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Industrial policy, learning, and development

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Industrial policy, learning, and development

Joseph E. Stiglitz*

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Abstract: Industrial policies have played an important role in successful development. Through these policies, governments intervene in the market's sectoral allocation of resources and choice of technologies. Earlier industrial policies had a narrow remit and made use of a limited number of instruments. This paper argues that they should pursue broader objectives with a wider range of instruments. In particular, it argues that 'learning' is central to development, there are intrinsic market failures associated with learning, and that carefully crafted industrial policies can promote learning and development.

Keywords: industrial policies, learning, learning-by-doing, technological progress, Washington Consensus

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1 Introduction

Industrial policy is back in fashion, and rightly so.

There is now an understanding that markets by themselves may not lead to economic efficiency—let alone a desirable distribution of income. The market may not lead to either a good allocation of resources among sectors or the appropriate choice of techniques. Industrial policies, aimed at affecting the economy’s sectoral allocation and/or choice of technique are one of the instruments for addressing these market failures. Appropriately designed government policies can lead to better outcomes. While this is true even for developed countries, it is perhaps particularly true for developing countries, and this is so even if developing countries have less developed governmental institutions. Limitations on the capacity of government should affect the choice of instruments for carrying out industrial policies, but not whether they should undertake industrial policies.

While there is renewed interest in industrial policies,¹ recent discussions are markedly different from those that characterized an earlier era in our understanding of both the objectives and the instruments of industrial policy. There are broader objectives and more instruments, to echo a more general theme I put forward in criticism of Washington Consensus policies (Stiglitz 1999). For instance, the government plays a central role in shaping the economy, not only through formal industrial policies and in its expenditure and tax policies, but in writing the rules of the game—markets do not exist in a vacuum, and the way that the government structures markets inevitably affects economic structure (Stiglitz 2015). In that sense, every country has an industrial policy but some countries do not know it. And that opens the possibility that the structure of the economy is set, or at least greatly influenced, by special interests. Such an economy is likely to be beset by rent seeking and the resulting pervasive inefficiencies, and the economy will be characterized by lower growth and more inequality than would be the case if they were more self-consciousness in the direction of the economy.

Financial market deregulation illustrates: this was actually an agenda pushed by those in the financial sector to increase its size. It was an industrial policy, but one which led to lower growth and more inequality and instability.

A traditional criticism of industrial policies is related to ‘political economy’, that such policies are likely to be captured by special interests to advance themselves. However, the previous paragraphs highlighted that not having an industrial policy—leaving it to the market, structured as it is so often by special interests—is itself a special interest agenda. To avoid capture by special interests there has to be openness, transparency, and a deeper understanding of the rationale for industrial policies. Some countries have developed institutional arrangements and cultures that have made it more likely that industrial policies will work and less likely that there will be corruption in their implementation.

I need to make four more preliminary remarks: (1) industrial policies, as I use the term, are not necessarily aimed at promoting industrialization. The term embraces any policy affecting the sectoral composition of the economy or the choice of technology. Thus, industrial policy in this sense should also be part of corporate governance, anti-trust and competition policy, and

¹ Evidenced, for instance, by the emphasis placed on industrial policies by the previous chief economist of the World Bank, Lin (2012). While I have long had an interest in industrial policies, my more recent engagement began with joint work with Bruce Greenwald (Greenwald and Stiglitz 2006, 2014a, 2014b; Stiglitz and Greenwald 2014a, 2014b). See also Stiglitz and Lin (2014) and Stiglitz et al. (2014).

monetary policy and bankruptcy frameworks, as well as (more obviously) tax and expenditure policy.

(2) The success of industrial policy is not to be judged by the success or failure of any individual project, but rather has to be evaluated systematically (i.e., on how the performance of the overall economy is affected). At the centre of our analysis is learning and the creation of new institutions, with benefits to those outside the particular project or sectors under scrutiny. That is why Greenwald and I titled our recent book, *Creating a Learning Society* (2014b). We were concerned with impacts and learning processes, which even went beyond the economy. We made a case for an ‘infant economy’ argument for protection, which was distinctly different from an ‘infant industry’ argument. Our earlier paper (2006) on the subject was titled ‘Helping Infant Economies Grow’. In this sense, our work follows on the earlier work of Hirschman (1958) emphasizing the linkages across sectors. In the standard vocabulary, there are externalities, and in assessing the success of industrial policy in general and any project in particular, one has to take these into account.

