

**Industrial Policy in a Changing World:
Basic Principles, Neglected Issues and New Challenges**

Ha-Joon Chang* and Antonio Andreoni**

*Faculty of Economics and Centre of Development Studies, University of Cambridge

**Department of Economics, SOAS University of London

Corresponding author: Ha-Joon Chang

E: hjc1001@cam.ac.uk T: 01223335213

University of Cambridge, Faculty of Economics, Sidgwick Ave, Cambridge, CB3 9DD

Abstract

This paper tries to develop a new theory of industrial policy, incorporating some issues neglected in the debate so far and taking into account the recent changes in economic reality. After reviewing three centuries of economic debate on industrial policy, the paper explores how the incorporation of some of the neglected issues – commitments under uncertainty, learning in production, macroeconomic management (especially demand management), and conflict management – will change the theory. It will then examine how the theory of industrial policy should be modified in light of recent changes in economic reality – the rise of the global value chain, financialisation, and the new imperialism.

Introduction

Over the last decade, the industrial policy debate has experienced an unexpected turn. After the very heated debate between the late 1970s and the mid-1980s, prompted by the success of Japanese and other East Asian industrial policy practices, the debate on industrial policy had lapsed into three decades of ideologically-motivated wilful neglect – ‘industrial policy’ became a phrase that one does not utter in polite company. Unexpectedly, however, industrial policy is now back in fashion, both in the academia and in the real world.

In the real world, after the 2008 financial crisis, many leading economies have become more willing to recognise the value of industrial policy and often strengthened it – the US and Germany are the most prominent examples (see Pisano & Shih, 2012; Chang, Andreoni & Kuan, 2013; Berger, 2013; O’Sullivan et al., 2013; Andreoni, 2016a and 2016b). Many developing countries, which had been busy dismantling their industrial policies during the 1980s and the 1990s, have realised that they need industrial policy if they are to upgrade their economies. Many middle-income countries in Asia and some in Latin America now talk of industrial policy as a tool to overcome the ‘middle income trap’ (Felipe, 2015; Noman and Stiglitz, 2016; Andreoni, 2016a; Mahmood et al., 2017). The oil economies in the Gulf region have started talking about industrial policy as a tool for economic diversification (Cherif & Hasanov, 2014). Even the African economies talk about it in their attempt to get out of poverty (Stiglitz et al., 2013; Stiglitz and Noman, 2015; Chang et al., 2016; see also various recent issues of *Economic Report for Africa*, the flagship publication of the UNECA [United Nations Economic Commission for Africa]).

In the academia, prominent mainstream (Neoclassical) economists, like Joseph Stiglitz, Dani Rodrik, and Justin Lin, have openly come out in favour of industrial policy, although most of them are very careful not to deviate from the Neoclassical framework (thereby warranting talks of ‘mainstreaming’ and ‘retro-fitting’ of industrial policy into the latter framework) and often emphatically distance themselves from the old-style industrial policy, especially tariff protection.

The paper aims to deconstruct the new, more ‘mainstreamed’, phase of industrial policy debate and in its place provide a broader and more sophisticated theoretical foundation for industrial policy. In particular, our theoretical framework brings in a number of foundational contributions by Cambridge economists and links them to newer insights on the modern mode of global capitalist production and

accumulation. We will then address the new challenges for industrial policy-makers in a changing world, such as the changing organisation of global production, the increasing financialisation of the world economy, and changes in the rules of the global economic system.

2. Deconstructing the debate

Industrial policy has been the subject of one of the most heated debates in economics from its earliest days, even though the term, industrial policy, was not used widely until the post-WWII period. There have been four main phases in the history of the debate on industrial policy.

2.1 The first phase: The infant industry

The first phase of the debate on industrial policy started with the dawn of capitalism, with economists like Antonio Serra, Giovanni Botero, and James Stewart arguing for deliberate government promotion of the manufacturing sector (Reinert, 1995). However, this gathered pace with Alexander Hamilton, the first ever Treasury Secretary of the USA.

Even before David Ricardo developed the theory of comparative advantage, Hamilton had developed the infant industry argument, against the then dominant doctrine of free trade (Hamilton, 1791 [2001], is the seminal text). As is well known, the theory is based on a rather simple but powerful insight that a catch-up country needs to protect its young industries against the competition from superior foreign producers, in the same way in which we protect our children before we send them into the adult world (see Chang, 2007a, ch. 3, for an exposition of this doctrine along this line; also see Cohen and DeLong, 2016).

Most people think that Hamilton used his theory only to justify tariff protection. However, he also recommended a host of other industrial policy measures, such as subsidies for strategic industries, tariff rebates on imported inputs used for exports, export ban on key raw materials, and the imposition of product standards by the government. Significantly, these are measures associated with the East Asian ‘miracle’ economies but, even more significantly, were also those that had already been used by Britain, especially under Robert Walpole (Prime Minister, 1721-42) (Brisco, 1907; Chang, 2002). Hamilton also recommended a host of policies that are not industrial policy in the usual sense but support industrialisation, such as those

regarding infrastructure (e.g., government investments in canals and roads) and finance (e.g., the developments of the banking sector and of the government bond market).

Hamilton's theory was developed by Friedrich List (List, 1841 [1885]) and have influenced generations of industrial policy-makers in a wide range of countries, from 19th century US and Sweden to the 'miracle' economies of late 20th-century East Asia. Naturally, along the way, there were heated debates, with big names like Gustav Schmoller, John Stuart Mill, Frank Taussig, and Bertil Ohlin throwing in their weights.

The first phase of the industrial policy debate focused on whether it makes sense to forego income in the short run by protecting inefficient producers that may or may not bring a higher income in the long run. Unfortunately, there were few discussions of 'systemic' issues: the balance between different sectors of the economy (especially between agriculture and manufacturing); the balance between different sectors within manufacturing (especially between the capital goods sectors and the consumer goods sector). Also, there were virtually no discussions of the relative merits of different tools of industrial policy (e.g., tariffs, subsidies, regulation) nor those issues related to policy implementation (e.g., administrative structure, bureaucratic capabilities, institutional mechanisms, or corruption).

2.2 The second phase: Inter-sectoral issues

The second phase started in the early to mid-20th century with the debate on Soviet industrialisation (see Erlich, 1960, and Ellman, 1979) and was further developed between the 1940s and the 1960s by 'classic' Development Economists, interested in the issue of developing post-colonial economies of Latin America, India, and Eastern Europe: the important names included Celso Furtado, Arthur Lewis, Raul Prebisch, Han Singer, Paul Rosentsein-Rodan, Prasanta Chandra Mahalanobis, Ragnar Nurkse, Tibor Scitovsky, Albert Hirschman, Simon Kuznets, Michal Kalecki, and Alexander Gerschenkron (key readings from many of these economists can be found in Agarwala & Singh (eds.), 1958).

The second phase of industrial policy debate was often conducted at the 'systemic' level, especially around its positions on the generation and the transfer of surplus from the agrarian sector to the industrial sector. However, it also brought to

our attention a number of issues that are relevant for more narrowly defined ‘industrial policy’.

First, the dynamic nature of the manufacturing sector was very much emphasised. Although this issue had been at the foundation of the infant industry argument, the second wave provided a more systematic explanation for the phenomenon, by deploying concepts like income elasticity, scale economies, and monopolistic competition.

Second, reflecting the influence of the Classical and the Marxist schools, the different roles that the capital goods and the consumer goods sectors play within manufacturing were highlighted, sometimes with the latter further divided into the wage goods and the luxury goods sectors. These distinctions have shown that different industries have different implications on capital accumulation, inflation, economic growth, income distribution, and living standards.

Third, and relatedly, the second phase theories very much highlighted the reliance of backward economies on imported capital goods and the consequent constraints that foreign exchange shortage impose on the paces of physical investment, technological change, and economic growth. Some, especially Raul Prebisch, emphasised the importance of export (and the policies to promote it) in overcoming these constraints.

Last but not least, the second phase theories very much emphasised the interdependence between different branches of manufacturing industry both in terms of technologies and of demands (especially the ‘big push’ argument and Hirschman’s linkage argument). They argued that policy-makers can deliberately exploit these interdependences and accelerate industrialisation.

The second phase ideas were subject to strong Neoclassical criticisms since the 1970s. Two issues stand out.

First, Neoclassical economists accused the second phase theorists of issuing misleading recommendations because of their excessive pessimism about international trade – especially the emphases on import substitution, the development of the capital goods industry, and the co-development of sectors producing final goods and those that supply capital goods and intermediate inputs to them (the ‘big push’ or ‘balanced growth’). All of these problems would disappear, the Neoclassical critics argued, if the backward economies can earn enough foreign exchanges through exports. Their ability to export, in turn, would be maximised if those countries

followed their comparative advantage, which will require the state not having any industrial policy – or at most the ‘general’ ones of providing infrastructure, education, and R&D. Unfortunately, the advocates of industrial policy in the second phase did not counter the Neoclassical argument by pointing out that sticking to comparative advantage may lead to a lower capacity to export in the long run than under an infant industry programme combined with export promotion policy (Lin & Chang, 2009; Chang, 2011).

Second, the second phase theorists were accused by the Neoclassical economists of being naïve about the intention and the capabilities of the state in backward economies. The politicians and the bureaucrats who run industrial policy in those countries do not necessarily (or, rather, usually don’t) intend to promote national interests but use industrial policy to promote interests of their own (e.g., bureaucrats wield more power when there are more regulations over private sector activities) or their supporters (e.g., politicians will bow to pressures from industrialists or trade unions and protect inefficient industries). The risk of ‘government failure’, it was said, was more serious than those of market failures. Although the advocates of industrial policy in the second phase were actually aware of the problem of government failure (Toye, 1987), it is also true that they did not fully acknowledge the importance of the issue (Chang, 1994).

2.3. The third phase: The full works

Partly overlapping with the second phase, the third phase of debate on industrial policy was started in the late 1970s. A heated debate erupted in the US between those who argued that the US should use Japanese style industrial policy in order to halt its industrial decline (Magaziner & Hout, 1980; Johnson, 1982; Reich, 1982; Cohen & Zysman, 1987; Okimoto, 1989; Dertouzos et al., 1989) and those who argued that such policy was *not* a reason for Japan’s industrial ascendancy (Trezise, 1983) or that it couldn’t be applied to the US (Badaracco & Yoffie, 1983).

In the 1980s, industrial policies of other advanced economies were also discussed. The French industrial policy, which had until then been discussed as an element of French ‘indicative planning’ (Cohen, 1977), also attracted attention, partly because of its similarity with the Japanese one (Hayward, 1986; Hall, 1987). Industrial policies of small European economies were discussed, especially their negotiated (rather than directed) nature, in contrast to the East Asian or the French

ones (Katzenstein, 1985). Less visible industrial policy by local governments in Germany and Italy were also brought to attention (Piore & Sabel, 1984; Best, 1990). By the late 1980s, industrial policy practices in (and their impacts on the economic successes of) the less developed East Asian economies, namely, South Korea and Taiwan, were also brought under scrutiny (Amsden, 1989, and Chang, 1993 on Korea; Amsden, 1985, and Wade, 1990, on Taiwan).

One noticeable thing about the third phase of the debate was that many participants in the debate were denying the very existence of the thing they were supposed to be debating on. For example, as late as in 1988, the free-trade economist Bela Balassa argued that the role of the state in Korea “apart from the promotion of shipbuilding and steel . . . has been to create a modern infrastructure, to provide a stable incentive system, and to ensure that government bureaucracy will help rather than hinder exports” (Balassa 1988, p. S286). A leading academic saying such a thing, at a time when a quick reading of the financial press or a brief conversation with a foreign businessman with experiences in Korea or Taiwan would have revealed the prevalence and the strength of industrial policy in those economies, shows how ideological the debate was in the third wave.

Subsequently, when it became difficult to deny the existence of industrial policy in these countries, the criticisms focused on the effectiveness of industrial policy in the East Asian countries themselves (the best example is World Bank, 1993; see Rodrik, 1994, Lall, 1994, and Chang, 1995 for criticisms) or the feasibility of drawing lessons from those countries for other countries, given the ‘special’ nature of history, politics, and institutions in those countries (see Chang, 1993 and 2011, for criticisms of this kind of argument).

The third phase has naturally covered the issues raised in the earlier waves: the logic of infant industry vs. the theory of comparative advantage; export promotion vs. import substitution; state failure vs. market failure. However, it also brought out some new issues.

First, it drew our attention to issues of competition and cooperation among domestic firms. In the previous phases, the issue of competition was discussed mainly in relation to the exposure of the firms in a backward economy to superior foreign competitors. In the third phase, well-calibrated regulation of competition between domestic firms regarding investment, export, and other activities, was also highlighted. It was argued that such regulations bring social benefits by ensuring that firms have

more than minimum efficient scale, by reducing duplication of efforts, and by reducing the chance of ‘excessive competition’ leading to the scrapping (rather than re-deployment) of ‘specific assets’ owned by failed companies (Johnson, 1982; Chang, 1994; Amsden & Singh, 1994)

Second, the third wave highlighted the importance of implementation issues. In addition to the leadership’s political will and the capabilities of the bureaucrats executing policies, attention was drawn to the institutions that are used for its implementation: the way the government is organized (e.g., how much coordination is there between different ministries); how the private sector is organized (e.g., whether they have well-functioning associations at the national, regional, and sectoral levels); and how the state and the private sector interact (e.g., whether there is a mechanism for regular exchange of opinions between key policy-makers and business leaders; whether there are effective ‘intermediate institutions’ in the public sector that provide critical inputs, like R&D, to the private sector) (Dore, 1986; Chang, 1994 and 2011; Evans, 1995).

