



# WHO'S AFRAID OF INDUSTRIAL POLICY?



Asia-Pacific Trade and Investment Initiative  
UNDP Regional Centre in Colombo

### **RCC Discussion Paper Series**

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# WHO'S AFRAID OF INDUSTRIAL POLICY?

DISCUSSION PAPER

Asia Pacific Trade and Investment Initiative  
UNDP Regional Centre in Colombo

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Dedicated to the memory of Dr. Sanjaya Lall, innovative and eminent development economist who was based at Oxford University.

## Preface

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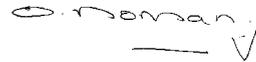
International trade has assumed a central role in economic growth and poverty reduction efforts in developing countries. Since its establishment in 2002, the Asia-Pacific Trade and Investment Initiative (APTII) at the UNDP Regional Centre in Colombo has contributed to developing approaches and strategies which help align trade dynamics with the objectives of poverty reduction and human development in the Asia-Pacific region. The APTII has promoted innovative research and policy advice that seek to clearly define the substantive linkages between trade and human development and is consistent with the objective of supporting the attainment of the Millennium Development Goals (MDGs).

Striving to build on its previous work and achievements, in its third and current phase of the work programme (2008-2011), the APTII aspires to make a significant contribution to policy dialogues by fostering regional trade and investment regimes that are consistent with human development goals in the region. A central challenge facing policy-makers in the region is to facilitate patterns of inclusive regional integration that enable them to address specific development priorities and goals, particularly with reference to the development needs of least developed countries (LDCs), landlocked developing countries (LLDCs) and small island developing states (SIDS). The focus, for APTII's current work programme therefore, will be on 1) enhancing trade competitiveness and capacity development to formulate employment- and gender-responsive trade policies; and 2) capacity strengthening to implement pro-poor regional integration strategies, including through key regional processes and/or mechanisms. In line with this focus, APTII will publish a series of studies and discussion papers which shall highlight the policy implications of the multifaceted dimensions of the current trade trends and patterns and their human development impacts in the Asia-Pacific region.

The current study, *Who's Afraid of Industrial Policy?*, by Emel Memiş and Manuel F. Montes seeks to examine the rationale and relevance of industrial policy for countries in an open economy setting. Many observers consider that strategic trade and industrial policies have propelled the success of East Asian economies leading to significant poverty reduction. Industrial policy is seen as a key driver for increasing the participation of new productive

sectors in domestic economy across the agriculture, industry and services sectors. The paper has conducted a survey of the industrialization experience in the Asia-Pacific while drawing out the critical policy lessons and mapping the challenges for the future.

We hope that the study would be useful to the governments, UNDP country offices, research institutions, civil society and other stakeholders in the Asia-Pacific region in furthering the debate on operationalizing the concept of industrial policy in diverse settings.

A handwritten signature in black ink, appearing to read "Omar Noman", with a checkmark at the end.

*Omar Noman*  
*Chief of Policies and Programmes*  
*UNDP Regional Centre in Colombo*

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## Abbreviations and acronyms

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|             |   |
|-------------|---|
| CAMA        | Centre for Applied Macroeconomic Analysis               |
| ECLAC       | Economic Commission for Latin America and the Caribbean |
| ESS         | Error Sum of Squares                                    |
| FDI         | Foreign Direct Investment                               |
| GDP         | Gross Domestic Product                                  |
| HCI         | Heavy and Chemical Industry                             |
| IBM         | Integrate Business Machines                             |
| IISEC       | Instituto de Investigaciones Socio-Económicas           |
| IMF         | International Monetary Fund                             |
| LEM         | Laboratory of Economics and Management                  |
| MDGs        | Millennium Development Goals                            |
| MIT         | Massachusetts Institute of Technology                   |
| MVA         | Manufacturing Value-Added                               |
| NAMA        | Non-Agricultural Market Access                          |
| OECD        | Organisation for Economic Co-operation and Development  |
| R&D         | Research and Development                                |
| RBF         | Rockefeller Brothers Fund                               |
| SUM         | Centre for Development and the Environment              |
| TRIMs       | Trade-Related Investment Measures                       |
| TRIPS       | Trade-Related Aspects of Intellectual Property Rights   |
| U.S./US/USA | United States/United States of America                  |
| UK          | United Kingdom  |
| UNCTAD      | United Nations Conference on Trade and Development      |
| UNIDO       | United Nations Industrial Development Organization      |
| UNDP        | United Nations Development Programme                    |
| UNSD        | United Nations Statistical Division                     |
| WTO         | World Trade Organization                                |

## Executive summary

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Industrial policy is the application of selective government interventions to favour certain sectors so that their expansion benefits the productivity of the economy as a whole. This study surveys the industrialization experience in the Asia-Pacific, drawing lessons and indicating challenges for the future. A lesson that can be drawn from this region of 'successful' globalizers is that development through strategic, as opposed to passive, integration into the external economy is possible. In the successful Asia-Pacific economies, the State played an indispensable role in undertaking the strategic integration, through various policies that can be categorized as industrial policy. The key thesis that this paper seeks to develop is that industrial policy, defined as State intervention to support new production activities and to build domestic capabilities in specific areas, is even more indispensable for countries seeking to pursue their development by integrating internationally. Governments are 'doomed to choose' to undertake 'industrial policy', whether consciously or otherwise. The more dependent countries are on exports and the international economy, the more unavoidable is industrial policy due to specific features in technology when undertaking efforts in capability building.

This paper makes the argument that governments in developing countries would be better off having a deliberate and explicit industrial policy, consistent with their natural endowments, their stage of development, and their political arrangements. Industrial policy involves the configuration and management of relations between the State, on the one hand, and investors, capitalists, and firms, on the other. When development is redefined as the reduction of poverty, effective industrial policy occurs when the ongoing relationship of firms and production units to the State results in risk-taking, technical upgrading, investment, and growth that reduces poverty.