Moreover, good industrial policy incorporates risk taking, and risk taking means that there will be successes and failures. No oil exploration company would judge its performance by pointing out that it drilled some dry wells. What matters is its overall success rate—whether the successes sufficiently offset the failures. Too often, critics of industrial policy point to failures, without weighing against such failures the successes. In the United States, they point to the failure of American solar cell company Solyndra, without noting that studies show the very high average of return to public investments in technology, which include, for instance, critical investments in the internet. Indeed, Mazzucato (2013) goes so far as to claim that in most of the major advances, government has played a central role. Industrial policies (here, meaning technology policies) have worked.

(3) Of course, if there are systematic, repeated failures, that points to a flaw in institutional design, which needs to be corrected. A central theme of this paper is learning; that is firms learn only by doing (e.g., the only way to learn to produce steel, and to become better at producing steel is to produce steel). However, the same point is true of institutions: the only way to learn how to do industrial policies is to carry out industrial policies, to learn consciously from one’s successes and failures. One of the reasons for the renewed interest in industrial policies is that so many countries have successfully carried out such policies. Countries rightly reason: if other countries, in similar circumstances to us (at the time they carried out such policies) were successful with such policies, why would we not be. East Asia carried out industrial policies when their incomes were far lower than they are today, and where their institutional development was much more limited.

Few economists argue that a country should not have a monetary policy or a central bank simply because in the past its Central Bank mismanaged. Rather, there is a broad consensus that countries can learn how to conduct monetary policy in ways that promote growth and stability; and that there are institutional arrangements that enhance the likelihood of success.

The same holds for industrial policies, and the analysis here suggest that these policies may be as important for the long-term success of a development strategy as any other.

(4) East Asia’s successful industrial policies were based on export-led growth. However, the scope for export-led growth in the future may be more limited—though there is still scope for African countries to avail themselves of this ‘model’. East Asia’s success was based not only on exports—after all, Africa has long exported commodities—but on the exports of manufactured goods. I will explain later why there is a difference between exporting commodities and

exporting manufactured goods: there are economy-wide benefits of learning (including institutional development) associated with the latter that are not typically associated with the former. However, global employment in manufacturing is likely to decrease, as a result of improvements in productivity outstripping increases in demand. China now has a formidable comparative advantage in a wide range of manufacturing goods, but as wages in China rise, its comparative advantage in ‘basic’ manufacturing, requiring limited skills, is likely to diminish. This will open the opportunity for some other developing countries, at lower stages of development, to enter into manufacturing export-led growth.

This paper first outlines the general argument for industrial policies, broadening the set of market failures, which should be the objective of such policies. It then focuses more narrowly on learning, which is so essential for development, and how the government can promote it.

2 Towards a broader agenda for industrial policies

There are a large number of market failures that impeded development. The basic underlying principle is simple: in perfectly functioning markets, private returns to any action (any investment) equal social returns. However, the conditions under which this is true are highly restrictive. Government policies can both address the underlying market failures and the consequences.

2.1 Imperfect risk and capital markets

Any investment in a new industry is risky, yet for reasons that are now well understood, financial markets provide far from adequate insurance against these risks. Industrial policies can help ‘socialize’ these risks, enabling projects that otherwise would not be undertaken to be implemented. Similarly, entrepreneurial firms need access to capital, but capital markets are notoriously imperfect (Stiglitz and Weiss 1981). Many of the industrial policies of East Asia were directed at ‘correcting’ this market failure by providing access to funds at commercial or near-commercial rates.

These two limitations are especially relevant to firms (sectors) where learning is important. Optimal social policy will entail producing beyond the point where the value of the marginal product equals the marginal cost of production; one needs to take into account the value of learning, and the reduction in future costs as a result of increased production today. The implication of learning is that it may be desirable for a firm to produce so much that its current profits are negative. However, if the firm is to do this, it has to find the finance for the loss. With imperfect capital markets, it is likely that it cannot do so.

Moreover, the value of this learning is highly uncertain—there is uncertainty both about the amount of learning (e.g., the magnitude of reduction in future costs of production) and its value (which depends on future output). Firms cannot insure themselves against these risks, so again, there is likely to be under-investment in learning.

2.2 Structural transformation

An important part of development is structural transformation, moving from an agrarian economy to an industrial economy. Markets do not make such transformations on their own well (Delli Gatti et al. 2012a, 2012b). Those in the declining sector often have low incomes, and the value of their assets (including their human capital) has been diminished by the same forces giving rise to the necessity for structural transformation. The imperfections of risk and capital

markets discussed in the previous paragraphs mean that individuals who should move from the old to the new sectors of the economy cannot get access to the resources needed to make the shift, and they have to bear the inevitable risks associated with the transformation.

