should conform to current comparative advantage or aim to miss out steps on the ladder: textiles first or mobile phones? The first position might be thought to be associated with neo-liberal theory which eschews intervention, the second with more structuralist policies which favour government support and extended infant-industry protection. The debate is more subtle than that, however. Both protagonists favour government intervention, but in different ways and for different purposes.

The two protagonists are:

- Justin Yifu Lin, since June 2008 Chief Economist and Senior Vice-President of the World Bank. Previously for 15 years Professor and Founding Director of the China Centre for Economic Research, Beijing University. Author of 16 books, and in 2007 gave the Marshall lectures at the University of Cambridge, on themes related to this debate, published as *Economic Development and Transition: Thought, Strategy, and Viability* (Cambridge University Press, 2009).
- Ha-Joon Chang, Reader in the Political Economy of Development, Faculty of Economics, University of Cambridge. Author, *inter alia*, of *Kicking Away the Ladder: Development Strategy in Historical Perspective* (Anthem Press, 2002), and *Bad Samaritans: Rich Nations, Poor Policies, and the Threat to the Developing World* (Random House, 2007).

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Introduction: growth and industrial upgrading

At a time when cyclical turbulence threatens to distract us from the longer-run goal of promoting sustained growth and development, I welcome the chance to launch a discussion on this crucial topic with my friend Ha-Joon Chang. The Nobel laureate Robert Lucas (1988) has commented that ‘Once one starts to think about them [questions of economic growth], it is hard to think about anything else’. What he had in mind was the remarkable sustained growth in productivity and living standards that has characterised especially the countries of East Asia in recent decades, compared with the stagnation that, at least at that time, afflicted much of the rest of the developing world.

To Professor Lucas’ comment, I would add that, once you start thinking about growth, it is hard not to focus on the continuous industrial and technological upgrading that is characteristic of sustained economic growth. In theory, as has long been recognised, poor countries should be able to take advantage of their backwardness, by importing modern technology and institutions developed elsewhere. But while some countries have done this well, many others have been far less successful at industrial upgrading and therefore at poverty reduction. What is it that makes it possible in one or two generations for a country to go from exporting wigs and plywood to competing in the most technologically advanced sectors?

The answer is not simply ‘a dynamic private sector’, though that is the ultimate driver. Historical examples make it clear that the answer must include effective government policies to catalyse private-sector growth. Governments have adopted a variety of measures to promote industrialisation and technological upgrading, with a wide variety of results. Used well, the unique powers available to governments can be wielded to initiate and support long-run sustained improvements in factors and productivity. Our central task as development economists is to learn from these historical examples, as well as from economic theory and empirics, so that we can help today’s poorer countries to map out and follow a sustained growth path. In this essay, I shall argue that industrial upgrading and technological advance are best promoted by what I call a *facilitating* state – a state that facilitates the private sector’s ability to exploit the country’s areas of comparative advantage. As I shall explain, the key is to make use of the country’s current comparative advantage – not in the factors of production that it may have someday, but in the factors of production that it has now.

The case for a state role: market failures that block innovation

First, however, it is necessary to justify why the state needs to take the lead in development, because the facilitating-state approach requires government to do much more than a pure laissez-faire approach would allow. Developing economies are ridden with market failures, which cannot be ignored simply because we fear government failure. One such market failure is caused by important *information externalities*. Economic innovations – whether they succeed or fail – yield information about profitable and unprofitable market opportunities. But because much of this information

is available not only to the innovators themselves but also to competitors and potential imitators, who do not bear any of the costs of the innovation, it will tend to be undersupplied by the market. Government subsidies are one possible mechanism for encouraging innovation and offsetting this first-mover disadvantage.

A second market failure is caused by *co-ordination problems*. Developing countries lag behind more developed countries, not only in technology and industrial structure, but also in human capital, infrastructure and institutions. For a country to climb up the industrial and technological ladder, a host of other changes also need to take place: technologies become more complicated, capital requirements increase, the scale of production increases, the size of markets increases, and market exchanges increasingly take place at arm's length. A flexible and smooth industrial and technological upgrading therefore requires simultaneous improvements in education, financial and legal institutions, and infrastructure. Individual firms clearly cannot internalise all these changes cost-effectively, and co-ordination among many firms to achieve these changes will often be impossible. For this reason, it falls to government either to introduce such changes itself or to co-ordinate them.¹

In these cases, the positive externalities of firm entry and experimentation and needs for co-ordination can justify government intervention, and do so in a way that is perfectly compatible with neoclassical economic theory. It is true that the force of this argument is lessened by the high risk of government failures, but fear of poor governance does not absolve us of responsibility for trying to design effective strategies for facilitating development. Another Nobel laureate, Arthur Lewis (1955), correctly pointed out that '[N]o country has made economic progress without positive stimulus from intelligent governments', even as he warned of the 'mischief done to economic life by governments'. A half-century later, it remains true that there are few if any examples of governments that have succeeded with a purely *laissez-faire* approach that does not try to come to grips with market failures, and far more examples of rapid growth in countries whose governments have led effectively. Therefore, it is incumbent upon policy-makers and researchers to identify the most effective ways of promoting the productivity growth and change in industrial structure necessary for development.