Third, the process of learning by producers was more explicitly theorized in the third phase, especially among evolutionary economists focusing on firm- and system-level innovation dynamics. Of course, learning is at the heart of the infant industry argument, but the standard infant industry argument assumes that learning automatically happens, once an appropriate level of protection is provided. In the third phase, it was recognized that, while some learning happens automatically through ‘learning by doing’, much of it requires deliberate investments in the capabilities to learn (education, training, and R&D). The National Systems of Innovation literature pioneered by Christopher Freeman, Bengt-Ake Lundvall and Richard Nelson pointed out the need to have explicit innovation policy on a number of grounds: infrastructural and institutional problems; technological lock-in, path dependency, and transition failures; quality of linkages and networks configuration failures; finally, issues related to learning dynamics at the firm, local networks, sectoral and system levels (Metcalf, 1995; Malerba, 2002). These contributions share a holistic conception of the innovation process and, more distinctively, a multi-layered representation of industrial systems, whereby agents (i.e. firms, research centres, intermediaries etc.) are embedded in a network of horizontal and vertical interdependences that determine their production and innovation performances. They highlighted that systemic failures may unfold both within and across regional and

national industrial systems, all of them being interconnected through global supply chains.¹

2.4. The fourth phase: ‘Mainstreaming’ of industrial policy and its limitations

From the mid- 2000s, we have entered the fourth phase of debate on industrial policy. During this period, we have seen the emergence of some important arguments justifying industrial policy on the basis of Neoclassical economics.

First, there is the ‘information externality’ argument of Ricardo Hausmann and Dani Rodrik (Hausmann & Rodrik, 2002; Rodrik, 2004; Hausmann & Rodrik, 2006). In this argument, in addition to the failures of the market to coordinate investments between related industries (the ‘big push’) and to supply ‘public goods’ (such as rules, standards, or R&D), information externality is seen as a major obstacle to industrial diversification in developing countries. Hausmann and Rodrik point out that a firm that enters a new industry before the others generates new information about the feasibility of the industry for other potential entrants but is not compensated for the risk it has to take to be the ‘pioneer’. The result is that there will be less than optimal entry into new industries, hampering industrial diversification and thus economic development. Given this, the government is justified in compensating the ‘pioneer’ (or ‘innovator’) firms by giving them targeted subsidies in the form of loans and loan guarantees² Hausamann & Rodrik (2003) explicitly advise against trade protection or export subsidies on the ground that they do not discriminate between the innovator and the imitators.³

¹ These types of ‘systemic and learning failures’ have been increasingly recognised in the fourth phase of the industrial policy debate (Klein Woolthuis et al., 2005; Tasseey, 2014; Dogdson et al. 2011; Wade 2012; Stiglitz and Greenwald, 2014), while relatively less emphasis has been given to sectoral explanations of technology push and demand pull dynamics, at least in the context of most developed economies (Soete, 2007; Laranya et al. 2008; Andreoni, 2015a and 2016a). See sections 3.2 and 3.3 below for further discussions of these points.

² Hausmann and Rodrik also advocate industrial policy to provide the ‘public goods’, like R&D, needed for the relevant industries

³ However, it is argued that, even though they do not discriminate in favour of the pioneers, export subsidies are still better than import protection, because they benefit only the better firms, which are able to enter the international markets.

Second, Justin Lin has developed what he calls New Structural Economics and, as a tool to apply it to industrial policy-making, the so-called Growth Identification and Facilitation (GIF) approach (Lin, 2012). While still sticking to the Neoclassical notion of factor-endowment-based comparative advantage, the GIF recommends that developing countries should not simply stick to their current patterns of comparative advantage but should try to anticipate their future ones and develop industries that fit them. Lin recommends that developing country governments should try to promote the production of “tradable goods and services that have been produced for about 20 years in dynamically growing countries with similar endowment structures and a per capita income that is about 100% higher than their own” (Lin, 2012, p. 161).

Unfortunately, these supposedly original arguments are rather clumsy translations of old ideas by non-Neoclassical schools into the Neoclassical language. The Hausmann-Rodrik information externality is essentially an incomplete version of infant industry argument translated into the language of Neoclassical market failure; it is an infant industry argument in that it recognises that the social benefit of starting a new activity in a developing country is higher than the private benefit for the ‘pioneers’, but it is ‘incomplete’ in that it ignores many types of inter-sectoral externalities, such as knowledge spill-over through inter-sectoral, rather than intra-sectoral, labour mobility; the development of supra-sectoral ‘industrial commons’ that can be used by many industries, rather than just one industry (see Rosenberg, 1969; Richardson, 1972; Andreoni, 2014; Andreoni and Chang, 2016; Andreoni et al., 2016). Lin’s NSE is a milder and inconsistent version of the infant industry argument; milder in the sense that it recommends deviation from comparative advantage only to a small degree (“imitate countries that are twice richer than you are”) and inconsistent in that, once you accept that deviation from comparative advantage may be beneficial, it is not clear *a priori* whether a particular degree of deviation is necessarily better (on the ‘second best’ consideration) or even whether there is an objective way to know how much deviation is feasible before actually trying it.

Moreover, these theories have important limitations, which lead to policy recommendations that are often overly restrictive and sometimes even rather muddled.

Hausmann and Rodrik over-play intra-sectoral externalities in that they assume that, once the pioneer ‘discovers’ the relevant information, the imitators can acquire all the information from it. This is because they (without thinking) base their arguments the Neoclassical theory of production, in which all knowledge in

production is perfectly transferrable. However, in reality, much of the knowledge about production discovered by the ‘pioneer’ would be firm-specific (and therefore useless even if it can be transferred) and/or tacit (and therefore cannot be transferred in the first place). If this is the case, the imitators cannot free-ride on the pioneer very much, which suggests that the information externality problem may not be a serious issue and that the lack of diversification in developing countries may have to be explained by something else.

Hausmann & Rodrik under-play intra-sectoral externalities. They do not consider the impacts of infant industry promotion at the systemic level, which are especially important for the earlier phase of industrialisation. They ignore things like the creation of a modern industrial workforce (with factory-style work discipline and the habit of time-keeping), the introduction of modern management techniques, the accumulation of knowledge about exporting, and even the very practice of capitalist profit-making that come from industrial production experiences in general. These new workers and managers may transfer knowledge out of the sectors where they were first formed into other sectors. Given this, in the Hausmann & Rodrik language, we could even say that all industrial firms (and not just sectoral ‘pioneers’) in less industrialised economies may be ‘pioneers’ that generate information externalities for the rest of the economy. This means that protecting or subsidising whole industrial sectors, and not just the ‘pioneers’ in those sectors, may be a good policy, unlike what Hausmann & Rodrik suggest.

As for the GIF, it suggests a totally arbitrary criterion in industrial policy because it tries to have its cake and eat it at the same time – that is, adhering to the theory of comparative advantage while admitting the need to deviate from it. It recommends developing countries to follow countries with incomes that are about 100% higher (that is, twice), but where does this particular number come from? Why 100%? Why not 150%? Why not 500%, for that matter? Indeed, empirical evidence shows that successful jumps have been far more ambitious than is suggested by the GIF – for example, the US per capita income was 2,000% that of Korea’s, when the latter entered the steel industry in the mid-1960s (Chang in Lin & Chang, 2009).

Also, the GIF implicitly assumes that an economy’s ‘ability to jump’, so to speak, is already known – hence Lin’s willingness to put a number (“about 100% higher”) on the ‘boundary of emulation’. However, very often, the whole point of economic development is that a backward economy doesn’t really know what it is

capable of until it tries new things – as Hirschman beautifully put it, economic development “depends not so much on finding optimal combinations for given resources and factors of production as on calling forth and enlisting for development purposes resources and abilities that are hidden, scattered, or badly utilized” (Hirschman, 1958, p. 5). It is because of this that countries like Japan, Korea, and Taiwan succeeded in entering industries that countries with incomes 500%, 1,000%, or even 2,000% higher specialize in.

The Product Space approach, developed by Ricardo Hausmann and Cesar Hidalgo (Hidalgo & Hausmann, 2009), which is supposed to provide practical guide to those who want to pursue the new mainstream approach to industrial policy (of Rodrik, Hausmann, and Lin), by charting the ‘natural’ path of industrial diversification by mapping the ‘distance’ between all exported products, also has some important theoretical problems. First of all, the approach defines the proximity between products in terms of their classifications in international trade, which is according to the character of the final product, rather than in terms of the technologies used in their productions. This can lead to rather misleading understanding of the relationships between different industries. Similar products may be produced using very different technologies (e.g., the food processing industry uses a wide range of technologies, including refrigeration, fermentation, and packaging), while different products may be produced by using similar technologies (e.g., shipbuilding companies also produce oil-drilling platforms).⁴ Second, it is not clear whether related diversification, which is advocated by the Product Space approach, is necessarily better or easier than unrelated diversification. The ‘miracle’ economies of East Asia have diversified into all sorts of unrelated, as well as related, areas, while even many world-class companies are results of unrelated diversification – Samsung used to produce textile and sugar before electronics, Nokia used to produce timber and rubber boots before electronics, and so on. Third, being based on an *ex post* mapping, the

⁴ For example, a classic study of Nathan Rosenberg shows that, in the 19th century, core technologies were shared by rifles, bicycles, and sewing machines – products that fall into different groups in international trade classifications (Rosenberg, 1982; see Andreoni, 2014 for an historical review). More recent studies have revealed similar processes of inter-sectoral learning in the context of injection moulding and micro-tubing technologies across medical device, automotive and agricultural sectors (Andreoni and O’Sullivan, 2014); or within the same sector between packaging machineries for food and pharmaceutical products (Andreoni et al., 2016).

Product Space approach does not recognise that the existing product space is not ‘natural’ and to a huge degree products of past industrial policies of the developed countries. Fourth, even if there are ‘natural’ paths of progression between different products, industrial policy will still benefit countries if it allows them to travel along those paths more quickly than otherwise or to skip steps within the given path.

On top of all of these theoretical problems, there are all sorts of ‘practical’ issues that the new mainstream approaches to industrial policy do not consider. For example, Hausmann & Rodrik (2002, p. 19) proposes a hierarchy of policies on the basis of their information externality argument – ‘government loans and guarantees’ over ‘export subsidies’ over ‘trade protection’ – but these quickly fall apart when we consider the costs involved in the implementation of policies. First of all, tariffs are the easiest tax to collect and therefore crucial for tax revenues in poorer countries with lower administrative capabilities. Given that it needs tax revenues in the first place in order to be able to provide subsidies, the government may have to engage in tariff protection to some extent before it can implement export subsidies. Second, more targeted policies (whether government loans or firm-specific subsidies) may require more administrative capabilities, although this is not necessarily the case (Chang, 2011). So, even if a policy tool is better in theory than another, the government may choose to use the inferior one because it is less demanding in terms of administrative resources. We are not advocating any particular policy here, but are pointing out that we need to pay attention to the implementation issues (e.g., financial and human resource demands, political considerations) before we decide on the superiority of particular types of policy based on theoretical models.

3. Neglected issues

In this section, we address four set of issues that have been largely neglected in the industrial policy debate so far. These are the commitment under uncertainty (3.1), learning in production (3.2), macroeconomic management (especially demand management) (3.3), and the conflict management (3.4). In doing so, we draw on a range of ‘Cambridge’ economists. This may sound rather startling. Cambridge economics is supposed to be macroeconomics, so what insights can those economists offer on industrial policy? Rather a lot, is our answer. Let us explain.

3.1 Commitment under uncertainty

One central characteristic of modern industrial economies is that production requires irreversible commitments. Most of them involve physical capital that embody certain technologies and cannot be re-moulded in any significant way to embody other technologies. Very often the commitments are organisational too – to particular types of internal organisational forms (e.g., vertical integration, diversification) or particular types of long-term relationships with suppliers (e.g., the Japanese JIT delivery system). Even at the individual level, workers often have to commit themselves to particular skills, which may be valuable only in a narrow range of industries – or even in just one industry or, in the extreme case, even just in one firm.

These irreversible commitments are made because they raise productivity, but the problem is that they make subsequent changes costly. Once you commit yourself to a particular technology by buying a machine that embodies it, by beginning to buy your inputs from particular suppliers that cater for that technology, and even by re-organising your company in order to facilitate the use of that technology, you cannot change over to another technology without big losses – even when the changes in the environment have been such that you would have adopted another technology, should you be making the choice *ab initio*.

Of course, if we can predict the future perfectly at least in the probabilistic sense (as we are assumed to do in Neoclassical theory), commitments and the consequent difficulties of making changes won't be a problem. In this case, based on our knowledge of the likelihood of each possible future state of the world, we can decide exactly what degree of commitments we are going to make, by balancing the gains from productivity increase (discounted over time) with the loss from the inability to make the necessary changes in response to the changing conditions (also discounted over time). However, the trouble is that the world is highly uncertain and this kind of calculation is impossible.