The result is that the economy can be ‘stuck’, unable to make a transformation that would be beneficial to most citizens of the country. The shift from an agrarian economy to an industrial economy is particularly difficult, because it typically is associated with urbanization, which requires a large movement of individuals with heavy investment in skills and housing. With more individuals in the old sector(s) than is optimal, incomes will be lower; and the lower incomes will result in lower demands for goods in the non-traded industrial sector.

East Asia managed to break out of the resulting inefficient equilibrium by focusing on exports. The demand for their exports was not limited by the low incomes in their own country. This is one of the reasons that their model of export-led growth was so successful; however, opportunities for manufactured export-led growth going forward are likely to be more limited. This means that industrial policies will have to be focused on a broader range of industrial policies, including promoting import substitution and the non-traded goods sector.

Import substitution policies got a bad name, especially in Latin America, because the industries that were created often only survived as the result of protection. It was particularly costly when countries protected intermediate goods, because that made goods farther down the production chain less competitive. Countries often paid a high price for this kind of protectionism, and the maintenance of this protection was often associated with corruption. The protected industries generated rents, and, as always, the recipients of such rents were willing to share some of the rents with the politicians who granted the rents to them.

It is not inevitable that industrial policies promoting import substitution fail in this way. There are institutional safeguards that make it less likely. Even the form of industrial policy affects the extent to which special interests intrude in a distorting way.

2.3 Learning and imperfect appropriability

A major set of ‘market failures’ that received insufficient attention in earlier literature were those associated with learning. Learning is essential for developmental transformation. However, there are inevitably large spillovers associated with learning—not only technological spillovers, but also institutional spillovers. The development of institutions like financial institutions and an education system that facilitate the functioning of the industrial sector have important spillovers for the rest of the economy. Whenever there are spillovers, private returns differ from social returns. These spillovers manifest themselves in multiple ways in the development process. For instance, firms that take the risk of trying out whether a particular product grows well in the particular environment of the country will not be able to reap the full benefits—if the project is successful, it will be imitated, if it fails, the firm undertaking the experiment bears the losses (Hoff 1997).

Even banks may find it difficult to appropriate the full benefits of their lending to a new entrepreneur. If the entrepreneur is successful, he will be poached away by others; if he fails, the original lender will be forced to bear the losses. This is one of the reasons that new businesses often find it difficult to obtain funds, even if lending to them has strong social benefits (Emran and Stiglitz 2009).

2.4 Macroeconomic externalities

Greenwald and Stiglitz (1986) explained why markets with imperfect risk markets and asymmetric information are not in general Pareto efficient. The pervasiveness of market failures means that governments necessarily have to focus their attention on the most important failures.

Among the most important failures are those that affect the macroeconomy. Firms, on their own, may engage in too much borrowing, especially in foreign denominated debt. Banks, on their own, may engage in excessive risk taking.

The social cost of instability is enormous, and firms and banks, in their own decision-making, do not fully take into account these social costs (see, e.g., Stiglitz 2013). There are, for instance, long-term hysteresis effects, as informational and organizational capital is destroyed as firms go bankrupt, as educations are interrupted, and as young people, who otherwise would be learning skills on the job, suffer unemployment and see their skills atrophy.

Thus, industrial policies also need to be designed to reduce the magnitude, structure, and consequences of the liabilities of corporations and banks, in an attempt to reduce the magnitude of economic fluctuations and the frequency of economic crises.

2.5 Inequality

Inequality should be a concern to any society. Stiglitz (2012, 2015), explains why inequality is associated with better economic performance (higher growth and more stability), and theoretical insights, which have been supported by empirical work at the IMF and the OECD (Berg and Ostry 2011; Berg et al. 2014; OECD 2015). Markets, by themselves, will pay no attention to their distributional impact. Thus, one of the objectives of industrial policies should be pursuing greater equality. For instance, policies that increase the demand for unskilled labour will reduce inequality. Stiglitz (2015) outlines a broader set of instruments including changes in legal frameworks, which would do so.

2.6 Climate change

The objective of industrial policies is to address market failures. Some market failures are more effectively addressed directly; but for a variety of reasons that may prove difficult, in which case industrial policies may be an effective second best substitute.

Climate change is perhaps the most important market failure facing the global economy. Charging a high enough carbon price would induce individuals and firms not to reduce significantly carbon emissions, but with few exceptions, it has proven difficult to induce countries to impose carbon pricing.

Instead, countries have been called upon to make commitments to reduce carbon emissions. One way that developing countries can succeed in reducing carbon emissions is industrial policies that encourage renewable energy, and discourage carbon intensive industries and technologies.

3 Creating a learning society

In this and the next section, we hone in on industrial policies associated with learning. As we noted, successful and sustained growth requires creating a learning society. This is especially so in the 21st century, as we move to a knowledge economy.