The facilitating state: helping the private sector exploit comparative advantage

In summary, these severe market failures can provide a rationale for government intervention to kick-start growth. But what kind of intervention? The key to answering that question is recognising that the optimal industrial structure is *endogenous* to the

1. Note that this is a different argument from the co-ordination role often proposed in the past for developing-country governments. That 'big push' line of argument stressed that if each potential firm's viability depends on inputs from another firm that does not yet exist, none of the potential firms may emerge. In this case, the government can theoretically move the economy to a higher-welfare equilibrium with a big push that leads to the concurrent emergence of upstream and downstream firms (see Rosenstein-Rodan, 1961; and Murphy et al., 1989). But changing global conditions have made the traditional big-push argument less compelling. The reduction in transportation and information costs in recent decades has led to global production networks in which many countries, both developed and developing, produce only certain parts of a final product according to each country's comparative advantage.

country's endowment structure – in terms of its relative abundance of labour and skills, capital, and natural resources. Upgrading the industrial structure requires first upgrading the endowment structure, or else the resulting industrial structure will become a drag on development. Therefore the government's role is to make sure that the economy is well launched on this endogenous process of upgrading.

Let me explain this. The role of the facilitating state is to encourage the emergence of firms, industries, and sectors that, once launched, will make effective use of the country's *current* comparative advantage. In many poor countries, that will mean focusing on labour- and/or resource-intensive types of production activities and services. Even with the increased international capital flows of recent decades, low-cost capital remains relatively scarce, whereas labour and resources are relatively abundant and less costly. Focusing on labour- and resource-intensive production activities allows poor countries' firms to be competitive in domestic and international markets. The facilitating state provides the necessary co-ordination to remove the barriers to the emergence of these firms and their related industries, and gives them a helping nudge to overcome externalities, but then is able to let them grow and advance organically because of their comparative advantage.

As the competitive industries and firms grow, they will claim larger market share and create the greatest possible economic surplus, in the form of profits and salaries. When the surplus is reinvested, it earns the highest return possible as well, because the industrial structure is optimal for that endowment structure. Over time, this strategy allows the economy to accumulate physical and human capital, upgrading the endowment structure as well as the industrial structure and making domestic firms more competitive over time in more capital- and skill-intensive products.

While this *comparative advantage-following* approach sounds gradual – and hence unsatisfying, when we consider the enormity of the poverty challenge – in fact progress is accelerated by the availability of technology and industries already developed by and existing in more advanced countries. Firms in developing countries can at each stage in their development acquire the technologies and enter into industries appropriate for their endowment structure, rather than having to do frontier innovation themselves. This ability to use off-the-shelf technology and to enter into existing industries is what has made possible the sustained annual GDP growth rates of 8 and even 10% achieved by some of the East Asian NIEs.

The state as midwife, not permanent nursemaid

Too often, developing-country policy-makers have tried to take a short cut in this endogenous process of industrial and technological upgrading. They have fixed their sights and their policies on an ideal industrial structure that they associate with modernisation, but that structure is of course usually capital- and skill-intensive and is characteristic of a higher-income country than their own. As I have argued in my Marshall Lectures (Lin, 2009), industrial strategies of the often newly-independent developing countries in the 1950s and 1960s were informed by incorrect perceptions of the binding constraints on development. These countries adopted development strategies that placed a priority on capital-intensive heavy industries, that is, industries that made intensive use of a factor that they largely lacked, and that neglected to use

many of the factors that they had in great abundance, such as unskilled labour and natural resources. In effect, these policy-makers took the optimal industrial structure as something that they could impose exogenously, rather than something that results from the characteristics of the economy and changes over time.

This approach can be thought of as *comparative-advantage-defying*, and it has high costs, both financially and in terms of governance quality. To implement this strategy, governments have to provide substantial protection and subsidisation to firms that are not viable without government subsidies and protection and cannot quickly become internationally competitive. Such firms cannot generate any real surplus for society. Without a continuous flow of surplus, it will be far harder to finance improvements in the factors of production – notably, capital and skilled labour – that are in turn necessary to make a more advanced industrial structure viable over the medium term. By distorting market signals and shifting resources from competitive to non-competitive sectors, high levels of protection and subsidies slow the country's accumulation of physical and human capital. They also encourage firms to divert their energies from productive entrepreneurship into rent-seeking, which corrupts institutions and further slows capital accumulation.

Suppose the government tries to protect and subsidise the growth of capital-intensive industries, or other industries in which it has no comparative advantage. In that case, the accumulation of capital and the upgrading of endowment structure are retarded, slowing the upgrading of its optimal technology/industrial structure. Rather than serving as midwife to healthy new industries, it is likely to find itself becoming a long-run nursemaid to sickly infant industries that never mature. The culture of rent-seeking that is likely to emerge will calcify the web of protection even more and make later reforms more difficult.

Comparative vs. competitive advantage

Putting domestic firms in a position to exploit the country's comparative advantage may sound sensible but old-fashioned. How does exploiting comparative advantage compare with the promotion of 'competitive advantage', a strategy popularised by Michael Porter (1990) over the past two decades? In that literature, the four key sources of competitive advantage are:

- sectors/industries that make good use of factors that are abundant domestically;
- large domestic markets, to enable firms to achieve scale;
- industrial clusters; and
- vibrant domestic competition, to encourage efficiency and productivity growth.

But these requirements can be simplified, in my view. First, consider domestic competition: if a country's strategy defies comparative advantage, it will generally be unable to enforce competition, because non-viable firms will need to be protected. Industrial clusters will also be hard to build and sustain, because, unless the government gives subsidies and protection, firms will not enter into this industry. However, the government will not be able to give subsidies and protection to many firms in an industry at the same time so as to form an industrial cluster. And if the country follows

its comparative advantage, large domestic markets become unnecessary, because the industries and firms should be able to compete on global markets. Thus these four requirements boil down largely to a single prescription: exploit your comparative advantage.