So, how do we deal with this problem? In answering the question, we can draw on the insights from a few prominent Cambridge economists. Uncertainty's effects on investments, of course, was at the heart of Keynes' economics, but more relevant insights come from Nicolas Kaldor, who emphasised the embodied nature of technological progress (that is, there needs to be investments in capital goods, if we are to use new technologies) and the consequent existence of increasing returns to

scale in production (which come from the fact that we are using capital goods). Joan Robinson has also provided important insights into our understanding of the irreversibility of the investments by telling us that capital accumulation happens in historical, as opposed to logical, time. George Shackle's characterisation of physical investment (as opposed to buying financial assets with fixed returns) as an act of buying 'the right not to know the future' and his emphasis on the sudden and radical changes that our expectations are subject to (Shackle, 1940) also help us think about the issue of commitments under uncertainty.

Naturally, firms can – and do – do things to reduce the uncertainty of their environment. One classic method is for a firm to increase its control over the market by reducing the number of rivals through predatory pricing (thereby driving some out of business) or through M&A (Richardson, 1960, pp. 208-9; Singh, 1971). Another common method is to form cartels, although they are not easy to form and maintain due to the well-known 'free-rider' problem. Third, firms can try to reduce uncertainty by increasing controls over the suppliers, either by becoming larger and thus increasing bargaining power (the Walmart solution) or by deliberately forming long-term relationship through investments and technical supports (the Japanese solution). Last but not least, firms try (and often succeed) to control the tastes of consumers by spending money on advertising and brand-building.

However, there are things that individual firms that cannot do but policy-makers can do, in order to reduce uncertainty. The motive of the policy-maker in reducing uncertainty for firms will be to encourage the making of productivity-enhancing commitments.

A number of industrial policy tools reduce uncertainty by guaranteeing demand. First, infant industry protection not only enables the infant firms to survive and continue learning but it significantly reduces demand uncertainty for them, by restricting competition from superior foreign producers, which have much greater ability to create uncertainty in the market through radical technological innovations than domestic firms do. Second, the government can guarantee demand by restricting competition among domestic firms. For examples, it can give monopoly right to a particular firm, subject the entry into particular industries to government licensing, or

allow – or even facilitate⁵ – cartels in particular industries to fix prices (especially in the export market) and/or divide up the market. Japan and Korea have used these measures particularly effectively (Chang, 1994, ch. 3). Third, the government can reduce demand uncertainty by giving preferential treatment in government procurement to domestic firms so that they have stability in demand; the US aircraft industry, the Japanese mainframe computer industry, and the Finnish electronics industry are some of the most prominent examples of industries that have benefited hugely from such treatment.

At the more dynamic level, industrial policy-makers can introduce measures that reduce the uncertainty about the future evolution of technology –rather than reducing the uncertainty about market demand, supply of inputs, and the strategies of the rivals, *given the technology*. First of all, the government can provide a clear platform for technological evolution of an industry by taking the lead in the development of the basic technologies (Tassej, 2007 and 2014). The best example in this regard is the US government, which initially financed the developments of technologies for the computer, the internet, the semi-conductor, and so on through public funding of R&D (Block, 2008; Block and Keller, 2011; Berger, 2013; Mazzucato, 2013). Second, the government can push firms to form research consortia to develop basic technologies, which they will share and use in developing more applied technologies, with which they will compete. The developments of Japanese mainframe computers and of US semi-conductors (SEMATECH) benefited from such an arrangement. Third, at the early stage in the development of an emerging industry, where different technological standards compete with each other, the government can reduce the uncertainty about the path of future technological evolution by imposing a technological standard early. This was done in South Korea in relation to the CDMA mobile phone technology standard, which it adopted on a national scale ahead of other countries, including the US, whose company Qualcomm developed the technology first.

Of course, policies to reduce uncertainty can fail. If the government reduces

⁵ As we have mentioned above, cartels are subject to collective action problems, so they can be more easily sustained if there is a third party, including the government, monitoring their operations.

uncertainty in an industry by restricting competition, such an action can (although does not have to) lead to lower productivity in the long run by making the firms concerned complacent. Especially in relation to the uncertainty about long-term technological evolution, policy-makers should be aware that industrial policy measures trying to reduce it runs the danger of prematurely ending the competition between different technological standards and/or backing the ‘wrong’ technology with lower innovation potential in the long run. More than anyone else, industrial policy-makers who are implementing measures to reduce uncertainty should be clearly aware that the very prevalence of uncertainty in the world means that their policies may fail.

However, the possibility that industrial policy measures to reduce uncertainty may turn out to be counter-productive should not be used as an excuse to recommend policy inaction. Even if we don’t know everything and, more importantly, don’t even know exactly what we don’t know, it does not mean that we do not know anything and therefore cannot – and should not – take any action. All that we are arguing is that policy-makers need to be aware of the limitations of their policies and also need to acknowledge that they need to constantly review the situation, given the prevalence of uncertainty. If there is no telling in advance exactly how things will unfold, the solution should be constant review and re-formulation, rather than inaction, because doing nothing is actually doing something. In fact, in advanced industrial nations, a number of governments are engaged with the private sector in road-mapping exercises aimed at identifying future societal needs and global challenges and the emerging technologies which will help us meet them (e.g. green technologies; new mobility solutions; robots for the aging society). By developing a joint vision as well as credible expectations among private companies around future public investments, not only does the government reduce the uncertainty faced by companies but it also sets the conditions for the creation of new markets (Andreoni, 2016b).

Our examination of the problem of ‘commitments under uncertainty’ has revealed how the government has the biggest role to play in the long term development of the country and the biggest responsibility in ensuring the future reproduction of the society. In this respect, the government can play a major role in creating the future markets, more than simply fixing the failures of the existing ones.

3.2 Learning in production

Learning in production is the most fundamental driver of industrial systems and innovation dynamics. Within the conventional industrial policy debate, learning is poorly conceptualised and it is still mainly understood as a process de-linked from specific production structures and activities. This fallacy is partially due to the innovation policy literature which dominated during the 2000s (see section 2.3 above), as exemplified by the ‘Lisbon Agenda’ in Europe and other innovation policies in both developed and developing countries (Soete, 2007; Berger, 2013; Pisano and Shih, 2013; Andreoni, 2016a and 2016b).

According to the innovation policy and the national systems of innovation paradigms, public research institutes, such as universities, and the R&D (not the production) departments within companies create new products and technologies by developing dense knowledge networks. Once new technologies are developed, they can be deployed (almost automatically) by any firm with more than the minimum absorption capacity. Given the public good nature of this knowledge and, thus, the risk of underinvestment in R&D (or in education or in skills development), the best way to promote learning (and innovation) is to give firms intellectual property rights (possibly complemented by some public investments in knowledge creation).

As a result, poor production performances are mainly understood as a problem of underinvestment in knowledge inputs, such as R&D and education. At the same time, offshoring of production from high- to low-wage economies is perceived as an efficient process of specialisation by the rich economies in innovation activities, with no negative consequences for their competitiveness and innovativeness (for critical discussions, see Chang, 2010; Andreoni and Gregory, 2013; Berger, 2013; Andreoni, 2016b).

Lack of adequate investments in skills or R&D activities resulting from market failures are certainly important issues, as they are key ingredients of the learning processes in production. However, they are not sufficient, as increasingly demonstrated by the poor production performances (especially in manufacturing industries) of countries with good level of education and R&D, the UK being the most paradigmatic example.

As soon as we move away from the dominant black-box view of production and learning (Andreoni 2014), it becomes clear how, by simply focusing on the potential lack of ‘knowledge inputs’, we miss the fundamental structural dynamics of

the modern economy, whereby the production process is transformed, the productivity of firms is increased, and new products are invented, developed, and manufactured.

Learning is a collective and cumulative process embedded in existing production structures, involving continuous and interdependent changes in agents' capabilities, organisational configurations as well as investments in material assets, including specific types of technologies, machineries and infrastructures (Penrose, 1959; Richardson, 1972; Tasse, 2007 and 2014; Lazonick, 2010; Berger, 2013; Andreoni, 2014; Andreoni and Chang, 2016). These interdependent changes, constituting what we call here 'learning in production', entails much more than the standard 'learning by doing' of individual workers (Arrow, 1962). In fact, learning in production is at the very core of the innovation process, especially in those manufacturing industries where the manufacturability of new products is the most critical step in the innovation chain, running from R&D through manufacturing to commercialisation (interestingly, this issue was already raised by Dertouzos et al., 1989; see also a more recent discussion in Tasse, 2007).

Learning in production is triggered by three main mechanisms (Andreoni, 2014). First, as "innovations hardly ever function in isolation" (Rosenberg, 1969), any change in the existing production processes and structures induces changes in complementary processes and technologies. For example, innovation in the materials used for a certain component can induce changes in the overall product architecture and/or in the nature of other components. Second, learning in production includes the opportunity of adopting similar technical solutions to production problems across different sectors. For example, the adoption of a certain machine or of a particular organisational technique can affect a whole range of different sectors, from textile to automotive and aerospace, as it has been the case with lean manufacturing (Andreoni, 2014). Third, attempts to solve the 'scale bottlenecks' in one industry may lead to fundamental organisational innovations not just in the industry itself but through the whole value chain (Andreoni and Chang, 2016). It can also enable the adoption in the supplier industries of technologies with high fixed costs that had not been adopted due to limited production volumes (Andreoni and Scazzieri, 2014).

Alongside these three production structure-technology push dynamics – complementarity, similarity and scale-bottlenecks – , learning in production is also driven by changes in the 'quantity' of demand (both final and intermediate demands

of commodities) as well as the ‘quality’ (or composition) of demand, as reflected by changes in income distribution (market pull dynamics).

The Cambridge school of economics has made major contributions in understanding the structural determinants of learning in production, in particular the role of ‘increasing returns’ for value creation, endogenous growth and competition dynamics (Marshall, 1920; Sraffa, 1926; Robinson, 1933; Kaldor, 1966, 1972, 1985; Pasinetti, 1981; Andreoni and Scazzieri, 2014; Pitelis, 2016). This starts with Alfred Marshall’s *Principles of Economics* (1920), which identified two fundamental sources of increasing returns, namely those internal to the firm (mainly determined by the Smithian advantages of division of labour) and those external to the firm (those arising from the overall transformation of the productive matrix of an economy). This foundational distinction and the interwar period debate between Sraffa (1926), Pigou (1927) and Young (1928), found an analytical synthesis in the later work of Nicholas Kaldor (1966, 1972, 1985).

Similarly to Charles Babbage (1832), who had made significant efforts to understand the micro-engineering mechanisms and the proportionality requirements in the expansion of the production scale of a plant (‘law of multiples’), Kaldor pointed to the dynamic economies of scale (and cost savings) associated with process-flow technologies as well as the indivisibilities of inputs at the plant level. He also highlighted the existence of firm-level scale economies, associated with bulk purchasing/selling, large-scale advertising, risk-reduction via diversification, and the advantages of vertical-horizontal integration of production activities.

The role of technical and economic indivisibilities in investment decision and the related, although separate issue, of coupling skills development with appropriate and proportional investments in gross fixed capital formation are barely mentioned in the current industrial policy debate. The result of today’s ‘de-materialised’ industrial policy discussion, is that scholars tend to undermine the critical role that scale and indivisibilities play in determining firms’ cost-competitiveness thresholds (minimum efficient operational scale of a plant), their internal increasing returns as well as the entry barriers they create thus affecting competition dynamics in global markets. The fact that the ‘instruments of production’ are not ‘finely divisible, like sand’ and that they tend to be production-task specific (Robinson, 1933:334), provides a production-based rationale for both trade policies which set the ‘wrong’ prices to allow firms to

reach the right scale, but also industrial policy which support firms in getting their scale, technologies and organisation right for global market competition⁶.

In Kaldor's (1972:1255) framework, indivisibilities and scale expansion can also trigger endogenous technological change: "With every enlargement of production, new 'activities' become profitable which would have not been employed earlier, whilst the introduction of such new 'activities' leads to the invention of further 'activities' which have not been known earlier...". These new activities tend to be related to the existing ones by a relationship of complementarity (more than a principle of substitution, which according to Kaldor is dominant in the Neoclassical theoretical framework for production), often reflected in fixed factor coefficients at the levels of both the plant and the firm.

Complementarities in production are however not limited within the boundaries of the firm. Building along the Marshall-Young line, Kaldor pointed to the fact that the internal economies of one firm becomes the external economies of other complementary firms. In the words of Young (1928:533), "every important advance in the organisation of production... alters the conditions of industrial activity and initiates responses elsewhere in the industrial structure which in turn have a further unsettling effect. Thus change becomes progressive and propagate itself in a cumulative way". This means that the increasing specialisation of firms in a limited number of production tasks (or production of intermediate goods), via investments in scale-appropriate indivisible machinery, will lead to an expansion of the size of the market for intermediate goods (reciprocal demand) and, in turn, to additional/complementary investments.

⁶ In this respect, a number of contributions (Tassey, 2007; Antonelli et al. 2009; Link and Scott, 2011; Rosenberg and Steinmueller, 2013; Andreoni and Chang, 2014; Andreoni 2016a and 2016b) have recently stressed the critical role of supporting the public provision of/access to quasi-public good technologies (including infra-technologies and tools, such as measurement systems, testing facilities, quality standards assessment equipment, pilot lines to test new processes and other physical and virtual tools for conducting R&D and manufacturing scaling-up, control production processes and reaching quality standards). The indivisible nature of these extremely expensive infra-technologies and tools (especially for SMEs) calls for production-targeted technology policies beyond the standard innovation policy approach (see above), as demonstrated in a number of advanced manufacturing policy systems (Tassey, 2007; Andreoni, 2016).