The transformation to ‘learning societies’ that occurred around 1800 for Western economies, and more recently for those in Asia, has had a far greater impact on human well-being than improvements in allocative efficiency or resource accumulation (Solow 1957; Stiglitz and Greenwald 2014a, 2014b).

This implies that our focus should be on the impact of policies on technological change, and how it is brought about by learning, as well as Research and Development (R&D). In the case of developing countries, the focus should be on the diffusion of knowledge from developed to developing country and the diffusion of knowledge within the country. As the 1998 World Development Report (World Bank 1999) emphasized, what separates developing from developed countries is as much a gap in knowledge as a gap in resources. However, even in developed countries, there are large gaps between productivity of best and other firms.²

Markets, on their own, are not efficient in promoting innovation and learning (Arrow 1962a, 1962b; Stiglitz 1987; Stiglitz and Greenwald 2014a, 2014b). Because markets on their own will not do a good job in creating a learning society, there needs to be systematic interventions by the government. The policies that do this are markedly different from those traditionally advocated by economists, which focus on improving the static efficiency of resource allocation and the accumulation of capital—including policies that constituted the Washington Consensus.

Indeed, from the perspective of creating a learning society, those policies may be counterproductive.

The analysis above implies that a central question of growth and development should be: What should governments do to promote growth through learning (technological progress and innovation)?

Creating a learning society entails looking comprehensively at all the factors affecting learning: the education system; what has been called the economy’s innovation system, which includes the IPR regime and technology policy; macroeconomic policies, including exchange rate policy; investment policies, and industrial and trade policies. Underlying questions include: How does learning occur? How do we learn to learn? We would argue that special attention should be placed on learning by doing, and, by analogy, learning to learn by learning.

We need to look at all policies and institutions through the lens of learning, asking (a) how they affect capabilities of learning; (b) how they affect incentives to learn (motivate learning); (c) how they facilitate learning and catalyse it, including how they help create mindsets that are conducive to learning—mindsets such as those associated with the Enlightenment; and (d) how they impose impediments to learning.

4 Industrial and trade policies

In this section, we focus on the various instruments that government can use to promote a learning society, suggesting that there are many more ‘instruments’ for industrial policy than has usually thought to be the case, and explaining how some of the standard policy advice was counterproductive to creating a learning society.

² The existence and persistence of such gaps undermines the concept of an aggregate production function. This has fundamental implications for the way many economists, especially within macroeconomics, approach development.

Standard trade theories focus on comparative advantage—on the country’s current relative strengths. Korea’s comparative advantage in the period after the Korean War was in rice, and it was advised to strip away trade barriers; such policies would have resulted in its focusing on rice. There is a one-time gain from liberalization, from stripping away trade barriers and opening up markets.

Our theories, focusing on learning, provide a different perspective. We focus on the diffusion of technology from developed to less developed countries, on spillovers from one sector to another, and on learning within any sector.

A closer examination of learning (including learning by doing and learning to learn) shows that much of it is what Atkinson and Stiglitz (1969) called localized learning—localized to particular technologies, but not necessarily to particular sectors. Similar technologies can be used across sectors. Many processes, practices, and institutions entail cross-sector learning and have potentially strong positive effects on productivity. Examples include inventory control processes (like just in time production), labour management processes, and computerization. Similarly, institutions (such as those providing financial services) that develop to serve one sector may prove useful in others.

Markets will under invest in (or under produce in) learning sectors, especially those with large learning spillovers to others, and even more so when there are imperfections in capital markets, or when learning is especially risky (because of the market failures referred to earlier, imperfect insurance and capital markets).

This helps explain the important role of government in promoting innovation and learning (e.g., in the internet, biotech, or even agriculture in the 19th century). And it is especially important when the research projects require large investments (such as the human genome project or the internet) and in basic research.

For developing countries, Greenwald and I (Greenwald and Stiglitz 2006; Stiglitz and Greenwald 2014a, 2014b) have put forward the ‘infant economy’ argument for protection. We explain why the industrial sector has greater learning spillovers than the agricultural sector, and therefore why it is desirable to encourage the industrial sector. Central then to growth and development is understanding the structure of learning within an economy—including within and across sectors.

The infant economy argument for protection is distinctly different from the infant industry argument. The latter is predicated on imperfections in capital markets. In the infant economy argument, externalities and spillovers, technological and institutional, are crucial.

In a learning economy, we focus on dynamic comparative advantage—recognizing that comparative advantage is endogenous. With learning by doing, a country’s comparative advantage is affected by what a country produces.