Closing notes

I am happy to launch this exchange with my friend and colleague Ha-Joon. We both care deeply about understanding the roots of rapid economic growth and poverty reduction, and we have both thought carefully about the East Asian growth successes of the past two generations. There will doubtless be differences in the conclusions we reach on trade and industrial policy, but it is illustrative that neither of us questions the importance of a major state role in promoting economic development. Perhaps this is because in the countries we know most intimately – China and South Korea – a crucial ingredient in growth was a capable and largely developmentally oriented state. The issue is identifying the key role played by the state in those countries and other rapid developers. My reading of these cases is that, while they took proactive steps to accelerate industrial upgrading, their success was spurred primarily by a state that made possible the effective exploitation of comparative advantage at each stage of development.

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Ha-Joon Chang

It is a pleasure to debate this issue with Justin Lin, whose intellectual interests are exceptionally wide-ranging and whose theoretical position, while firmly grounded in neoclassical economics, is never dogmatic.

In his opening essay, Justin acknowledges the importance of industrial upgrading for economic growth and development. This is a point that is often missed by today’s development mainstream, which emphasises static allocative efficiency; so Justin’s emphasis on industrial upgrading is really welcome.

On top of that, Justin also acknowledges the positive role that state intervention can play in promoting industrial upgrading, given important market failures that exist in the supply of new technological knowledge, such as the externalities generated by innovators experimenting with new things and the co-ordination failures across different input markets (for example, education, finance, legal institutions, and infrastructure). Justin also rightly warns against the possibility of government failure, but goes on to note that ‘there are few if any examples of governments that have succeeded with a purely laissez-faire approach that does not try to come to grips with market failures, and far more examples of rapid growth in countries whose governments have led effectively’.

Up to this point, we are on the same platform. However, there are some important differences in our views. Our main difference is that, whereas Justin believes that state intervention, while important, should be basically about facilitating the exploitation of a country’s comparative advantage, I believe that comparative advantage, while important, is no more than the base line, and that a country needs to defy its comparative advantage in order to upgrade its industry.

The concept of comparative advantage, first invented by David Ricardo, is one of the few concepts in economics that is more than common sense (the others include Keynes’ notion of effective demand and Schumpeter’s concept of innovation). The beauty of this concept is that it shows how even a country with no absolute international cost advantage in any industry may benefit from international trade by specialising in industries at which it is least bad. Indeed, it was the brilliance of Ricardo’s concept that first drew me into economics. And as a guide to finding out the best way to maximise a country’s current consumption opportunities, *given its current endowments*, we cannot do better than that.

As is well known, this theory, especially in the Heckscher-Ohlin-Samuelson version that Justin uses, is based on some stringent assumptions. Of course, all theories have assumptions and therefore the fact that there are some stringent assumptions in itself cannot be a point of criticism. However, we still need to ask whether the particular assumptions made by a model are appropriate for the particular questions we happen to be asking. My contention is that, while the assumptions made by the HOS theory may be acceptable when we are interested in short-term allocative efficiency (i.e., when we want to find out whether a country is exploiting its given resources with the maximum efficiency), they are not acceptable if we are interested in medium-term adjustment and long-term development.

First, let us look at the issue of medium-term adjustment. One of the key assumptions of the HOS theory is the assumption of perfect factor mobility (within each country). When this is assumed, no one loses out from changes in trade pattern caused by external shocks. So, if a steel mill shuts down because, say, the government reduces tariffs on steel, the resources employed in the industry (the workers, the buildings, the blast furnaces) will be employed (at the same or higher levels of productivity and thus higher returns) by another industry that has become relatively more profitable, say, the computer industry. No one loses from the process.

However, in reality, factors of production are usually fixed in their physical qualities. Blast furnaces from a bankrupt steel mill cannot be re-moulded into a machine making computers. Steel workers do not have the right skills for the computer industry:

unless they are retrained, they will remain unemployed; at best, they will end up working in low-skill jobs, where their existing skills are totally wasted. In other words, even if the country as a whole benefits from trade liberalisation (which is not always the case even in the short run), the owners of factors of production that have low or no mobility are going to lose from it, unless there is deliberate compensation. This is why trade liberalisation has produced so many 'losers', despite the prediction of HOS theory.

This is a more serious problem in developing countries, where the compensation mechanism is weak, if not non-existent. In developed countries, the welfare state works as a mechanism partially to compensate losers from the trade-adjustment process through unemployment benefit, guarantees of health care and education, and even guarantees of a minimum income. In some countries, such as Sweden and other Scandinavian countries, there are also highly effective re-training schemes for unemployed workers. In most developing countries, however, such mechanisms are very weak and often virtually non-existent. As a result, the victims of trade adjustment in these countries are not even partially compensated for the sacrifice that they have made for the rest of society.

If the assumption of perfect factor mobility makes HOS inadequate for the analysis of medium-term adjustment, its assumption about technology makes it particularly unsuited to the analysis of long-term economic development.

The assumption in the HOS model is that there is only one best technology for producing a particular product and, more importantly, that all countries have the same ability to use that technology. So, in the HOS theory, if Ecuador should not be producing BMWs, it is not because it cannot do it, but because doing it has too high an opportunity cost, as producing BMWs will use too much of its scarce factor of production – capital.

However, this is assuming away the very thing that makes some countries developed and others not – namely, their differential abilities to develop and use technologies, or what is known as 'technological capabilities'. In the end, the rich countries are rich and the poor countries are poor because the former can use, and develop, technologies that the latter cannot use, let alone develop.

Moreover, the nature of the process of acquiring higher technological capabilities is such that a country trying to catch up with a more technologically advanced country needs to set up and protect industries in which it does not have comparative advantage. Why should that be the case? Can the country not wait until it accumulates enough physical and human capital before it enters a more advanced industry that uses physical and human capital more intensively?