Specialisation of one firm, and the resulting productivity gains, is made possible by an expansion of demand from other firms that are also specialising in other activities, which are often complementary and geographically proximate to the activities of the original firm. In this theory, increasing returns stem from the increasing division of labour at the level of the local production system, its deepening and innovatory investments and the consequent expansion in the extent of the market. In particular, Kaldor (1985:69) stressed the importance of “joint production between small specialised firms which involves frequent transfer of an unfinished product between numerous specialised firms”. Of course, the model does not exclude an increasing expansion and integration of the local production system/market with regional or global production systems⁷.

In its original Marshall-Young-Kaldor formulation, however, the external economies were associated with the advantages of geographically ‘localised learning’, based on local supply-demand relationships entailing ‘technological pollination’ (Andreoni, 2014) and other forms of ‘learning in production’, triggered by similarities, complementarities and indivisibilities. These ideas were developed within the Italian industrial district literature pioneered by Giacomo Becattini and Sebastiano Brusco and the work of scholars like Mike Best; it was also adopted in the new geography literature and information-based modelling of localised technological learning (Stiglitz, 1987).

Thinking about learning in production within this localised system framework points to the fundamentally collective and cumulative nature of such learning process, whereby distinctive productive capabilities develop and ‘sediment’ in certain regions and not in others. Recently, this insight from the Cambridge school has been repackaged in the industrial policy debate under the notion of ‘industrial commons’ (Pisano and Shih, 2012: 2), which include “R&D and manufacturing infrastructure,

⁷ Indeed, increasing returns are the fundamental machinery behind Kaldor’s overall growth model (1961), recently rediscovered by a number of scholars (Jones and Romer, 2009; Marconi et al., 2016). In his own words “Economic growth is the result of a complex process of interaction between increases of demand induced by increases in supply and of increases in supply generated in response to increases in demand. Since in the market as a whole commodities are exchanged against commodities, the increase in demand for any commodity, or group of commodities, reflects the increase in supply of other commodities, and vice versa (Kaldor, 1966:19).

know-how, process-development skills, and engineering capabilities” and are embedded in a number of organisations (firms and universities in particular) and provide the foundation for innovation and growth to a range of industries.

The above discussion about learning in production has some important implications for industrial policy design. In the last couple of decades, much emphasis has been put on ‘smart’ industrial policies that encourage knowledge generation (investments in education and R&D), against those clumsy, traditional ones that provide protection and subsidies. However, once we recognise the importance of learning in production, we begin to see that no amount of ‘smart’ policies will generate innovation without those ‘dumb’ policies that keep firms in business and help them expand their production.

Indeed, the East Asian ‘miracle’ economies have shown that industrial policy is most successful when it combines measures to help their firms produce more (e.g., trade protection, subsidies, state-led restructuring of failing enterprises, export promotion) with the measures to help them acquire and generate new knowledge. Moreover, when it comes to the latter measures, successful countries did not just invest in education and R&D but also in knowledge activities that are more closely linked to production activities – such as worker training and publicly-provided technological consulting services for SMEs (‘industrial extension service’).

While the idea of industrial commons captures the Marshallian original concept of external economies from the point of view of capabilities development and technological linkages across sectors, Pisano and Shih (2012) tend to take for granted the supply-demand relationships whereby local production systems develop and experience increasing returns to large production. In fact, this is only an example of a more general tendency in the industrial policy debate to do *not* link the supply-side analysis of learning in production and local production system with an analysis of the role of demand (in particular, reciprocal effective demand). Understanding the role of demand in relation to the learning in production processes described above is another fundamental contribution of the Cambridge school to the current industrial policy debate⁸.

⁸ In fact, while acknowledging the path breaking work in circular and cumulative causation theory of Allyn Young, Kaldor criticised his explanation of the almost automatic mechanism adjusting increasing supply to demand among different economic sectors, mainly agriculture and industry (this critique was extended to

3.3 Macroeconomic management

The industrial development and policy debate has historically had a supply-side bias (Gilboy, 1932, is an early criticism along this line). This supply-side bias is responsible for the tendency for industrial-policy scholars to overlook the influence of demand management on the conduct of industrial policy, both domestically (through monetary and fiscal policies) and internationally (especially through exchange rate policy). This tendency, in turn, has led to the neglect of different impacts that changes in demand (sometimes deliberately managed by the government) have on different sectors and on different countries in terms of diversification, specialisation, and restructuring (Imbs and Wacziarg, 2003). While a number of classical development scholars like Young and later Hirschman (1958 and 1977) have pointed to the role of reciprocal demand and consumption linkages, they implicitly assumed that the economic system is able to adjust automatically to rising supplies. However, according to Kaldor (1972:1249-50), the absorption of a continuously rising volumes of production depends on “additional incomes resulting from the accumulation of capital (in other words, from investment expenditures) combined with the induced character of such investment”. According to Kaldor, for the income multiplier and investment accelerator mechanisms to be effective, the banking system as well as the ‘merchants’ (this expression is used by Kaldor to identify specific types of financial actors) have to play critical roles. The banking sector enables capital investments, which, in turn, generate the savings-additional investments-savings dynamics, while the merchants operate as countercyclical forces absorbing stocks in response to excess supply, and releasing stocks in the face of excessive demand.

One obvious macroeconomic policy that has a direct bearing on industrial policy is interest rate policy. High (real) interest rates discourage investments in general, but it has more negative impacts on investments in the manufacturing sector, where the requirement for borrowing is greater due to higher capital requirements. We have vividly seen the negative impacts of high interest rates on the manufacturing sector in countries like Brazil and South Africa in the last couple of decades, with real

classical political economists like Ricardo and Mill; Kaldor, 1977; see also Toner, 1999).

interest rates frequently being around 10%-12% and few firms being able to borrow to invest.

Interest policy may not be an ‘industrial policy’ issue in the conventional sense, but it has important bearings on industrial policy, insofar as high interest rates disproportionately damages capital-intensive industries. The effect can be, and often has been, countered by industrial policy measures – selective provision of cheaper loans (or priority in lending) for such industries through state-owned banks (e.g., Brazil’s BNDES) or through directed credit programmes imposed by government regulation on private banks (e.g., Japan). However, it is very difficult to have lively investments when interest rate policy is such that firms do not make enough profits to repay even the interests on their loans⁹.

The relationship between industrial policy and macroeconomic management does not stop at the domestic front. It also has an international dimension. And in the management of foreign demand – the so-called ‘foreign trade multiplier’ – the management of the exchange rate becomes crucial.

Overvalued currencies may be created by the ‘Dutch disease’ (a sudden inflow export earnings from natural resource bonanza that is not countered by macroeconomic policy) or by the bias of policies towards the financial sector. Overvalued currencies tend to negatively affect the export industries, especially manufacturing industries, harder, although different sectors tend to be affected in different ways according to the price elasticities of demand of their export products. Those products whose elasticity of demand in the global market is lower tend to be affected less than those with high elasticity do. Thus, for example, countries like Germany that export ‘unique’ products (that is, products with low price elasticity of

⁹ Within the standard Keynesian model of a capitalist economy the failure to invest is mainly due to excessive savings (or an insufficient propensity to consume within the domestic economy) relative to unfavourable business expectations and, thus, the increasing liquidity preferences and weakening of the saving/investment multiplier. However, according to Kaldor (1977:199) “the limitation of effective demand due to over-saving is a short-run (or cyclical) phenomenon, whereas the rate of growth of ‘external’ demand is a more basic long-run determinant of both the rate of accumulation and the growth of output and employment in the ‘capitalist’ or ‘industrial’ sectors of the world economy”. In fact, private companies investments tend to be largely (external) demand-induced, while they are relatively less responsive to direct incentives such as interest rates, tax incentives or subsidies.

demand) can afford to have significantly overvalued currencies. In contrast to Germany, since it has joined the Euro, Italy has experienced a dramatic process of industrial decline, thanks to exporting a much higher proportion of low-tech products, which have high price elasticities of demand, than Germany does (Italy's medium- and high-tech sectors, which have low price elasticities of demand, have actually sustained their performances and in certain cases even expanded their export penetration).

Once again, the effects of overvalued currency can be countered to an extent by industrial policy. For example, over the last couple of decades, the BNDES in Brazil has tried to counter the effects of overvalued currency by extending subsidised credit to selected industries.

Exchange rate policy can also be complemented in a positive way by other internationally-oriented demand management policies, affecting balance of payments and trade performances. Among these, there may be even policies that are 'micro' in their conduct but have important macroeconomic consequences that have impacts on industrial policy. These are policies that relieve the balance of payments constraints in developing countries. In these countries, once such constraints are relaxed, there can be more investments (as investments mostly rely on imported capital goods). If this happens in a country with strong industrial policy, the impacts of such relaxation will be magnified. One important example is the control imposed on the imports of luxury consumption goods by the governments of Japan and Korea in the earlier days of their economic developments, in the 1950s and the 1960s in Japan and between the 1950s and the mid-1980s in Korea (on this, see Chang, 1998). Such control enabled these countries to invest more by relaxing their balance of payments constraints, which, when combined with their highly selective industrial policies, enabled the investment and thus the expansion of selected industries.

Thus seen, it is very important for the government to align the multitude of interrelationships between traditional industrial policy instruments and macroeconomic policies. This need was highlighted by Kaldor, who stated (Kaldor 1971:3): "the failure of post-war Governments [in the UK] to pursue a policy consistent in terms of its declared objectives could thus be primarily attributed to an insufficient orchestration of instruments – of not having enough separate policy instruments at hand to secure the simultaneous attainment of the various objectives". Interestingly, this 'orchestration of instruments' was one of the reasons for the East

Asian economic successes (Stiglitz, 1996; Chang, 2010), but few contributions have so far looked at these policy alignment and synchronisation between industrial and macroeconomic policies (Andreoni, 2016a). More attention is warranted to this aspect.

3.4 Conflict management

All economic policies are in the end political actions, in the sense that it is partial; it favours one group over another, one ideology over another, or even one culture over another. Indeed, in some languages, like Italian and Spanish, the word for ‘politics’ and ‘policy’ are the same; industrial policy in these languages are ‘politica industriale’ and ‘política industrial’ respectively, while politics is ‘politica’ and ‘política’ respectively. Being political, all policies inevitably involve conflicts – at least in latent forms. Therefore, successful implementation of any policy requires management of the conflicts that it causes and/or of the already-existing latent conflicts that it unintentionally ‘stirs up’.

It is important here to note that ‘leaving things to the market’ is also a very particular type of conflict management strategy. This method compels the losers from a change to accept the market outcome, thereby clearly taking sides. When the adjustments that need to be made by the losers are large, leaving things to the market may create a lot of conflicts, and therefore may be viable only when the state can prevent the losers from organising countervailing actions, such as industrial strikes (if the losers are workers in particular industries) or capital flight (if the injured party are the wealthy). This is why a free market, somewhat paradoxically, requires a strong state (Gamble, 1988; Glyn, 2007).

When it comes to ‘policies’ in the conventional sense, as a rule, the more targeted the policy is and therefore the easier it is to identify the winners and the losers, the more immediate conflict it is likely to provoke. This means that the more targeted policy is likely to require more conflict management.

So, for example, fiscal policy is more likely to require more conflict management than monetary policy, as much of it has clearer winners and losers than the latter does. A government does not just increase (or reduce) spending in general but increases (or reduces) it for particular groups – old age pensioners, poor people, or firms that receive R&D subsidies. Likewise, an increase (or reduction) in taxes are made up of changes in taxes for many different groups – high-earners, consumers in general, or consumers of tobacco. Given this, changes in fiscal policy (rightly)

provokes accusations of the government being on this side or that, which requires the government to make explicit deals with representatives of different groups of winners and losers or at least to present its fiscal policy with high degree of obscurity that people cannot easily tell who is the winner and who is the loser.

It would seem that monetary policy does not require conflict management, as it does not involve targeting in the way fiscal policy does. However, it affects the outcome of distributional conflicts, as explained in the conflict theory of inflation by Bob Rowthorn, another Cambridge economist (Rowthorn, 1977; also see essays in Lindberg & Maier (eds.), 1985). For example, a tight monetary policy is likely to favour capitalists over workers, as most capitalists can more easily counter the impacts by raising their prices, although some small capitalists in highly competitive markets may not be able to do that while some organized workers may be able to defend themselves by raising their wages. Further, a tight monetary policy also favours financial capitalists over industrial capitalists, as the former tend to benefit from a stronger currency while the latter are forced to pay higher more interests on their loans. Moreover, in countries where the state controls credit rationing (e.g., South Korea in the 1970s and the 1980s), a tight monetary policy and a consequent fall in credit availability may even conceal a relatively small fall (or even an increase) in the availability of credit to certain 'priority' sectors (Chang, 1993). Given all of this, there are fierce political manouvring and lobbying going on around monetary policy, despite the widespread pretense that it is something that can be managed in a technocratic way, only if the central bank can be given political independence (that is, independence from the elected representatives).