We have focused on ‘learning’, but even more important is ‘learning to learn’. Industrial and trade policy can enhance an economy’s learning capacities. This, of course, introduces complex strategic questions.

4.1 Multiple instruments

Traditionally, governments have employed multiple instruments, including subsidies and trade interventions. Trade restrictions have a short run cost. However, if those ‘distortions’ lead the economy to produce more of the good with higher learning and learning spillovers, then

productivity in future years will be higher. There is a long-run benefit offsetting these short-run costs. Under quite general conditions, it can be shown that it is optimal to impose trade restrictions or to intervene in the market in other ways to promote these sectors.

Unfortunately, the World Trade Organization (WTO) has restricted the set of instruments that developing countries can employ, e.g., they may not be able to provide direct subsidies or trade interventions.

Exchange rate policy is an effective, low-cost instrument with some political economy advantages. Because it is broad based, it is less subject to capture.

Markets will undersupply research, especially basic research. R&D is even more important in developing countries, for instance, for adapting existing technologies to circumstances of their country, for facilitating the transfer of knowledge (which itself is an important part of the learning process for developing countries), and for leapfrogging. Some countries (such as Brazil) have shown that even in developing countries, industrial policies can promote R&D, and that even leapfrogging is possible.

4.2 Political economy

There is a standard objection to industrial policies based on political economy. The argument holds that with an ideal government, intervention might improve matters, but real world interventions do not. It is worth observing that such political economy objections are based on political analysis, not economic analysis, and the political analysis is often as or more simplistic than the simplistic economic analysis, which we have already criticized.

In fact, almost every successful country has had ‘industrial policies’. In the United States in the 19th century, the government supported major advances in telecommunications (the telegraph) and agriculture (then the dominant sector of the economy). Of course, the private sector has played a central role in bringing innovation to the market.

Successful countries learned how to manage the ‘political economy’ problems, through a variety of institutional arrangements, e.g., requiring those receiving support to put in funding of their own, peer review systems, sunset clauses, etc. Broad-based export subsidies and support as in East Asia (including through exchange rate policies and broad-based educational and infrastructure policies) may be a desirable way of promoting the industrial sector, partly because they may be relatively immune from special interest influence.

The infant economy argument in particular has been criticized on the grounds that government cannot pick winners. The point of industrial policies is not to pick winners, but to identify externalities and other market failures.³

There is, however, an important lesson to be learned from the failures of industrial policies in the past. The design of industrial policy has to reflect capacities and capabilities of government; governments have to assess constantly how well their industrial policies are working, and whether they are being ‘captured’ by special interests; and they have to strive constantly to implement industrial policies more effectively.

³ There are, of course, other objections to industrial policies, which are dealt with more extensively elsewhere, e.g., in Greenwald and Stiglitz (2014a, 2014b).

4.3 Intellectual property rights

When one thinks about creating a learning society, one naturally thinks about intellectual property rights (IPR). Advocates of intellectual property rights often seem to argue that they are at the centre of creating a learning and innovative economy. However, as I (and others) have argued, they are but a small part of a country's innovation system, which includes government-funded research and a country's education system.

There are significant static costs of intellectual property. It impedes the use of information and gives rise to monopoly power. Increasingly, the alleged dynamic benefits have come to be questioned. IPR, especially if poorly designed, can impede innovation and learning. Knowledge is the most important ingredient to production of knowledge, and IPR reduces access to knowledge. Moreover, the patent system intervenes with the open system that is essential for the advancement of science. In addition, the patent thicket and patent trolls have provided further impediments to research. The patent system even distorts the pattern of research, encouraging more research directed at extending market power.

These adverse effects are especially significant for developing countries. Successful development entails closing the knowledge gap and necessitating access to knowledge.⁴ It is even more important in areas of health—access to life saving medicines has implications that go beyond the budget.

5 Economic diversification: an application of policies aimed at changing the structure of production

Many regions of the world (notably in Africa and Latin America) are still highly dependent on commodities, making them highly vulnerable to changes in commodity prices. However, a healthy economic structure should not be so dependent on external factors, especially given the high volatility of export markets and prices.

Because the production of these natural resources does not incorporate much skilled labour, it does not incentivize citizens to invest in human capital. Because mining is sufficiently different from other production processes, there are limited learning spillovers. Commodities production provides a weak basis for creating a learning economy and society.

Many countries failed to implement reforms that might create a more diversified structure of production. Indeed, among the African countries, only a few have made much progress in creating an economy with even limited diversification. Today, one of the main objectives of industrial policies should be to diversify the structure of production.