Unfortunately, it cannot be done quite like that. Factor accumulation does not happen as an abstract process. There is no such thing as general 'capital' or 'labour' that a country can accumulate and that it can deploy wherever necessary. Capital is accumulated in concrete forms, such as machine tools for the car parts industry, blast furnaces, or textile machines. This means that, even if a country has the right capital-labour ratio for the automobile industry, it cannot enter the industry if its capital has been accumulated in the form of, say, textile machines. Likewise, even if a country accumulates more human capital to justify its entry into the automobile industry, it cannot start making cars if all its engineers and workers were trained for the textile industry.

Most (although not all) technological capabilities are accumulated through concrete production experiences, and at that in the forms of 'collective knowledge' embodied in organisational routines and institutional memories. Even if a country has all the right machines, engineers, and workers (which is not possible anyway, as I have just explained), they still cannot be combined into an internationally competitive firm overnight because they actually need to be put through a (potentially very lengthy) learning process before they can acquire all the necessary technological capabilities.

This is why Japan had to protect its car industry with high tariffs for nearly four decades, provide a lot of direct and indirect subsidies, and virtually ban foreign direct investment in the industry before it could become competitive in the world market. It is for the same reason that the electronics subsidiary of the Nokia group had to be cross-subsidised by its sister companies for 17 years before it made any profit. History is full of examples of this kind, from eighteenth-century Britain to late twentieth-century Korea.

Of course, Justin is absolutely right in saying that deviating too much from one's comparative advantages is to be avoided. Comparative advantage does offer a useful guideline in telling us how much the country is sacrificing by protecting its infant industries. The more you deviate from your comparative advantage, the more you pay in order to acquire capabilities in new industries.

However, this does not mean that a country should conform to its comparative advantage, as Justin puts it. As I have argued, given the nature of the process of factor accumulation and technological capability-building, it is simply not possible for a backward economy to accumulate capabilities in new industries without defying comparative advantage and actually entering the industry before it has the 'right' factor endowments.

Given this, a good neoclassical economist may be tempted to argue that a country should do a cost-benefit analysis before deciding to enter a new industry, weighing the costs of technological upgrading against the expected future returns, using comparative advantage as the measuring rod. However, this is a logical but ultimately misleading way of looking at the process. The problem is that it is very difficult to predict how long the acquisition of the necessary technological capabilities is going to take and how much 'return' it will bring in the end. So it is not as if Nokia entered the electronics industry in 1960 because it could clearly calculate that it would need to invest such and such amount in developing the electronics industry (through cross-subsidies) for exactly 17 years but then would reap huge future returns of such and such amount. Nokia probably did not think that it would take 17 years to make a profit in electronics. It probably did not know how large the eventual return was going to be. That is the nature of entrepreneurial decision-making in a world with bounded rationality and fundamental uncertainty. In other words, unless you actually enter the industry and develop it, it is impossible to know how long it will take for the country to acquire the necessary technological capabilities to become internationally competitive.

At the most general level, Justin and I share the same policy conclusions. We agree that industrial upgrading is necessary for economic development. We agree that it will not happen purely through market forces and will need government intervention. We also agree that the government should not push the economy too far away from its current structure too quickly.

However, there are some important differences between the two of us. In the theory of neoclassical comparative advantage that Justin uses, the issue of limited factor mobility is neglected, resulting in the systemic underestimation of the costs of trade liberalisation and hence the need for good redistribution mechanisms. More importantly, technological capabilities are missing from the theory, when they are really what distinguishes developed countries from developing ones. Once we realise that a lot of technological capabilities are acquired in an industry-specific manner through actual production experiences, we begin to see that it is by definition necessary to defy comparative advantage if a country is going to enter new industries and upgrade its industrial structure. And the length and the strength of such protection can be very large, as the examples of Toyota, Nokia, and countless other examples of successful infant-industry protection show, and also inherently difficult to predict.

Justin Lin

Ha-Joon summarises well our key areas of agreement: government has a role to play in promoting technological and industrial upgrading, but there are risks in deviating too far from a country's comparative advantage. Our differences lie in how to define 'too far' – how to interpret trade models and historical evidence, and how to promote technological learning cost-effectively.

Do adjustment costs and technological differences really undermine the theory of comparative advantage?

Ha-Joon argues that, because of imperfect factor mobility (in effect, adjustment costs) and simplified assumptions about technology, arguments against infant-industry protection that are based on standard trade models (such as Baldwin, 1969) do not provide good guidance for policy. Clearly, there are frictions in labour-market adjustment to changes in industrial competitiveness, and physical capital is often industry-specific. Workers cannot move costlessly from one industry to another, or from one region to another, and many developing-country governments do little to compensate the losers. But adjustment costs can easily be incorporated into standard trade models, without undermining the basic theory of comparative advantage (Mussa, 1978). Moreover, when a country loses comparative advantage in the existing industry, the industry-specific capital can be relocated in the form of foreign direct investment to other countries, in what has been called a flying-geese pattern of economic development in East Asia and many other parts of the world (Akamatsu, 1962).

Ha-Joon's second point is that the Heckscher-Ohlin-Samuelson model incorrectly assumes that the same technology is available to producers in all countries. Yet the theory of comparative advantage does not hinge on having identical technology. Ricardo's original model of comparative advantage recognised that England and Portugal had different technologies for producing wine and cloth, for example. Moreover, theoretical models are intended to be simplifications; in empirical trade

models, richer and poorer countries are routinely recognised to be using different technologies. Thanks to the dramatic reduction in information and transportation costs, countries at different stages of development could even concentrate on different segments of the same industry, each using different technologies and producing different products according to comparative advantages. Take the information industry as an example: high-income countries, like the US, specialise in product/technology development; middle-income countries, like Malaysia, concentrate on the fabrication of chips; and lower-middle-income countries, like China, focus on the production of spare parts and the assembly of final products.