Having said all of this, it has to be admitted that industrial policy is probably the type of policy that is most prone to open conflicts, as it tends to be more explicitly selective than other policies; it inevitably chooses between sectors, technologies, or even individual firms in the same industry. Constant questions will be raised as to why the government is channeling money into a particular industry, why it is bailing out some industries while letting go of others, or why it is betting on one technology over another. Of course, these questions point directly to the ways in which, within a certain political settlement, powerful organisations are able to influence governments' industrial policy and their distribution of rents in society (Khan and Jomo, 2001; Khan, 2013). It is a lot more difficult to hide who the winners and losers are from an industrial policy than in relation to fiscal policy or monetary policy. Therefore,

conflict management is more important for industrial policy than other policies.

There are two types of measures that can be used in order to reduce conflicts involved in industrial policy – we call them ‘reactive measures of conflict management’ and ‘anticipatory measures of conflict management’

Reactive measures of conflict management in industrial policy can be subdivided into two sub-categories – one temporary and the other permanent.

When the trouble that a particular sector is experiencing is deemed to be of temporary nature, the government can reduce the extent of conflicts in the sector by offering temporary protection and subsidies so that it can more easily weather the difficulties and possibly also re-structure itself in the meantime. Reactive measures of conflict management in industrial policy are rather widely used – even the WTO, which is not a fan of tariffs, allows its member countries to impose emergency tariffs in the face of a sudden surge in sectoral imports.

When the trouble that a sector is going through is deemed to be of long-term nature, the government can impose, or offer inducements for, more radical restructuring. There are a number of types of long-term reactive measures of conflict management in industrial policy. First, as the Japanese government did with the shipbuilding industry in the 1980s, it can mediate negotiated capacity scrapping among the firms in the sector (Dore, 1986). Second, as the South Korean government did with the textile industry in the 1980s, it can offer subsidies to the scrapping of obsolete machines and the purchase of new machines (Chang, 1993). Third, as the US government did with the auto industry after the 2008 financial crisis, the government can bail out the enterprises in trouble. Fourth, the government can nationalize an industry in trouble, with a view to winding it down (as in the case of the nationalisations of Swedish shipbuilding industry in the late 1970s) or a view to restructuring and eventually privatizing the (temporarily) nationalized firms (as in the case of Volkswagen in West Germany, in the late 1970s).

The ‘reactive’ measures of conflict management in industrial policy have often been condemned for ‘picking losers’ and thereby preventing ‘natural selection’ in the market and reducing the dynamism (Lindbeck, 1981 and Burton, 1983, are classic statements of this viewpoint). This may well be the case, but the critics of these measures fail to recognize that those measures can bring much greater benefits than the costs they create through a temporary suspension in restructuring.

First of all, insofar as the sector in trouble possesses ‘specific assets’ that

cannot be deployed in other sectors (or can be deployed only with a serious reduction in their values), bankruptcy of the firms in a sector that is viable in the long run will incur social costs, as they lead to an unnecessary scrapping of assets.

Second, as it is likely, if some owners of those specific assets can put up resistance, there also will be social costs. For example, if the capitalists in a sector with over-capacity refuse to exit in a game of ‘chicken’, all of them will suffer with low profits and thus greater risk of bankruptcy. In such a situation, the government mediating, or even imposing, a coordinated capacity scrapping arrangement is socially more productive. Likewise, if the workers in a sector are resisting changes because they own sector-specific skills, which have low or even no value outside the sector, they will disrupt production in the short run (thereby increasing the chance of bankruptcy of their firms) and, more importantly, delay the inevitable restructuring in the long run. In such a case, the government can reduce the resistance from the workers concerned, and thus reduce the social costs from the conflicts, by offering them extra severance payments and/or schemes for re-training and re-deployment.

Of course, unless it is accompanied by efforts to restructure (or even gradually wind down in the long run) the sectors concerned, reactive measures of conflict management industrial policy may lead to the provision of life-support machine for an industry that has no future. However, if used as a part of a forward-looking industrial strategy, these measures can actually reduce the costs of industrial restructuring and also quicken it in the medium- to long run, even though they may somewhat slow down the process in the short run.

Measures of conflict management in industrial policy may be ‘anticipatory’, rather than ‘reactive’.

First of all, a clear announcement of policy priorities and their justifications (why the government is backing particular sectors, technologies, or even individual firms) in advance – through long-term national vision, 5-year plans, or long-term sectoral strategy – can help reduce the conflicts arising out of industrial policy. While it cannot deny the accusation of ‘favouritism’ *per se*, such announcement can deflect the accusation of corruption, clientelism, vote-seeking, etc., to a substantial degree. Industrial policy measures will become politically even more acceptable if they are announced together with explicit performance targets, evaluation criteria, and, a long-term plan to phase them out, where appropriate (e.g., infant industry protection or temporary technological upgrading programmes).

Second, anticipatory measures of conflict management in industrial policy can take various forms of ‘social insurance’ that puts floor below the feet of those who fail and thus reduce their incentives to resist socially-beneficial changes that harm them. These are not industrial policy measures in the conventional sense, but they can play very important roles in the processes of structural change that characterise the process of industrial development.

The most important social insurances for capitalists are limited liability and the modern bankruptcy law (see Chang, 2002, ch. 3, on the role of these institutions in industrial development). Limited liability caps the loss to what has been invested, thereby reducing the risk of business failure leading to personal ruin, as it did before the late-19th century. The modern bankruptcy law reduces the cost of business restructuring by giving temporary protection from creditors and even making debt write-downs possible. It also wipes the slate clean for the failed capitalist and gives him/her a second chance. These measures not only encourage risk-taking by capitalists *ex ante*, but they also reduce their resistances to restructuring *ex post*.

The welfare state is the most important social insurance mechanism for workers. By giving them the floor to their living standards – both in cash terms through unemployment benefit and income support and in kind through guaranteed access (or subsidies for) housing, education, and healthcare – the welfare state reduces the incentive for workers to resist restructuring on the industries in which they work. If it is combined with effective programmes for re-training and re-deployment, as it is the case in countries like Sweden and Finland, this social insurance becomes even more effective in helping economies make structural change.

4. New realities (and the consequent need for new theories)

In this third part, we expand our theory of industrial policy by focusing on the new industrial policy challenges. In particular we focus our attention on three major transformations of the economic reality, which call for the development of a new industrial policy theory. These are: the new patterns of accumulation, value creation and capture; the financialisation of the global economy; finally, the new forms of imperialism.

4.1 New patterns of accumulation, value creation and capture

The global production landscape has been profoundly reshaped by three interdependent processes involving changes in (i) the global organisation of production (vertical disintegration and the establishment of regional/global supply chains), (ii) the relationship between different sectors of the economy (fuzzy boundaries and linkages, and finally (iii) the nature of technology systems (capability domains). While each of these issues have received some attention in the recent literature, the relationship among these three manifestations of the same phenomenon and their impact on accumulation, value creation and value capture dynamics remain unclear. In order to understand these dynamics we have to refrain from a simplistic assessment of global supply chains and, more critically, move beyond traditional conceptualisations of sectoral boundaries and technologies.

The global business revolution and the emergence of global/regional value chains since the early 1990s have been made possible by a number of technological advances (e.g., falling transport costs, and more interconnectedness via ICTs), cost-reduction opportunities associated with off-shoring labour-intensive manufacturing processes, and the increasing openness in global markets for trade and investments (Nolan, 2001; Milberg and Winkler, 2013; Neilson et al 2014; Gereffi, 2014; Kaplinsky and Morris, 2015)¹⁰. For a number of emerging economies, the internationalisation of transnational corporations (TNCs) and the resulting global segmentation of production tasks have been an opportunity for entering in technology-based markets and capture value from advanced manufacturing technology. For example, China became the largest producer of machine tools in 2002 and in 2012 consumed four times of machine tools of the US (Tassey, 2014; see also Andreoni and Gregory, 2013 and Berger, 2013), while the US share of global production of machine tools declined from 20.4 percent in 1980, to 9.8 in 2000 and to 5.3 percent in 2012.

¹⁰ From 1990 to 2013, the world trade dependence ratio increased from 19.5 to 30 per cent, while in economies like the US the firms that export and import account respectively for almost 90% of known value (WDI, 2015; US Department of Commerce, 2013). Finally, the trade in value added of developing countries has increased its global share from 22 percent in 1990 to 42 percent in 2010 (UNCTAD, 2013).

Despite the fact that not only China but also South Korea and Taiwan started their industrialisation by linking (backward) to global supply chains in electronics and other sectors mainly characterised by short-technology cycles (Amsden, 1989; Wade, 1990; Chang, 1993; Milberg and Winkler, 2013; Lee, 2013), the industrial policy debate has only very recently recognised the different opportunities and challenges that the evolving pattern of global division of labour is posing to catching up economies. In fact, for the majority of countries such as the Philippines, Mexico or the majority of African economies, the globalisation of production has not resulted in greater capital accumulation, domestic value creation and international value capture. Among neoliberal scholars, under the mantra, ‘you need to import if you want to export’, GVCs have been used to re-emphasise the benefits of international trade and, thus, the need for more trade liberalisation. Surprisingly, the majority of the Developmentalist scholars have also highlighted the opportunity offered to developing countries by the GVC-based industrialisation model to overcome the highly uncertain and capital-demanding task of developing entirely new sectors. GVCs open the opportunities for accessing regional and global markets, while diversifying and upgrading in specific tasks and new products. However, we need to carefully analyse the conditions required for countries and companies to benefit from GVC integration as well as the potential risks associated with this new industrialisation model.

First, TNCs are extremely powerful organisation, whose internal economy can be comparable to the GDP of many developing countries. These TNCs exercise their power in global oligopolistic markets and command enormous global market shares. Nolan (2007) estimated that since 2000, in the majority of global industries the market has been controlled by a handful of TNCs. This power is exercised in a systematic and strategic manner to capture value in the market, by creating entry barriers in the forms of patents, quality standards, copyrights, trademarks, etc. (what Kaldor understood as ‘institutional monopolies’), and by squeezing the supply chains. This is particularly the case with commodity-based GVCs, where big companies capture value by controlling the retailing stages of the chains, or with low-tech manufacturing GVCs, where TNC can squeeze value by inducing suppliers to increase scale and product quality and then, when resources are committed, exercising downward pressures on prices (‘hostage situations’; Williamson, 1983).

Second, from a learning perspective, the risk of committing resources in specific assets to perform relatively unsophisticated activities (basic processing or assembling) can lead to situation of production lock-in or value-chain delink in case of unmet quality standard requirements or emerging competitors. As a result, industrial systems in developing economies in the early stages of economic transformation are characterised by similar features: foreign-owned companies create few backward and forward linkages due to limited supplier and processor capacities in the host economy. Existing small enterprises lack the scale and skills to provide reliable intermediate products as well as the resources to invest in technological upgrading. Particularly problematic is therefore the lack of medium-sized manufacturing firms that can do those things – the so-called ‘missing middle’ phenomenon. The few domestic companies engaged in large-scale production face the same constraints and rely on imports of semi-processed raw materials and capital goods as well as on the re-export of assembled products, rather than being successful in creating backward and forward linkages. Breaking through this low-productivity, high-cost and low-value added cycle requires policy intervention (Andreoni, 2016c).

The emergence of a global production system and, thus, the proliferation of offshoring practices has gone hand in hand with the phenomenon of outsourcing, especially from the mature industrial economies (Andreoni and Gregory, 2013). As a result, the traditional sectoral boundaries – especially those between manufacturing and services – have become increasingly fuzzy. While the literature has increasingly recognised the emergence of companies specialised in knowledge-intensive production-related services, and the consequent difficulty in drawing the boundary around the manufacturing sector, less emphasis has been given to the fact that, even within the manufacturing sector, the boundaries between different manufacturing industries have become fuzzier. In fact, production units (manufacturing firms) providing intermediate goods and components are often involved in different ‘manufacturing processes’ (traditionally classified as different ‘manufacturing industries’). Sectoral boundaries are also continuously challenged by technical change. Technical innovations can change the nature of one sector while technical innovations crossing sectors can redefine the same sectoral boundaries. The problem is that standard classification of boundaries between sectors are mainly based on products, but they are better defined in terms of underlying production technologies and their linkages (Andreoni, 2016c). This problems associated with standard

Marshallian categorisations of industry boundaries has been originally raised by Nathan Rosenberg (1963:422; italics added):

“it is necessary to discard the familiar Marshallian approach, involving as it does the definition of an industry as a collection of firms producing a homogenous product- or at least products involving some sufficiently high cross-elasticity of demand. For many analytical purposes it is necessary to group firms together on the basis of some features of the commodity as a final product; but *we cannot properly appraise important aspects of technological developments ...until we give up the Marshallian concept of an industry as the focal point of our attention and analysis.* These developments [rapid technical change in the American production of machine tools] may be understood more effectively in terms of certain functional processes which cut entirely across industrial lines in the Marshallian sense...”

Technological linkages among different manufacturing processes may be used to define ‘capability domains’, that is, domains of techniques, productive knowledge, and production technologies/equipment that show high degree of similarity and complementarity. Beyond standard sectoral boundaries, a manufacturing process could be re-conceptualised according to the underpinning capability domain. Different manufacturing processes could be then clustered based on their reliance on particular capability domains. This procedure would allow for a transition from a product-based taxonomy to a production technology-based taxonomy.

Using this taxonomy, governments can target the development of capability domains (e.g., food processing, advanced materials, mechanics and control systems, ICT), rather than the development of particular industries defined in terms of the final product. Each one of these capability domains constitutes a platform of competencies, technologies, productive knowledge, and experiences that can be deployed in a plurality of sectors. For example, the agro-food sector might draw on a combination of food processing capabilities but also on the capabilities in mechanics and control systems for food packaging, the ICT capabilities for food tracking and, finally, the capabilities in advanced materials for smart packaging.