Approaches that were the rule in the 1980s and 1990s that relied on the market clearly did not work (Noman and Stiglitz 2015). We now have a better theoretical and empirical understanding of these failures. What is required is a portfolio of instruments. Perhaps the most important macro instrument is 'Competitive and Stable Real Exchange Rate Policies'. However, these must

⁴ This explains the call for a 'developmentally oriented' intellectual property regime. The intellectual property regime that is appropriate for a developing country is markedly different from that appropriate for an advanced country. The agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) tried to achieve excessive harmonization: the TRIPS regime of WTO is not developmentally oriented. Even so, it is important for developing countries and emerging markets to make full use of latitude given by TRIPS; most have failed to do so.

be accompanied by industrial policies, public investments, and monetary policies that do not stifle the real sector.

Long-term strategies placing technological change and learning at the centre need to ensure macro consistency (full employment and current and capital account balances), which requires a balanced strategy that includes some traditional activities that generate revenues in foreign currency, and others to ensure full employment of the less skilled population.

The state will have to fulfil other roles. Education policies need to ensure that there are no bottlenecks in the supply of well-trained workers. There is need for infrastructure investments, in highways, ports, and airports. Public-private partnerships may be able to play some role in providing infrastructure, but we have learned from the past that such partnerships often fail, with the government bearing the losses and the private sector taking the gains.⁵

Even an economy based on natural resources can use those resources as a basis of diversification, as South Africa demonstrated as it moved from earth-moving equipment into automobiles. There are backward, forward, and horizontal linkages that can be exploited (Jourdan 2014). Export taxes and restrictions on natural resources that have not had ‘value added’ components may be an important part of the appropriate industrial policies.

Trade in manufactured goods and in services will be important as these formerly natural resource-dependent economies attempt to diversify. The right strategy is, however, more than simply increasing exports and strengthening import competing industries. Strengthening the non-traded sector is necessary, and this, as in the traded-goods sector, requires supply side measures (e.g., constructing the appropriate infrastructure, providing the appropriate skills through the education system, and ensuring that the financial system is capable of providing finance for small- and medium-sized enterprises). But demand-side policies are also necessary: poverty reduction and a larger middle class will increase the size of domestic markets.

6 Industrial policies: broader objectives and more instruments

This paper has set out to argue that we need more expansive industrial policies with broader objectives and more instruments. Industrial policies should be concerned not only with growth, especially through creating a learning society, but also with mitigating inequality and carbon emissions. We have also explained that there is a much wider range of instruments, which is the flip side of the observation made at the beginning of this paper that all governments, whether they know it or not, are engaged in industrial policy.

The rules, institutional and legal frameworks, and policies governing our economy and our society affect the structure of our economy, including the industrial structure and the choice of technology. The choice of one infrastructure over another favours one industry over another; the design of the educational system provides a supply of labour with various skills, which affects the profitability of different industries; and bankruptcy laws may be more favourable to one industry (such as the financial sector) relative to others. If a government decides not to have, or not to enforce, strong competition laws, it favours monopolies and oligopolies, at the expense of the sectors, which use the output of those sectors as inputs.

⁵ Part of the problem is an asymmetry in rights and responsibilities: with limited liability, firms can always evade contractual obligations, simply by going into default; and the threat of doing so provides the basis for contract renegotiation. Governments, however, are long lived, and especially when the country has signed an investment treaty, may be sued for the loss of expected profits.

6.1 Macroeconomics as an industrial policy

Exchange rate policy has traditionally been thought of as a macroeconomic policy but it is also an industrial policy and that is true too of other aspects of macroeconomic policy. Economies that rely on monetary policy for macroeconomic stabilization are, simultaneously, affecting the economies sectoral allocations, e.g., relative to what they would be if the government relied more on fiscal policy. Monetary policy entails varying interest rates in response to economic conditions, putting the burden of adjustment on interest sensitive sectors. These sectoral effects are ignored in the overly simplistic models typically employed by macro-economists, but they can be of first order importance, especially in the developmental process. If, for instance, the interest sensitive sectors include manufacturing, in which learning potentials are particularly significant, then reliance on interest rates for macroeconomic adjustment can have an adverse developmental effect.

The extent to which governments pursue macro-stability is itself an industrial policy and one, which is especially important for creating a learning society. Stability is important to learning, for a number of reasons. Much of our knowledge resides within institutions and within organizations, like firms. Recessions destroy firms and the embedded knowledge that they contain. There is, in effect negative learning. Moreover, recessions impede learning, as attention is focused on survival. In addition, recessions impede one of the most important aspects of human capital accumulation—on-the-job learning—with long term consequences for growth and standards of living. Deep downturns lower a country's potential growth rate, not only the level of future income; there are significant hysteresis effects associated with recessions, helping to explain why effects of downturns persist.