Ha-Joon correctly observes that in reality trade liberalisation has produced many losers in the past two decades. But this is because those countries started with many industries that were inconsistent with their areas of comparative advantage, as a result of comparative advantage-defying (CAD) strategies that their governments had adopted in the past. Removing protection in a shock-therapy manner caused the collapse of non-viable firms. However, if, in the liberalisation process, the government liberalises the entry to sectors in which the country has comparative advantage, and phases out protections to the CAD industries gradually, as argued in my Marshall Lectures (Lin, 2009), the country can obtain a Pareto improvement by achieving stability and dynamic growth simultaneously in the process. Indeed, this is how China has managed its transition from a planned to a market economy.

What do we learn about technological upgrading from the success stories?

Underlying Ha-Joon's line of argument is research that he and others have done on some of the most rapid industrialisers. Here, I will comment on the case of Korea with a brief note about his Nokia example as well.

On the one hand, it is hard to argue that an active industrial and trade policy substantially hindered growth in the Republic of Korea. The country did protect certain sectors with high trade barriers, and in some cases took an aggressive approach to industrial upgrading into capital-intensive industries. And over the past 40 years, Korea has achieved remarkable GDP growth rates, and has performed impressively on industrial upgrading, into such industries as automobiles and semiconductors.

Yet we should not overstate the extent to which Korea pushed ahead of its comparative advantage. In the automotive sector, for example, early in its growth period, Korean manufacturers concentrated mostly on the assembly of imported parts – which was labour-intensive and in line with their comparative advantage at the time. Similarly, in electronics, the focus was initially on household appliances, such as TVs, washing machines, and refrigerators, and then moved on to memory chips, the least technologically complex segment of the information industry. Korea's technological ascent has been rapid, but then so has its accumulation of physical and human capital, due to the conformity of Korea's main industrial sectors to the existing comparative advantages, and hence its changes in underlying comparative advantage.

Equally important, the Korean government had a record of managing the protected sectors in ways that kept them subject to market discipline, which made large-scale deviation from the economy's comparative advantage impossible. Industries benefiting from protection and subsidisation were required to prove on export markets that their

competitiveness was increasing over time. In addition, the government worked hard to make sure that Korean manufacturers could access intermediate inputs at world prices, for example through duty-drawback and exemption schemes and export-processing zones. So the government clearly recognised that comparative advantage mattered, and that successful technological upgrading depended on firms being influenced by world prices for both inputs and outputs. The evidence indicates that Korea's government served as a facilitating state, as argued in my opening contribution.

Let me add a footnote on the Nokia example, which I would interpret differently from Ha-Joon. Nokia's technological upgrading – from timber company to footwear, to manufacturing for Philips and then manufacturer of own-brand household electronics, and finally to mobile-phone powerhouse – took place roughly in line with the growth of Finland's stocks of physical and human capital. The Finnish government helped in ways that were far-sighted, but that I would interpret as consistent with the facilitating role in a comparative-advantage-following strategy. It promoted R&D and competition in the mobile-phone industry in the 1970s, creating and building on a pan-Nordic mobile network (Ali-Yrkkö and Hermans, 2004). The learning-by-doing that Nokia gained was invaluable, but the core element of this strategy was not high levels of protection of the domestic market. Nokia apparently cross-subsidised the development of its mobile-phone division through profits in other areas. However, Finland's per capita income in 1970, measured in 1990s' purchasing power parity, had already reached 9,600 international dollars, which was at a level close to Germany's 10,800 dollars in the same year (Maddison, 2006). Nokia's decision is wholly consistent with a model of technological/industrial upgrading by a profit-maximising private firm in an open, competitive, high-income country.

Are dynamic comparative advantage and infant-industry protection sound foundations for industrial policy?

Finally, we should turn to the question of Ha-Joon's theoretical foundation for using trade policy as a tool for promoting industrial upgrading. His argument is based on the idea of dynamic comparative advantage and infant-industry protection. Nevertheless, if industrial upgrading proceeds step by step in conjunction with changes in comparative advantage, learning costs are lower than if the country attempts a big leap. As an analogy, think of mathematics learning. Typically, a student starts by studying algebra, then proceeds through calculus to real analysis. If instead he started with real analysis, even though he might eventually master it, the learning costs would most likely be much higher than otherwise. Similarly, if a firm begins by manufacturing bicycles, then learns to make motorcycles, and eventually moves into making automobiles, the total learning costs will probably be much lower than if it starts with the daunting task of mastering the efficient production of automobiles.

When a government chooses to provide protection or incentives to firms in sectors that may be viable only in twenty or more years, it will inevitably have to draw resources from firms in areas of current comparative advantage. This will reduce the surpluses they earn, and will therefore slow capital accumulation and the upgrading of the country's endowment structure and comparative advantage, making the infant industry stay as an infant much longer than otherwise (Baldwin, 1969; Saure, 2007).

Furthermore, excessive protection risks institutionalising a culture of rent-seeking. Given how important the quality of institutions and governance is to development, the indirect effects of protection through poor governance may be even more damaging than the direct effects.

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Ha-Joon Chang

Even though we come from different theoretical traditions, Justin and I agree on the broad framework for the analysis of industrial upgrading. To be sure, we have our differences. While we may both be of the view that comparative advantage is an important principle, I see it as only a 'base line', whereas Justin thinks it should be stuck to very closely, if not perfectly. We agree on the importance of adjustment costs and technological learning, but we differ in how important we think they are and we analyse them in different ways.