By nurturing the development of complementary sets of capabilities, the scope for technological innovation within and across sectors can be increased and new development trajectories built. Of course, the evolution of production capability domains is path dependent and context specific. A country’s production capabilities accumulate over time and tends to concentrate in specific geographical locations. Therefore, while governments should select the capability domains to develop (in

partnership with the private sector and according to its political vision), industrial policy strategies should be always accompanied by a country-specific mapping of inherited production capabilities and existing structures.

4.2 Financialisation

Since the 1980s the dramatic restructuring of the global production system has been coupled by an increasing financialisation process, starting with mature industrial economies. Financialisation has been particularly strong among those economies which developed an Anglo-Saxon variety of the capitalist model (Dore et al., 1999; Lazonick and O'Sullivan, 1997a and 1997b). It is now widely acknowledged that, in these economies, the recent financial crisis has been only the latest manifestation of structural unbalances resulting from widespread financialisation (Blankenburg and Palma, 2009). More recently, the financialisation process has also involved a number of developing countries, as revealed by declining trends in investment rates and their volatility (even among fast catching up economies like China), wages contraction and the growing share of finance in the GDP (UNCTAD, 2016).

Financialisation is a multifaceted phenomenon, as it operates at different levels (corporation, country, global) and involves different actors (managers, financial investors, banks and stock markets, as well as governments). As a result, the mechanisms whereby the global economy has become increasingly financialised are various, span across more than one country, and tend to reinforce each other. This is why addressing the problem of financialisation is extremely difficult from a single country policy perspective. For example, even taking for one moment aside the impact of global financial markets and assuming that a government has the policy space to reduce the instability of capital flows, the same government might not be able to stop more fundamental processes of financialisation occurring at the level of foreign corporations. Today, TNCs have become new potential channels through which financialisation practices are transmitted, this time in the form of financialised corporate strategies, corporate control and structures. This also means that through these various channelling mechanisms even countries at earlier stages of economic development (without a developed financial market) and relatively lower government regulatory capabilities can become over financialised.

We are now living in a financialised global economy where corporations have learned how to make profit without producing (Lapavitsas, 2013), and the overall

capitalist model is under threat given the shrinkage of the middle-class, increasing inequalities, and more critically the reduced capacity of corporations to create value and diffused prosperity (Lazonick, 2009 and 2014). We argue that, without tackling these multiple dimensions of the same financialisation phenomenon and without understanding the different ways in which it affects industry development (in particular, capital investment), even the most well design industrial policy will be ineffective.

Let's then start looking at financialisation from the corporation level. At this level, financialisation manifests itself in five fundamental forms, that is, (i) short-termism in investment strategy and corporate control, (ii) increasing distribution of dividends, (iii) increasing reliance/dependence on external finance, (iv) an increasing size of their financial division (*vis a vis* their production divisions) and, related to that, (v) the derailing of a growing share of profits away from productive investments towards buybacks of stocks and other speculative financial operations. The bottom line of this financialisation process is the breakage of the profit-investment nexus, which has driven the emergence of the Chandlerian 'modern business enterprise' and the industrialisation of today's developed countries (Kalecki, 1954; Kaldor, 1962; Andreoni, 2016d).

Historically, during the first wave of big business development, from the mid-19th century through the 1920s, finance capital did not play a critical role, with the exception of the financing of the infrastructures, primarily railroads and telecommunications. Industrial firms increased their scale mainly through reinvesting profits as well as adopting various corporate restructuring strategies, such as mergers to integrate production and distribution (O'Sullivan, 2010). Starting from the 1980s, this profit-investment nexus started weakening and corporations became increasingly financialised. The increasing globalisation and fragmentation of production, the refocusing of TNCs on core businesses and the increasing power of institutional investors, shifted corporate strategies from the old logic of 'retaining and investing' to one of 'downsizing and distribution'. The affirmation of what came to be called 'shareholder value' ideology (Lazonick and O'Sullivan, 2000; Lazonick 2014) is thus the main mechanism underpinning corporate financialisation, but there are others linked to that which cumulated in the financialisation of entire economies.

Not only was the investment-profit nexus broken, the relationship between the banking and the industrial sectors deteriorated dramatically (Andreoni, 2016d).

Financial system structures and their relationships with productive organisations have transformed since the beginning of the industrial revolution. Historically, cooperative and popular banks have played a central role during the initial stages of countries industrialisation, also by specialising on different productive sectors and market segments. The structural transformations of the productive sector and the increasing use of capital-intensive production systems have induced changes in the financial systems structure, at least in those countries that underwent the second industrial revolution.

Probably the most well-known example of the interplay between structural economic dynamics and institutional transformations is the one provided by Alexander Gerschenkron (1962: especially chapter 5). A century ago, when Germany was attempting to catch up with Britain, production technologies available were more capital intensive than those that had been discovered when Britain underwent its first round of industrialisation some fifty years before. Thus, Germany had to develop new institutional instruments for which there was “little or no counterpart in an established industrial country” such as coordinated investments, vertically integrated production units, and a financial sector which was transformed in its institutional form and functions.

The financial system has been itself increasingly ‘financialised’, in the sense that it has lost its capacity to adapt and respond to productive sectors specific needs, both in terms of their credit allocation, and risk assessment practices as well as diversity of credit products. It has also acquired the same short-termism characterising corporations embracing the same shareholder value ideology. It is interesting to note that, although to a lesser extent, even financial institutions like development banks have become paradoxically less capable to perform their critical functions (Andreoni, 2016d).

Finally, if we look at financialisation from the country and the global level perspectives, it has been widely stressed how the international financial architecture is incapable of channelling financial resources in the right direction – from the centre to the periphery – as well as into the productive sectors of the economy, thereby supporting industrial development and overall economic growth. Not only has the unregulated global financial system ineffective in making resources available where needed, it has in fact exposed countries to instability in financial capital flows and

macroeconomic shocks (Epstein, 2005; Chang, 2007). The financialisation of the global economy and the lack of global regulations in the areas of capital flows as well as tax avoidance and evasion have weakened governments in both developed and developing countries (country level). In particular, the capacity of governments to set and maintain favourable macroeconomic conditions for growth, finance infrastructural investments and industrial policy has been declining dramatically. Given that public investments tend to play a catalytic role for private investments (crowding-in effect), the reduced capacity of government to make investments (or support them through industrial policy) combined with the financialisation of corporation, has pushed economies towards a spiral of dis-investments and decumulation. This lack of investment in the future is a fundamental threat to the very social reproduction of the economy.

A number of policy measures entailing different levels of intervention aimed at countering the effects of financialisation have been proposed (UNCTAD, 2008 and 2016). At the corporate level, this includes longer reporting practices to enable evaluation from a longer-term perspective, restrictions on dividends distribution when investments are low (or even impoverishment of corporations' assets), restrictions on stock buy backs, minimum time thresholds on asset holding. At the country level, fiscal policies could be extremely powerful tools to affect corporate strategies, including the adoption of preferential fiscal treatments for investments and equity, special depreciation allowances. At the cross-country or the global level, the introduction of a Tobin tax on financial transaction, various forms of capital control as well as forms of quantitative easing.

Industrial policy can play an important role in reversing the vicious cycle caused by financialisation. However, given the systemic nature of the financialisation phenomenon, industrial policies are destined to fail if they are not aligned and coupled by interventions at all different levels discussed above, that is, at the level of corporate governance regulation, financial system regulation and global financial markets regulation.

4.3 Imperialism – Old and New

All economic policies have an international power dimension. For example, the rich countries have used the IMF and other global financial organisations that they

control in order to impose ‘monetarist’ macroeconomic policies on the developing countries in macroeconomic trouble, while conducting more ‘Keynesian’ policies when they face similar problems (Chang, 2007a, ch. 7). However, nowhere is this international power imbalance more prominent than in the area of industrial policy, whose scope has been very explicitly and clearly constrained by the imperialist policies of the stronger countries in the last three centuries. To put it bluntly, the imperialist countries have always done things to prevent weaker countries from entering more dynamic sectors, albeit with some differences in the degree of the constraints across different periods.

Up until the end of WWII, in the colonies, these actions took the most blatant forms (see Chang, 2002, pp. 51-53). First, certain high-value manufacturing activities were banned outright in the colonies. For example, under Robert Walpole, the construction of steel mills were banned in the American colonies, which were thus forced to specialise in (less sophisticated) iron. Second, exporting activities by producers in the colonies were restricted in order to minimise competition with the producers in the colonising countries. For example, in the 1699 Wool Act, Britain banned the export of woollen cloth from its colonies, including Ireland, whose woollen textile industry (which was considered superior to the British one at the time) never recovered from the blow. In 1700, Britain banned the importation of (then superior) cotton textile products from India (known as ‘calicoes’), destroying the industry. Third, in the colonies, raw material production was strongly encouraged through policies, with the explicit purpose of making manufacturing activities less attractive. For example, in the 1720s, Robert Walpole introduced subsidies for the production of raw materials like hemp and timber in the American colonies, while abolishing British import duties for those products.

Between the early 19th century and the mid-20th century, ‘unequal treaties’ were forced upon the weaker countries that were not formally colonies. Starting with the newly-independent Latin American countries in the 1810s and the 1820s (these ended in the 1870s and the 1880s), a string of nominally independent countries – the Ottoman Empire (Turkey today), China, Siam (Thailand), Persia (Iran), Korea, and even Japan, to name the most prominent ones – were forced to sign such treaties.

Among other things¹¹, these treaties deprived them of the right to set their own tariffs (known as ‘tariff autonomy’), which made it impossible for them to use infant industry protection. These treaties also introduced the concept of ‘most favoured nation’ (MFN), which enabled all the countries that signed (unequal) a treaty with a weaker country to get a more favourable treatment, if one of them manages to extract it, thus allowing the stronger countries to bully the weaker ones collectively. These treaties lasted well into the 20th century for some countries: for example, Japan’s, signed in 1854, expired in 1911; Turkey’s, signed in 1838, ended only in 1923; and China’s, signed in 1842, lasted until 1929.

With the end of the unequal treaties by the 1920s and the subsequent wave of de-colonisation between the 1940s and the 1970s, the imperialist countries significantly loosened their grips on what the developing countries could and could not do. The new global regime of trade, embodied in the GATT, put only mild restrictions on the trade policy of developing countries, with the choice not to sign up to the agreements that they don’t want (so-called plurilateralism). Within this relatively permissive framework, the need for infant industry protection and other industrial policy measures were widely recognised, although the free-trade ideology re-asserted itself soon enough. By the 1970s, the ‘second phase’ industrial policies were under severe attack.

The 1980s was the turning point. Following the Third World Debt Crisis of 1982, IMF-World Bank Structural Adjustment Programmes (SAPs) – which emphasised trade liberalisation, de-regulation, and privatisation – were rolled out across the developing world. The collapse of the Soviet bloc in the late 1980s ushered in an era of free-market triumphalism, further strengthening the ideological dominance of free-market, free-trade economics worldwide.

These shifts were institutionally consolidated in the 1990s. In 1994, the NAFTA (North American Free Trade Agreement), the first free-trade agreement comprising both developed and a developing country, was signed. The NAFTA also contained an important new provision, known as chapter 11, on the so-called Investor State Dispute Settlement (ISDS) mechanism, which unprecedentedly allowed corporations to directly sue host governments for damaging their profits through

¹¹ The most important of these was ‘extra-territoriality’, which deprived the weaker countries of the right to try foreign citizens who are accused of criminal activities.

regulation. In 1995, following the conclusion of the so-called Uruguay Round of trade talks, the GATT was transformed into the WTO. In contrast to the plurilateral principle of the GATT, the WTO demanded that all member countries sign up to all the agreements (the so-called ‘single undertaking’ provision), which were not only more restrictive than those under the GATT but also covered new areas, most notably intellectual property rights (TRIPs) and regulations on foreign investment (TRIMs). The 1990s also saw the rapid spreading of investment treaties. The number of investment treaties signed were less than 50 per year in the 1980s, but it started increasing from 1990s, shooting up to over 100 per year in 1992 and then numbering between 150 and 200 per year between 1994 and 2002. The cumulative number of investment treaties, which was less than 500 at the beginning of the 1990s, went over 2,000 by the end of the decade (Tucker, 2014, p. 36, figure 1). The number of bilateral free trade agreements also started increasing in the 1990s and exploded in the 2000s; they numbered around 50 in the mid-1990s but there are now over 250 of them.¹²

Today, the developing countries are much more constrained in the use of many industrial policy measures that were the standard fares of the early post-colonial era between the mid-1940s and the mid-1970s. However, it is important to note that, unless they have signed bilateral agreements with the rich countries, there is still a considerable amount of ‘policy space’ (for further details on the points below, see Chang et al., 2016, chapter 5, section 5.1).

First, there are industrial policy measures that are basically domestic in nature and thus not subject to international agreements. Targeted infrastructural investments, subsidies for (or public provision of) worker training or R&D, government procurement programme, tax incentives for physical investments, the strategic use of SOEs are only some of the more prominent examples of ‘domestic’ policies. As a rule of thumb, with regard to multilateral obligations, if a policy measure does not affect exports or imports, it does not fall directly under WTO laws and should be allowed.