This analysis has strong policy implications: there are significant long-term consequences of not having strong counter-cyclical policies. A focus on government debt can be shortsighted and counterproductive, since it can give rise to far more important adverse effects on real wealth accumulation.

7 Towards a developmental state

Few economies have made the transition from a less developed economy to a more advanced economy relying simply on market forces. Successful economies have realized that market failures are pervasive in all economies, and especially in developing countries. Even in developed countries, whenever one talks about innovation, learning, and structural transformation, one is in a world in which there is a presumption that markets are not efficient and that well-designed economic policies, including industrial policies, can improve economic performance.⁶

Successful countries have employed a portfolio of instruments, of interventions, in the market economy. The variety of approaches suggests that there is no one way; but the multiplicity of failures suggests that there are also many ways to fail. The difficulty of achieving a successful developmental transformation suggests that countries should not necessarily seek the optimal set

⁶ As we have emphasized, credit/revenue constraints are likely to be particularly important, there is likely to be imperfect competition (sometimes because of increasing returns to scale and scope), and risks will be large, but risk markets will be absent. All of these were elements of standard Schumpeterian economics, and should be at the centre of endogenous growth theory and growth policy. Unfortunately, policies are often based on simplistic models, consistent with simplistic ideologies, and used by special interests to advance particular policy agenda. Schumpeter's (1942) own ideas in this area were misguided: even though he recognized that markets would be dominated by a single firm, he thought competition for the market—Schumpeterian competition—would suffice to ensure efficiency. He was wrong, as experience and theory over the subsequent half century showed (Greenwald and Stiglitz 2014a, 2014b; Stiglitz and Greenwald 2014a, 2014b).

of policies (whatever they might mean or entail), but rather, a politically acceptable strategy, involving a portfolio of instruments, which has a reasonable chance of success. These choices should be based on learning from the success and failures of others.

One of the most important lessons to be learned, however, from those countries that have been successful is that they have learned how to conduct industrial policies as they have gone along—there has been institutional learning.

Industrial policies that work at one stage of development and in one environment do not work in another. The mere fact that an industrial policy has been successful may necessitate a change in that policy, because the circumstances of the country have changed. The world today is different than it was at the time when East Asian countries embarked on their transformation. One cannot simply follow what worked well for other countries in the past.

Thus, this paper has not attempted to set forth a single set of prescriptions—it is not a handbook from which those seeking to pursue industrial policies can look up a set of policies appropriate to their circumstances. Rather, it is a set of principles, which I hope will guide countries as they attempt to forge a set of policies that will lead to a successful developmental transformation.

References

- Arrow, K.J. (1962a). 'The Economic Implications of Learning by Doing'. *Review of Economic Studies*, 29(3): 155-73.
- Arrow, K.J. (1962b). 'Economic Welfare and the Allocation of Resources for Invention'. In R. Nelson (ed.), *The Rate and Direction of Inventive Activity: Economic and Social Factors*. Princeton, NJ: Princeton University Press and National Bureau of Economic Research (NBER).
- Atkinson, A., and J.E. Stiglitz (1969). 'A New View of Technological Change'. *Economic Journal*, 79(315): 573-78.
- Berg, A.G., and J.D. Ostry (2011). 'Inequality and Unsustainable Growth: Two Sides of the Same Coin?'. IMF Staff Discussion Note 11/08. Washington, DC: IMF.
- Berg, A.G., J.D. Ostry, and C. Tsangarides (2014). 'Redistribution, Inequality, and Growth'. IMF Staff Discussion Note 14/02. Washington, DC: IMF.
- Delli Gatti, D., M. Gallegati, B. Greenwald, A. Russo, and J.E. Stiglitz (2012a). 'Mobility Constraints, Productivity Trends, and Extended Crises'. *Journal of Economic Behavior and Organization*, 83(3): 375-93.
- Delli Gatti, D., M. Gallegati, B. Greenwald, A. Russo, and J.E. Stiglitz (2012b). 'Sectoral Imbalances and Long Run Crises'. In F. Allen, M. Aoki, J.-P. Fitoussi, N. Kiyotaki, R. Gordon, and J.E. Stiglitz (eds), *The Global Macro Economy and Finance*. IEA Conference Volume 150-III. Houndmills, UK and New York: Palgrave, pp 61-97.
- Emran, S., and J.E. Stiglitz (2009). 'Financial Liberalization, Financial Restraint, and Entrepreneurial Development'. Available at: SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1332399 (accessed on 30 December 2015).
- Greenwald, B., and J.E. Stiglitz (1986). 'Externalities in Economies with Imperfect Information and Incomplete Markets'. *Quarterly Journal of Economics*, 101(2): 229-64.