However, these are differences whose clarification actually helps us think through some of the finer points and advances our knowledge, rather than those that lead to unproductive bickering.

First, on adjustment costs. Justin is right in saying that these costs can be (and occasionally have been) incorporated into mainstream trade models. But my question is: if adjustments costs are important, why have they been so much neglected *in practice* by mainstream economists, who keep recommending trade liberalisation with only perfunctory, if any, attention to adjustment costs? It is not enough to say that adjustment costs can be incorporated into mainstream models. Intellectual leaders in the mainstream camp, like Justin, should encourage people actually to do it and then fully apply the results in designing trade-policy reform. The same applies to the assumption of identical technology. If it is better *not* to assume identical technology (as Justin

implicitly acknowledges), why do mainstream economists keep using the HOS version of comparative advantage rather than the Ricardian version, in which differences in technology determine the comparative advantages of different nations?

As for Justin's point that even activity-specific assets do not need to lose their value entirely in the adjustment process because they can be shifted to another country, I thank him for reminding me of this important point. However, this mainly applies to physical assets and then only to a limited extent. Not all physical assets can be shipped abroad and many of them need complementary assets and skills if they are to realise their full productive potential. Moreover, workers with specific skills (or human capital, if you like) cannot move to the 'next-goose' country, except for a limited number of technicians who may be called upon to advise the factories in the new host countries. For the workers, it is cold comfort to learn that the physical assets they used to work with may preserve some of their value by moving to another country. To make things worse, the workers usually have fewer and less diversified assets (even including their own human capital) than the owners of physical assets, so they are less capable of coping with the consequences of the adjustment, even if they are subject to the same magnitude of shocks (in proportional terms) as the capitalists.

Thus seen, Justin's 'flying geese' point does not lessen the need to incorporate adjustment costs into trade policy design. If anything, it actually highlights the need to better design compensation schemes for the workers with specific skills (for example, subsidised re-training programmes).

Justin argues that trade liberalisation in the last two decades has produced many losers 'because those countries started with many industries that were inconsistent with their areas of comparative advantage' because of wrong policies in the past. This may often (although not always) have been the case, but it does not justify the way trade liberalisation has been conducted in the last two decades. If we know that a country has deviated 'too much' from its comparative advantage, the prudent course of action will be not to try to liberalise trade too much too quickly, as otherwise the adjustment costs will be very high.

Two wrongs do not make a right.

This naturally leads me to Justin's second point – the challenge of deciding how much to deviate from comparative advantage. Using the Korean and Finnish examples, he argues that these countries succeeded because they did not deviate from their comparative advantages too much. He is right in saying that Korea's move along the 'ladder' of international division of labour has often been carried out in small, if rapid, steps. Although I do not fully agree with this characterisation (for example, the moves into industries like steel and shipbuilding were big leaps, with virtually no 'intermediate' steps), I also agree that making excessive leaps can result in excessive learning costs.

Thus seen, we could suppose some kind of inverted-U-shaped relationship between an economy's deviation from comparative advantage and its growth rate. If it deviates too little, it may be efficient in the short run, but its long-term growth is slowed down, as it is not upgrading. Up to a point, therefore, increasing deviation from comparative advantage will accelerate growth. After a point, negative effects of protection (for example, excessive learning costs, rent-seeking) may overwhelm the

acceleration in productivity growth that the 'infant' industries generate, resulting in negative growth overall.

I think Justin would probably agree with the above way of seeing things. However, there is one big disagreement between the two of us in applying this idea. It is the question of 'how much (deviation from comparative advantage) is too much?' (or where is the apex in the inverted-U curve?)

Using the Finnish example, Justin says that Nokia was justified in moving into the electronics industry, as Finland was already a pretty rich country, with per capita income (in international dollars) only 13% lower than that of Germany in 1970 (\$9,577 vs. \$10,839). However, the relevant year is not 1970 but 1960, which is when the electronics subsidiary of Nokia was set up, and in that year the income gap with Germany was much greater, at 23% (\$7,705 vs. \$6,230).² Anyway, these figures are purchasing power parity (PPP) figures, which tend to inflate a poorer country's income. PPP figures are preferable if we are interested in measuring comparative living standards, but if we are interested in comparative advantage in international trade, current dollar figures, rather than PPP figures, are better figures to use.

If we use current dollars, the picture becomes quite different.³ In 1960, the per capita income of Finland was only 41% that of the US, the frontier country in electronics and overall (\$1,172 vs. \$2,881). This does not look like the case of a country sticking closely to comparative advantage. If Finland's decision regarding Nokia does not look 'wrong' enough, how about Japan? In 1961, the per capita income of Japan was a mere 19% that of the US (\$563 vs. \$2,934), but Japan was then protecting and promoting all sorts of 'wrong' industries – automobiles, steel, shipbuilding, and so on.

For an even more dramatic example, take the case of South Korea. Its (then) state-owned steel mill, POSCO, which had been set up in 1968, started production in 1972, when its per capita income was a mere 5.5% that of the US (\$322 vs. \$5,838).⁴ To make it worse, in the same year, South Korea decided to deviate even further from its comparative advantage by launching its ambitious Heavy and Chemical Industrialisation programme, which promoted shipbuilding, (home-designed) automobiles, machinery, and many other 'wrong' industries. Even as late as 1983, when Samsung decided to design its own semiconductors, Korea's income was only 14% that of the US (\$2,118 vs. \$15,008). Does this sound like a 'comparative advantage-conforming' strategy, as Justin calls it?