Second, many industrial policy measures that are international in nature can still be used. Some policy measures have no international restrictions because no international consensus has evolved around them. Also, ambiguities in certain rules or their application can create further scope for pushing certain policies till they are

¹² <http://www.economist.com/blogs/graphicdetail/2015/10/global-trade-graphics>

detected or challenged. For some measures, international rules do not apply or do so rather leniently to developing countries, especially the least developed countries (LDCs). For example, they can use export subsidies that are illegal for all others.

Third, as for tariffs, there is still quite a room for using them. The WTO requirement is only that its members 'bind' (that is, set the upper limit to) at least some of their tariffs. As a result, many poorer members of the WTO have bound virtually none of their tariffs, while even many of those who have bound their tariffs have done so at quite high levels. Given that the current levels of tariffs in most countries are well below their bound levels, they can raise tariffs substantially, if they wanted. Countries can also apply extra tariffs or even quantitative restrictions to address balance of payments problems, even though the procedures for getting the permission from the WTO are rather cumbersome – several countries, such as Indonesia and Ecuador, have used the provision.

Fourth, as for subsidies, the WTO categorically bans only those for export promotion (except for the LDCs and some selected developing countries) and those requiring local contents. However, all subsidies can be challenged in a WTO dispute ('actionable' in the WTO parlance). However, the procedures of subsidies dispute are rather complicated and time-consuming, so even an 'illegal' subsidy can remain in force a few years before it is challenged (if it ever is) and ruled illegal – even not counting another few years that may be needed for the accumulation of the damage that makes it eligible for a WTO dispute. Also, there are 'safer' subsidies – those for R&D, upgrading of disadvantaged regions, and developing environmentally friendly technology. They are 'actionable', but have hardly ever been challenged, most probably because they are subsidies frequently used by the rich countries.

Fifth, under the WTO, it has become more difficult to regulate FDI, due to the (Trade Related Investment Measures) agreement and the GATS (General Agreement on Trade in Services) agreement. However, not all is lost. The TRIMs agreement only prohibits domestic content requirements and foreign exchange balancing requirements. Regulations regarding joint venture, technology transfer, or limitations on foreign equity ownership can still be used. As for the GATS, countries are required to accept restrictions on their FDI regulation only in sectors in which they have made 'commitments' – most countries, especially developing countries, have made only a limited number of commitments in relation to the service industries.

To sum up, the restrictions on industrial policy by developing countries have become strengthened in the last couple of decades, with the launch of the WTO, and the proliferation of bilateral and regional free trade agreements (FTAs) and bilateral investment treaties (BITs), when compared to the period between the mid-1940s and the mid-1970s. However, industrial policy has certainly not become impossible.

For countries that have not fully integrated themselves into the international system (e.g., some countries are not yet even WTO members), the ‘policy space’ is still ample. Countries that are WTO members have more restrictions, but there is still considerable room for manoeuvre. Of course, industrial policy becomes much more difficult if you have signed bilateral (or regional) trade or investment agreements with the US or the EU, as they are ‘WTO-plus’. However, even here, there is some room for manoeuvre. Even for developing countries that have signed multiple FTAs with the rich countries (e.g., Chile), the room for policy manoeuvre is still greater than what it was during the days of old imperialism. Especially in relation to the BITs (bilateral investment treaties), countries can revoke them. Indeed, recently South Africa has revoked 14 of its 47 BITs, while Bolivia, Ecuador and Venezuela have opted out of the controversial Investor State Dispute Settlement (ISDS) mechanism (which allows foreign investors directly sue governments).

In other words, the recent shrinkage in policy space does not spell the end of industrial policy. It just means that industrial policy-makers of the developing countries need to know the international constraints on their policies well, so that they can use policy measures that are not just most effective but are politically most feasible (see Chang, 2007b, for further discussion on policy space in historical perspective).

5. Concluding remarks

Since the eighteenth century, the debate surrounding industrial policy has been one of the most important in the political economy of development. However, with the end of the so called Golden Age of capitalism and the global affirmation of the Washington Consensus, the word ‘industrial policy’ was banned, and remained so until the end of the century. However, since the mid-2000s, and increasingly after the global financial crisis, we have witnessed a resurgence of interest for industrial policy in both the academic and policy circles. This has led to the proliferation of a

substantial amount of new contributions, up to the point that today we can talk of a mainstreaming of industrial policy. The paper contributed to this debate along three main lines, towards the development of a new theory of industrial policy grounded in the Cambridge tradition.

First, we put today's industrial policy debate into perspective by providing an historical-analytical reconstruction of the theories of industrial policy. In particular, we distilled the basic principles developed by key contributors during the first three waves of industrial policy thinking since its start. From this standpoint, we deconstructed today's mainstream theories of industrial policy by looking at both the supposedly new theoretical rationales for industrial policy, as well as the empirical tools that these approaches proposed for policy design. A number of critical limitations were identified which suggested the need for a more fundamental rethinking of the mainstream theory of industrial policy, and the proposition of an alternative framework.

In the second 'costruens' part of the paper, we drew heavily on the Cambridge theoretical (and policy thinking) legacy to develop the building blocks of a new theory of industrial policy. We showed how this tradition has a lot to contribute in a number of areas which have been neglected in the industrial policy debate so far. The paper systematised insights from key thinkers within the Cambridge tradition which cut across the micro-meso and macro dimension of industrial policy as well as the political economy of industrial policy.

Starting from the firm level, the paper showed how the problems of commitments under uncertainty, in particular with respect to specific productive investments, is a key issue as it affects one of the most fundamental driver of capitalist accumulation and technological change. Then we moved to analyse various processes of learning in production and the critical relationship between agency and material structures within the production realm. We highlighted how learning is the main source of value creation and how it involves various firms and sectors. Third we showed how the dynamics triggered by the commitments under uncertainty and learning processes within firms are linked in a circular and cumulative relationship with demand. In this respect, we highlighted how a virtuous industrialisation cycle is possible only within certain macroeconomic conditions. The problem of macroeconomic management and, in particular demand management, opens a completely unexplored chapter in the theory of industrial policy. Finally, we focused

on the political economy of industrial policy, specifically by concentrating on the most fundamental function performed by the state in the industrialisation process, that is, conflict management.

The third part of the paper juxtaposed these new insights with three critical features of today's global economy. First, we analysed how the transformation of the global production system has led to a new accumulation regime as well as new value creation and capture dynamics. In this respect, we focused on the importance of looking at the vertical disintegration of global businesses, the increasing fuzziness of standard sectoral boundaries, and how production processes are better clustered within capability domains. Second, we analysed the financialisation of the global economy. We showed how the financialisation of corporations as well as of the same financial system has led to a spiral of under-investments, and is threatening the social reproduction of capitalist economies. Finally, we looked at the extent to which countries have been able to provide policy responses to these new challenges within the new global policy regime. The analysis focused on the distinctive features of what we can call a new form of imperialism.

Today's industrial policy discussion has entered a decreasing return trajectory. The proliferation of ungrounded contributions and their increasing 'mainstreaming' are responsible for the persistent neglect of a number of key issues, and a lack of understanding of their relationships with the new global challenges. This paper attempted to provide a new theory of industrial policy which we hope will set the current industrial policy debate within a new increasing returns trajectory.

Bibliography

- Agarwala, A. & Singh, S. (eds.) 1958. *The Economics of Underdevelopment*, Delhi, Oxford University Press.
- Amsden, A. 1985. 'The State and Taiwan's Economic Development' in P. Evans, D. Rueschemeyer & T. Skocpol (eds.), *Bringing the State Back In*, Cambridge, Cambridge University Press
- Amsden, A. 1989. *Asia's Next Giant*, New York, Oxford University Press
- Andreoni, A. (2014) 'Structural Learning: embedding discoveries and the dynamics of production', *Structural Change and Economic Dynamics*, 29, 58-74.
- Andreoni, A. (2015a) 'The Political Economy of Industrial Policies: after the crisis, back on the agenda', in Mattei, U. and Haskell, J., eds., *Handbook of Political Economy and Law*, Cheltenham, UK and Northampton, USA: Edward Elgar.
- Andreoni, A. 2016a. 'Varieties of Industrial Policy: Models, Packages and Transformation Cycles', in Noman, A. and J. Stiglitz, eds., *Efficiency, Finance and Varieties of Industrial Policy*, New York: Columbia University Press
- Andreoni, A. 2016b. 'Strategies for Emerging Technologies and Strategic Sectors', *OECD Science, Technology and Industry Working Papers*.
- Andreoni, A. 2016c. 'A Generalised Linkage Approach to Local Production Systems Development in the Era of Global Value Chains, with special reference to Africa', IPD Task Force Paper, Columbia University.
- Andreoni, A. 2016d. 'The production-finance nexus', UNCTAD Working paper.
- Andreoni A. and Scazzieri, R. (2014) 'Triggers of Change: structural trajectories and production dynamics', *Cambridge Journal of Economics*, 38(6), 1391-1408.
- Andreoni, A. and O'Sullivan E. 2014. 'Vectors of innovation in industrial ecosystems: The role of specialist production and engineering contractors in the co-detection and co-creation of opportunities', presented at the Edith Penrose Centenary Conference, SOAS – University of London, 14-15 November
- Andreoni, A. and Chang, H-J. 2014. 'Agricultural policy and the role of intermediate institutions in production capabilities transformation: Fundacion Chile and Embrapa in action', DRUID Annual Conference, Copenhagen, 16-18 June
- Andreoni, A. and Chang, H.-J. 2016. 'Bringing production transformation and jobs creation back development: Alice Amsden's legacy for a New Developmentalist agenda' under review for *Cambridge Journal of Regions, Economy and Society*
- Andreoni, A., Frattini, F. and Prodi, G. (2016) 'Structural Cycles and Industrial Policy Alignment: The private-public nexus in the Emilian packaging valley', *Cambridge Journal of Economics*, forthcoming.
- Antonelli, C., Link, A. and Metcalfe, S. 2013. *Technology infrastructure*, Routledge.
- Badaracco, J. & Yoffie, D. 1983. "'Industrial Policy": It Can't Happen Here', *Harvard Business Review*, Nov./Dec. 1983
- Arrow, K. 1962. 'The economic implications of learning by doing', *Review of Economic Studies*, 29:155-173
- Babbage, C. 1832. *On the Economy of Machinery and Manufactures*, London, Charles Knight.
- Balassa, B. 1988. 'The Lessons of East Asian Development: An Overview', *Economic Development and Cultural Changes*, vol. 36, no. 3, Apr. 1988, Supplement.
- Berger, S. 2013. *Making in America*, Cambridge, MIT Press.
- Best, M. 1990. *The New Competition. Institutions of Industrial Restructuring*, Cambridge: Polity Press.
- Block, F. 2008. 'Swimming Against the Current: The Rise of a Hidden Developmental State in the United States', *Politics and Society*, vol. 36, no. 2.
- Block, F. and Keller, M. 2011. *State of Innovation. The US Government's Role in Technology Development*, Paradigm.
- Brisco, N. 1907. *The Economic Policy of Robert Walpole*, Columbia University Press, New York.
- Burton, J. 1983. *Picking Losers . . . ? : The Political Economy of Industrial Policy*, London, Institute of Economic Affairs
- Chang, H-J. 1993. 'The Political Economy of Industrial Policy in Korea', *Cambridge Journal of Economics*, vol. 17, no. 2.
- Chang, H-J. 1994. *The Political Economy of Industrial Policy*, Basingstoke, Macmillan.
- Chang, H-J. 1995. 'Explaining "Flexible Rigidities" in East Asia' in T. Killick (ed.), *The Flexible Economy – Causes and Consequences of the Adaptability of National Economies*, London, Routledge.