- Greenwald, B., and J.E. Stiglitz (2006). 'Helping Infant Economies Grow: Foundations of Trade Policies for Developing Countries'. *American Economic Review: AEA Papers and Proceedings*, 96(2): 141-6.
- Greenwald, B., and J.E. Stiglitz (2014a). 'Industrial Policies, the Creation of a Learning Society, and Economic Development'. In J.E. Stiglitz, J.Y. Lin, and E. Patel (eds), *The Industrial Policy Revolution I: The Role of Government Beyond Ideology*. Houndmills, UK and New York: Palgrave Macmillan, pp 43-71.
- Greenwald, B., and J.E. Stiglitz (2014b). 'Learning and Industrial Policy: Implications for Africa'. In J.E. Stiglitz, J.Y. Lin, and E. Patel (eds), *The Industrial Policy Revolution II: Africa in the 21st Century*. Houndmills, UK and New York: Palgrave Macmillan, pp 25-49.
- Hirschman, A. (1958). *The Strategy of Economic Development*. New Haven, CT: Yale University Press.
- Hoff, K. (1997). 'Bayesian Learning in an Infant Industry Model'. *Journal of International Economics*, 43(3-4): 409-36.
- Jourdan, P. (2014). 'Towards a Resource-based African Industrial Policy'. In J.E. Stiglitz, J.Y. Lin, and E. Patel (eds), *The Industrial Policy Revolution II: Africa in the 21st Century*. Houndmills, UK and New York: Palgrave Macmillan, pp 364-86.
- Lin, J.Y. (2012). *New Structural Economics: A Framework for Rethinking Development and Policy*. Washington, DC: World Bank.
- Mazzucato, M. (2013). *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*. London: Anthem Press.
- Noman, A., and J.E. Stiglitz (2015). 'Economics and Policy: Some Lessons from Africa's Experience'. I.C. Monga and J.Y. Lin (eds), *The Oxford Handbook of Africa and Economics, Volume II: Policies and Practices*. Oxford, UK and New York: Oxford University Press, pp 830-48.
- OECD (2015). *In It Together: Why Less Inequality Benefits All*. Paris: OECD Publishing.
- Schumpeter, J.A. (1942). *Capitalism, Socialism and Democracy*. New York: Harper & Row.
- Solow, R.M. (1957). 'Technical Change and the Aggregate Production Function'. *Review of Economics and Statistics*, 39: 312-20.
- Stiglitz, J.E. (1987). 'On the Microeconomics of Technical Progress'. In J.M. Katz (ed.), *Technology Generation in Latin American Manufacturing Industries*. New York: St. Martin's Press, pp 56-77.
- Stiglitz, J.E. (1999). 'More Instruments and Broader Goals: Moving Toward the Post-Washington Consensus'. In G. Kochendorfer-Lucius and B. Pleskovic (eds), *Development Issues in the 21st Century*. Berlin: German Foundation for International Development, pp 11-39.
- Stiglitz, J.E. (2012). *The Price of Inequality: How Today's Divided Society Endangers Our Future*. New York: W.W. Norton.
- Stiglitz, J.E. (2013). 'Macroeconomic Fluctuations, Inequality, and Human Development'. *Journal of Human Development and Capabilities*, 13(1): 31-58.
- Stiglitz, J.E. (2015). *Rewriting the Rules of the American Economy: An Agenda for Growth and Shared Prosperity*. New York: W.W. Norton.
- Stiglitz, J.E., and B. Greenwald (2014a). *Creating a Learning Society: A New Approach to Growth, Development, and Social Progress*. New York: Columbia University Press.

- Stiglitz, J.E., and B. Greenwald (2014b). *Creating a Learning Society: A New Approach to Growth, Development, and Social Progress: Readers' edition*. New York: Columbia University Press.
- Stiglitz, J.E., and A. Weiss (1981). 'Credit Rationing in Markets with Imperfect Information'. *American Economic Review*, 71(3): 393-410.
- Stiglitz, J.E., and J.Y. Lin (eds) (2014). *The Industrial Policy Revolution I: The Role of Government beyond Ideology*. Houndmills, UK and New York : Palgrave Macmillan.
- Stiglitz, J.E., J.Y. Lin, and E. Patel (eds) (2014). *The Industrial Policy Revolution II: Africa in the 21st Century*. Houndmills, UK and New York: Palgrave Macmillan.
- World Bank (1999). *World Development Report 1998–99: Knowledge for Development*. New York: Oxford University Press.