A further difficulty with Justin's argument is that in all these examples of defiance of comparative advantage, the market gave Finland, Japan, and Korea unambiguous signals that they should not promote those industries; all the companies in those industries ran losses or earned profits on paper only because they were subsidised by profitable companies in the same business group and/or by the government (directly through subsidies and indirectly through protection and entry restrictions). But if Justin thinks Nokia's experience is 'consistent with a model of technological/industrial upgrading by a profit-maximising private firm in an open, competitive, high-income

2. All the PPP income figures are from Maddison (2006: Tables 1-c for Europe, 2-c for the USA, 5-c for South Korea).

3. All the current dollar income figures are from http://www.nationmaster.com/red/graph/eco_gdp_percap-economy-gdp-per-capita, which draws on the World Bank and the CIA data.

4. Even in PPP terms, its income was only 16% that of the US (\$2,561 vs. \$15,944).

country', is he saying that market signals are not to be taken seriously? Within the neoclassical framework, how else are we to judge whether or not a country is following its comparative advantage, except by looking at profits and losses made by the relevant companies?

I think that, deep down, Justin and I actually agree. We agree that countries should deviate from comparative advantage to upgrade their economy, although Justin thinks this deviation should be fairly small and I think it can be big. However, because Justin is too faithful to neoclassical economics, he has to say that a country with an income level that is only 5% of the frontier country moving into one of the most capital-intensive industries (Korea and steel) is consistent with the theory of comparative advantage. Once Justin frees himself from the shackles of neoclassical economics, our debate will be more like two carpenters having a friendly disagreement over what kind of hinges and door handles to use for a new cabinet that they are building together, on whose basic design they agree.

Justin Lin

I've enjoyed this extended exchange, which has given us a chance to highlight our differences, while recognising our points of agreement. In response to Ha-Joon's latest submission, it is useful to focus on two points: the dynamic nature of industrial upgrading, and the role of government in promoting it.

Industrial upgrading as a dynamic process

First, let me reiterate that innovation is necessary for industrial upgrading and development, and that government has a role in supporting that innovation for the positive externalities innovation brings to an economy's development. It is hard work to climb technological ladders, to use a metaphor employed by Ha-Joon and others. The developed countries that are at the technology frontiers recognise this. They provide considerable public support to firms in their frontier industries – directly by giving a patent to a new invention and sometimes also through defence contracts; and indirectly through supporting basic research at universities, which ultimately spills over into product development and benefits firms and industries at the technological frontier. As inside-the-frontier innovations in developing countries involve similar risk and externalities, public support can be desirable and justifiable in that context too. Well-thought-out subsidisation is not only consistent with the role of a facilitating state, but is even implied. However, as pointed out in my first essay, the subsidies to compensate for an innovative firm's externality will be small compared with those that would be required to protect non-viable firms in industries that go against an economy's comparative advantage.

Second, industrial upgrading in an economy is a continuous process. Although government needs to help solve externality and co-ordination problems for the pioneer firms, their upgrading is based on the fact that the economy has successfully exploited

its existing comparative advantages and its endowment structure, as well as comparative advantage shifting. When the Korean government started its world-class state-owned Pohang Iron and Steel company in 1968, to use Ha-Joon's example, that investment was built upon the success of development in garments, plywood, wigs, footwear, and other labour-intensive industries. With the success of those labour-intensive industries, Korea accumulated capital and the capital intensity of its endowment structure increased. From the perspective of the comparative-advantage-following strategy, the upgrading of a few firms into more capital-intensive industries became a necessity.

The 'flying geese' metaphor is useful in the domestic context as well as the international one: when an economy follows its comparative advantage in economic development, its endowment structure and comparative advantage change dynamically. Some firms need to play the role of a 'lead goose' so as to pioneer the upgrading into new industries. This appears to be one area of difference between Ha-Joon and me: I see the lead goose as a small but important leading wedge in a dynamic process, whereas he sees it as a more quantitatively significant part of the economy making larger discrete technological leaps. The quantitative difference can cause a qualitative difference. When the lead goose is a small wedge in the dynamic process, the nature of the economy is consistent with its comparative advantage. Unlike the upgrading in the comparative-advantage-defying strategy discussed in my first essay, the subsidies to the lead goose can derive mostly from intra-firm profits obtained in the operations of other products in competitive markets, as in the case of Samsung and Nokia.

Third, the global technological frontier is continually being pushed outward. Industries such as steel production and shipbuilding were among the most advanced industries globally in the nineteenth century, but by the mid-twentieth century they no longer held this leading-edge position. Compared with new industries, such as aviation, information, and heavy chemicals, their technologies had become mature. Investments in these mature industries required a large amount of capital, compared with traditional labour-intensive industries, but their capital intensities were much lower than in the new emergent industries. It is therefore not surprising that, with some government support for overcoming the difficulty of mobilising a large amount of capital in an economy with an underdeveloped financial sector, these industries are viable in countries that have achieved or are approaching lower-middle-income status. When Korea established Pohang Iron and Steel, its per capita income in dollar terms was just 5.5% that of the US, as pointed out by Ha-Joon. I would also like to mention that China had become the largest producer of steel in the world by 2000, at a time when its per capita income in dollar terms was only about 2.5% of the US level.⁵ Korea and China were able to succeed in the steel industry at a relatively low income level because steel had become a mature and relatively low capital-intensity industry in the global industrial spectrum.