- Chang, H-J. 1998. 'Luxury Consumption Control and Economic Development', a report submitted to UNCTAD (United Nations Conference on Trade and Development), Geneva.
- Chang, H-J. 2002. *Kicking Away the Ladder – Development Strategy in Historical Perspective*, London, Anthem Press.
- Chang, H-J. 2007a. *Bad Samaritans*, London, Random House, and New York, Bloomsbury USA.
- Chang, H-J. 2007b. 'Policy Space in Historical Perspective – with special reference to Trade and Industrial Policies' in A. Deshpande (ed.), *Globalization and Development – A Handbook of New Perspectives*, New Delhi, Oxford University Press
- Chang, H-J. 2010. *23 Things They Don't Tell You About Capitalism*. London: Penguin Group.
- Chang, H-J. 2011. 'Industrial Policy: Can We Go Beyond an Unproductive Confrontation?' in J. Lin and B. Pleskovic, (eds.), *Annual World Bank Conference on Development Economics 2010, Global: Lessons from East Asia and the Global Financial Crisis*, Washington, DC, World Bank.
- Chang, H-J., Hauge, J. & Irfan, M. 2016. *Transformative Industrial Policy for Africa*, Addis Ababa, United Nations Economic Commission for Africa.
- Cherif, R. & Hasanov, F. 2014. 'Soaring of the Gulf Falcons: Diversification in the GCC Oil Exporters in Seven Propositions' Working Paper WP/14/177, Washington, D.C., the International Monetary Fund (IMF)
- Cohen, S. 1977. *Modern Capitalist Planning: The French Model*, 2nd edition, Berkeley, University of California Press
- Cohen, S. & Zysman, J. 1987. *Manufacturing Matters*, New York, Basic Books
- Cohen, S. and DeLong, J.B.. 2016. *Concrete Economics*, Harvard: Harvard Business Review Press.
- Dertouzos, M.L., Lester, R.K., and Solow, R. 1989. *Made in America. Regaining the Productive Edge*, Cambridge, MIT Press.
- Dogdson, M., Hughes, A. Foster, J. and Metcalfe, S. 2011. 'System thinking, market failure, and the development of innovation policy: The case of Australia', *Research Policy*, 40, 1145-1156.
- Dore, R. 1986. *Flexible Rigidities: Industrial Policy and Structural Adjustment in the Japanese Economy 1970-80*, London, The Athlone Press
- Ellman, M. 1979. *Socialist Planning*, Cambridge, Cambridge University Press.
- Erlich, A. 1960. *The Soviet Industrialization Debate, 1924-28*, Cambridge, Massachusetts, Harvard University Press.
- Felipe, J. 2015. Ed., *Development and Modern Industrial Policy in Practice*, Edward Elgar.
- Fransman, M. 1990. *The Market and Beyond*, Cambridge, Cambridge University Press.
- Gamble, A. 1988. *The Free Economy and the Strong State: The Politics of Thatcherism*, London and Basingstoke, Macmillan.
- Gereffi, G. 2014. 'Global value chains in a post-Washington Consensus world', *Review of International Political Economy*, 21(1), 9-37.
- Gerschenkron, A. 1962. *Economic Backwardness in Historical Perspective*, Cambridge, Harvard University Press.
- Gilboy, E. W. 1932. 'Demand as a Factor in the Industrial Revolution', in A.H. Cole et al (eds.) *Facts and Factors in Economic History*, Cambridge Mass, Harvard University Press,
- Glyn, A. 2007. *Capitalism Unleashed*, Oxford: Oxford University Press.
- Hall, P. 1987. *Governing the Economy*, Cambridge, Polity Press
- Hausmann, R. & Rodrik, D. 2002. 'Economic Development as Self-discovery', Working Paper no. 8952, National Bureau of Economic Research.
- Hausmann, R. & Rodrik, D. 2006. 'Doomed to Choose – Industrial Policy as Predicament', mimeo., John F. Kennedy School of Government, Harvard University.
- Hayward, J. 1986. *The State and the Market Economy*, Brighton, Wheatsheaf Books.
- Hidalgo, C. & Hausmann, R. 2009. 'The Building Blocks of Economic Complexity', *Proceedings of the National Academy of Sciences*, vol. 106, no. 26.
- Hirschman, A. O. 1958. *The Strategy of Economic Development*. New Haven, Conn.: Yale University Press.
- Hirschman, A. O. 1977. 'A generalized linkage approach to economic development with special reference to staples', *Economic Development and Cultural Change*, 25:67-97.
- Imbs, J. and Wacziarg, R. 2003. 'Stages of Diversification', *American Economic Review*, 93, 1, 63-86.
- Johnson, C. 1982. *MITI and the Japanese Miracle*, Stanford, Stanford University Press
- Jones, C. and Romer, P. 2009. 'The new Kaldor facts: ideas, institutions, population, and human capital', *NBER Working paper series* 15094.

- Kaldor, N. 1966. *Causes of the Slow Rate of Economic Growth of the United Kingdom*, Cambridge, Cambridge University Press.
- Kaldor, N. 1971. 'Conflicts in National Economic Objectives', *The Economic Journal*, LXXXI, 1-16.
- Kaldor, N. 1972. 'Capitalism and industrial development: some lessons from Britain's experience', *Cambridge Journal of Economics*, 1, 193-204.
- Kaldor, N. 1985. *Economics without Equilibrium*, New York: ME Sharpe
- Kaplinsky, R. and Morris, M. 2015. 'Thinning and Thickening: Productive Sector Policies in the Era of Global Value Chains', *European Journal of Development Research*.
- Katzenstein, P. 1985. *Small States in World Markets*, Ithaca, Cornell University Press
- Khan, M. H., and K.S. Jomo. 2001. *Rents, Rent-seeking and Economic Development*. Cambridge: Cambridge University Press.
- Khan, M. 2013. "Technology Policies and Learning with Imperfect Governance." In *The Industrial Policy Revolution I*, pp. 79-115, ed. J. Stiglitz and J. Lin. Basingstoke: Palgrave
- Klein Woolthuys, R., Lankhuizen, M. and Gilsing, V. (2005), 'A system failure framework for innovation policy design', *Technovation*, 25, 609-619.
- Lall, S. 1994. The East Asian Economic Miracle: Does the Bell Toll for Industrial Strategy?, *World Development*, vol. 22, no. 4.
- Laranja, M., Uyarra, E. and Flanagan, K. 2008. 'Policies for science, technology and innovation: Translating rationales into regional policies in a multi-level setting', *Research Policy*, 37, 823-835.
- Lazonick, W. 2009. *Sustainable prosperity in the new economy?*, UPJOHN Institute.
- Lazonick, W. 2010. 'The Chandlerian Corporation and the Theory of Innovative Enterprise', *Industrial and Corporate Change*, 19, 2: 317-349.
- Lazonick, W. 2014. 'Profits without Prosperity', *Harvard Business Review*, Sept.
- Lazonick, W., O'Sullivan, M. 1997. 'Finance and industrial development. Part I: the United States and the United Kingdom', 4,1, 7-29
- Lazonick, W., O'Sullivan, M. 1997. 'Finance and industrial development. Part II: Japan and Germany', 4,2, 117-138.
- Lazonick, W., O'Sullivan, M. 2000. 'Maximizing shareholder value: a new ideology for corporate governance', *Economy and Society*, 29,1, 13-35.
- Lee, K. 2013. *Schumpeterian Analysis of Economic Catch-up*, Cambridge, Cambridge University Press.
- Lin, J. & Chang, H-J. 2009. 'Should industrial policy in developing countries conform to comparative advantage or defy it? - A debate between Justin Lin and Ha-Joon Chang', *Development Policy Review*, 2009, vol. 27, no. 5
- Lindbeck, A. 1981. 'Industrial Policy as an Issue in the Economic Environment', *The World Economy*, vol. 4, no. 4.
- Linberg, N. & Maier, C. (eds.) 1985. *The Politics of Inflation and Economic Stagnation*, Washington, D.C., The Brookings Institution.
- Link, A. and Scott, J. 2011. *Public Goods, Public Gains: Calculating the Social Benefit of Public R&D*, New York: Oxford University Press.
- Magaziner, I. & Hout, T. 1980. *Japanese Industrial Policy*, London, Policy Studies Institute.
- Mahmood, M, Andreoni, A. and Chang, H.-J. *Developing with Jobs: Manufacturing Growth, Productive Employment and Policies in Developing Countries*, Basingstoke, Palgrave.
- Malerba, F. 2002. 'Sectoral system of innovation and production', *Research Policy*, 31, 247-264
- Marconi, N., de Borja Reis, C. and de Araujo, E. 2016. 'Manufacturing and economic development: The actuality of Kaldor's first and second laws', *Structural Change and Economic Dynamics*, 37, 75-89.
- Marshall, A. 1920 [1919]. *Industry and Trade*, London, Macmillan
- Mazzucato, M. 2013. *The Entrepreneurial State*, London, Anthem Press.
- Metcalfe, S. 1995. 'Technology systems and technology policy in an evolutionary framework', *Cambridge Journal of Economics*, 19, 25-46.
- Milberg, W., Winkler, D. 2013. *Outsourcing Economics. Global Value Chains in Capitalist Development*. Cambridge: Cambridge University Press.

- Nielson, J., Pritchard, B., Wai-chung Yeung, W. 2014. 'Global value chains and global production networks in the changing international political economy: An introduction', *Review of International Political Economy*, 21(1), 1-8.
- Nolan, P. 2001. *China and the Global Economy: National Champions, Industrial Policy, and the Big Business Revolution*. New York: Palgrave.
- Nolan, P. 2007. *Integrating China: towards the coordinated market economy*, London: Anthem.
- Noman, A. and Stiglitz, J. 2015. Eds., *Industrial Policy and Economic Transformation in Africa*, New York: Columbia University Press.
- Noman, A. and J. Stiglitz, eds., *Efficiency, Finance and Varieties of Industrial Policy*, New York: Columbia University Press
- Okimoto, D. 1989. *Between MITI and the Market: Japanese Industrial Policy for High Technology*, Stanford, Stanford University Press.
- O'Sullivan, M. 2010. 'Finance capital in Chandlerian capitalism', *Industrial and Corporate Change*, 19, 2, 549-589.
- Pasinetti, L. L. 1981. *Structural Change and Economic Growth: A Theoretical Essay on the Dynamics of the Wealth of Nations*, Cambridge, Cambridge University Press
- Pasinetti, L.L. 2007. *Keynes and the Cambridge Keynesians. A 'Revolution in Economics' to Be Accomplished*, Cambridge, Cambridge University Press
- Penrose, E. 1959. *The Theory of the Growth of the Firm*, Oxford: Oxford university Press.
- Piore, M. & Sabel, C. 1984. *The Second Industrial Divide*, New York, Basic Books.
- Pisano, G. P., & Shih, W. C. 2013. *Producing Prosperity*. *Harvard Business Review Press*.
- Pitelis, C. 2016. 'Learning, innovation, increasing returns and resource creation: Luigi Pasinetti's 'original sin' of, and call for a post-classical, economics', *Cambridge Journal of Economics*
- Reich, R. 1982. 'Why the U.S. Needs an Industrial Policy', *Harvard Business Review*, Jan./Feb. 1982
- Richardson, G. B. 1960. *Information and Investment*, Oxford, Oxford University Press
- Richardson, G. B. 1972. The Organisation of Industry. *The Economic Journal*, 82(327), 883-896.
- Robinson, J. 1933. *The Economics of Imperfect Competition*, London MacMillan.
- Rodrik, D. 1994. 'King Kong Meets Godzilla' in A. Fishlow et al., *Miracle or Design? - Lessons from the East Asian Experience*, Washington, D.C., Overseas Development Council.
- Rodrik, D. 2004. 'Industrial Policy for the Twenty-First Century', UNIDO Working paper.
- Rosenberg, N. (1963) Technological Change in the Machine Tool Industry 1840-1910, *Journal of Economic History*, 23:414-443.
- Rosenberg, N. 1969. 'The direction of technological change: inducement mechanisms and focusing devices', *Economic Development and Cultural Change*, 18, 1-24.
- Rosenberg, N. 1982. *Inside the Black Box: Technology and Economics*, Cambridge, Cambridge University Press.
- Rosenberg, N. and Steinmueller, W.E. 2013. 'Engineering Knowledge', *Industrial and Corporate Change*, 22(5), 1129-1158.
- Rowthorn, B. 1977. 'Conflict, Inflation, and Money', *Cambridge Journal of Economics*, vol. 1, no. 1.
- Shackle, G. 1940. 'The Nature of the Inducement to Invest', *Review of Economic Studies*, vol. 8. No. 1.
- Singh, A. 1971. *Take-overs*, Cambridge: Cambridge University Press.
- Soete, L. 2007. 'From Industrial to Innovation Policy', *Journal of Industrial Competitiveness and Trade*, 7, 273-284.
- Sraffa, P. 1926. 'The Laws of Returns under Competitive Conditions', *The Economic Journal*, 144, 535-550.
- Stiglitz, J., 1987. 'Learning to learn, localized learning and tech-nological progress'. In: Dasgupta, P., Stiglitz, J. Eds., *Economic Policy and Technological Performance*. Cambridge, Cambridge University Press.
- Stiglitz, J., Lin, J.Y., and Patel, E. 2013. Eds., *The Industrial Policy Revolution II*, Basingstoke, Palgrave.
- Stiglitz, J. and Greenwald, B. 2014. *Creating a Learning Society*, New York: Columbia University Press.
- Tassey, G. 2007. *The Technology Imperative*, Edward Elgar.
- Tassey, G. 2014. 'Competing in Advanced Manufacturing: The Need for Improved Growth Models and Policies', *Journal of Economic Perspectives*, 28(1), 27-48.
- Toner, P. 1999. *Main Currents in Cumulative Causation Theory*, Basingstoke, Palgrave.
- Toye, J. 1987. *Dilemmas of Development*, Blackwell, Oxford.
- Treize, P. 1983. 'Industrial Policy is not the Major Reason for Japan's Success', *The Brookings Review*, vol. 1, spring.

- Tucker, T. 2014. 'Institutions and Development Ideologies in Investment Arbitration', Ph.D. dissertation, Centre of Development Studies, University of Cambridge.
- Pigou, A. 1927. 'The Law of Diminishing and Increasing Costs', *The Economic Journal*, 37, 188-187.
- UNCTAD. 2008. *Commodity prices, capital flows and the financing of investment*, Trade and Development Report, Geneva, UNCTAD.
- UNCTAD. 2016. *Structural transformation for inclusive and sustained growth*, Trade and Development Report, Geneva, UNCTAD.
- Wade, R. 1990. *Governing the Market*, Princeton, Princeton University Press
- Wade, R. 2012. 'Return of industrial policy?', *International Review of Applied Economics*, 26:2, 223-239.
- Williamson, O. 1983. 'Credible Commitments: Using Hostages to Support Exchange', *American Economic Review*, 73(4), 519-540.
- World Bank 1993. *The East Asian Miracle – Economic Growth and Public Policy*, New York, Oxford University Press.
- Young, A. 1928. 'Increasing Returns and Economic Progress', *Economic Journal*, 38, 518-42.