A related point is that, within industries, some segments are more accessible to developing countries than others. Manufacturing includes various stages – product R&D, design, production of complex parts, production of simpler parts, and assembly –

5. Here I use Ha-Joon's method of comparison based on market exchange rates, but PPP incomes are the more appropriate basis for comparison, in my view. Although market exchange rates govern international trade, PPP figures are better indicators of the level of development and capacity of an economy, and are therefore more relevant for discussions of industrial upgrading.

and they all have different factor requirements and are consistent with different patterns of comparative advantage. Countries therefore scale the ladder of technological sophistication and capital intensity within industries dynamically in a flying-geese pattern as well. Samsung's entry in 1983 into the development of the 64-kilobit dynamic random access memory (DRAM) chip, which was relatively low-tech on the microchip spectrum at that time and was produced with the proprietary technology from Micron of the United States and Sharp of Japan, was built on some 15 years of successful operations in consumer electronics. It is worth noting that, in spite of the success of its entry into microchips in 1983, Samsung, on the one hand, has not entered the more complicated and advanced CPU chips and, on the other hand, has maintained its successful operations in consumer electronics.

Facilitating comparative advantage, with equal parts vision and realism

To sum up my argument in this exchange, I reiterate that the comparative-advantage-following approach is dynamic in nature and the state should play a facilitating role in that process. This means that economic development in a country should exploit pragmatically the existing opportunities embedded in the country's areas of comparative advantage, while recognising the potential for industrial upgrading when those areas of comparative advantage have been exploited. Industrial upgrading is an innovation involving risks and externalities, whether in developed or developing countries, and thus requires the government to play a facilitating role. Governments in developing countries can play that role through the channels of information, co-ordination and compensation for externalities, as discussed in my first essay.

Ha-Joon's rhetorical jibe notwithstanding, neoclassical economics is simply a useful tool in all this, not a constraint. It is flexible enough to model the externalities, dynamics, and co-ordination failures that give the government a role to play, while also providing the metrics to judge whether government is supporting industries that take the economy too far from its areas of comparative advantage. Without the former, developing countries may lack the wisdom to seize opportunities to develop competitive industries and lay the foundation for sustainable industrial upgrading and development. But without the latter, as the historical record emphasises, governments can make any number of costly mistakes, most notably by funding large-scale, unrealistic and unsustainable comparative-advantage-defying projects and industries. By facilitating industrial upgrading where domestic firms will be able to survive and thrive, government can intervene in ways that yield the greatest social returns.

Ha-Joon Chang

As the exchange shows, Justin and I agree on many things. Both of us recognise that 'climbing up the ladder' is a hard slog that involves more than 'getting the prices right'. It requires, *inter alia*, intelligent industrial policy, organisation building, and efforts to accumulate technological capabilities through R&D, training and production experiences. We agree that, in climbing up the ladder, a country can skip some rungs

with the help of industrial policy, but that it can slip, fall, and even be destroyed, if it tries to jump too many rungs. The principle of comparative advantage, Justin says and I agree, can tell us what a country's 'natural' climbing ability is and thus help us to see how much risk it is taking in trying to skip a certain number of rungs.

However, we have some important differences.

Justin emphasises that neoclassical economics is flexible enough to allow us to deal with all the complex issues arising during the development process. I think it is not enough.

I agree that neoclassical economics is a lot more flexible than is usually recognised by many of its critics and that it can justify most types of state intervention, even of pretty 'unorthodox' kinds. After all, in the 1930s, the famous Marxist Oskar Lange tried to justify socialist planning with a neoclassical general equilibrium model.

However, the rational-choice, individualistic foundation of neoclassical economics limits its ability to analyse the uncertain and collective nature of the technological learning process, which is at the heart of economic development. I have emphasised the importance of bounded rationality, fundamental uncertainty (and not just calculable risk), and collective knowledge in the development process. This means that the industrial upgrading process will be messy. It will not be possible for a country to follow market signals closely and enter an industry when its factor endowments are right, as will happen with the smooth comparative-advantage-conforming strategy that Justin advocates. In the real world, firms with uncertain prospects need to be created, protected, subsidised, and nurtured, possibly for decades, if industrial upgrading is to be achieved.

In practical terms, my difference with Justin lies primarily in the extent to which we think the defiance of comparative advantage is advisable. While Justin believes that the skipping of the rungs in climbing the ladder should be very small ('comparative-advantage-conforming' in his words), I believe that it can be, and sometimes has to be, large ('comparative-advantage-defying' in his words). There is, of course, a chance that such an attempt may not succeed, but that is the nature of any venture into new activities, whether purely private or assisted by the state.

Justin is right in pointing out that Korea's forays into industries like steel, shipbuilding, and microchips were not as dramatic as they may have looked at first sight. By the time Korea entered them, steel and shipbuilding were technologically mature, although I am not sure whether that necessarily means lower capital intensity, as Justin assumes; technological maturity will increase capital intensity by leading to a greater embodiment of technologies in capital goods, while it may reduce capital intensity by lowering the relative prices of the relevant capital goods. Even in microchips, the segment that Korea entered, namely, the DRAM chip, was (and still is) technologically the easiest.

However, all these still do not mean that Korea's entry into these industries was comparative-advantage-conforming. First of all, technologically mature or not, the fact remains that industries like steel were still way too capital-intensive for Korea at the time (or, for that matter, today's China). More interestingly, Korea's success in steel was owed especially to the fact that it reaped the maximum scale economy by deliberately going for the most up-to-date and capital-intensive technology available (bought from New Nippon Steel).

Most importantly, the market clearly signalled that these were ‘wrong’ industries to enter, by making the producers run losses or forcing the government or the relevant business groups to manufacture ‘artificial’ profits by protecting and subsidising them. I do not think any version of neoclassical economic theory can justify protecting an industry for four decades (for example, Japanese and Korean cars) or cross-subsidising a loss-making subsidiary for 17 years (Nokia).

I have learned a lot from this exchange with Justin. We come from different intellectual traditions, but we have conducted a cordial and very productive debate that bears no bitterness or petty point-scoring. I wish there could be more exchanges like this in the pages of *Development Policy Review* and elsewhere.

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