The paper also explores the required capacities that States need for industrial policy, addressing the observations that governments do not have the knowledge and tools to intervene and that the international rules severely constrict the space of governments to do so. It discusses the role of policy space and the kind of reforms in the international arena that are needed to permit countries to be truly responsible for their own development.

# 1. Introduction

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Trade policy plays an indispensable role in poverty reduction. A productive interaction with the international economy is necessary for upgrading domestic productivity through the adaptation of foreign technology and processes and the exploitation of external markets to reduce domestic unemployment. This paper discusses the channels through which trade and government policy interact in efforts to raise domestic productivity through the process of industrialization.

It can be said that nations that have risen out of poverty have done so through the process of industrialization. While it is entirely possible that external trade in the services sector, which has recently been increasingly acquiring importance in certain developing countries, such as India, will make possible another path out of poverty without industrialization, the only proven path out of underdevelopment at the time of this writing, however, has been through industrialization. The transformation of a society from a pre-industrial to an industrial one has involved the following elements:

- (i) a qualitative increase in the use of capital and machinery in the production of goods and services and consequent increase in the productivity of labour; and
- (ii) the large-scale production of goods of high technological content, and consequently falling costs, and the attainment of international competitiveness.

These changes have been accompanied by, and have induced, a significant diversification of production, labour skills, and professions and profound changes in social and political institutions. It is a truism that development is coincident with structural change, a permanent change in the kinds of goods produced by and the kinds of jobs needed in an economy.

This study surveys the industrialization experience in the Asia-Pacific, drawing lessons and indicating challenges for the future. A lesson that can be drawn from this region of 'successful' globalizers is that development through strategic, as opposed to passive, integration into the external economy is possible (APTII 2005). The State played an indispensable role in undertaking the strategic integration, through various policies that can be categorized as industrial policy. The key thesis that this paper seeks to develop is that industrial policy,

defined as State intervention to support new production activities and to build domestic capabilities in specific areas, is even more indispensable for countries seeking to pursue their development by integrating internationally. If, as observers such as Bhagwati (2004) suggest, international economic integration is not a matter of national choice in the current 'era of "globalization"', then the capacity to undertake effective industrial policy is a matter of social survival.

In the 2000 United Nations summit, the international community coalesced to set mutual development targets grounded in the concept of human development – the Millennium Development Goals (MDGs). The year 2015 had been agreed to the point at which these targets were to be achieved. In order to generate the resources to meet these commitments, it is clear that States must find a way to ensure that their economies grow at about double the rates of growth of the last 25 years (UNCTAD 2005). In the last four years, growth in the many developing countries, including in many least developed countries, has been at elevated levels because of high commodity prices. Even if all developing countries were to meet the MDG targets in 2015, there is still the question of whether developing countries would have installed the domestic capacity required to sustain the achievement of the MDGs. The industrial economies that have met these targets have also reached a requisite proportion of total production and total employed labour in the more productive manufacturing and services sectors. They have also "achieved" at least a minimum level of public services and public spending as a proportion of GDP based on their own domestic tax base (that is, not augmented by foreign aid, as is the case in many least developed countries). The levels of public spending are certainly still quite low in economies that used to be classified in the category of "Third World." The issue is not that of raising the proportion of public sector GDP, but of raising the productivity of both the public and private sector so that society can afford to devote a higher proportion of income to public services. Improving domestic productivity is thus the only permanent way to achieve the MDGs.

Sufficient progress in upgrading domestic productivity and State capability should thus not be neglected in efforts to achieve the MDGs, and this is where attention to industrial policy is required. There is a common argument that says that openness to the global economy can be relied upon as the means to upgrade domestic productivity. The discussion in this paper seeks to illustrate that productivity upgrading has not been an automatic outcome of market forces historically and unlikely to be automatic in the future precisely because of the forces of globalization<sup>1</sup>. In fact, market pressures could be premature and obviate productivity increases because productivity efforts require investment and the risk-taking that is involved in investment.

---

<sup>1</sup> The ongoing food price crisis illustrates some of the features of globalization. First, there are asymmetries in production that, in spite of increased diversification potentially offered by globalization, are concentrating and cumulative and not self-correcting—otherwise the sudden rise of prices of food, which is consumed almost everywhere, would not have occurred. Second, while the current high prices should encourage food production in all parts of the globe, installed capacity in many developing countries has declined due to competition from subsidized imports. Therefore, these developing countries are unable to respond and exploit the current high returns. Third, the international regime, in which industrial countries have the means to subsidize agricultural production, inflicts high uncertainty with regard to investments towards increased food production in developing countries, which are open to the world market. Fourth, the rechanneling of agricultural production toward biofuels, whether or not environmentally sustainable, is an instance of industrial policy.

There is also the question of whether the least developed countries (LDCs), small island states, and economies with small populations, that are determined to integrate and compete internationally, should even consider or afford industrial policy. Due to their situation, many of these countries have installed regimes aspirant of, or even suppliant to, foreign investments which hold the promise of capturing foreign markets and technology. The conditions in these countries are, in fact, the conditions that require them to develop clear guidelines, regulations, and plans for industrial upgrading. While middle income countries and larger developing have a more diversified economic base, domestic markets in these types of countries are often too small to attract significant amounts of foreign investment. As the local market and labour force is relatively small, the entry of foreign companies could undermine genuine domestic competition and the development of a domestic private sector.

Many LDCs, for example, have pronounced their attraction toward developing their software and business process outsourcing services, because these are “weightless” exports and can absorb some of their labour force. While middle income countries, with diversified educational systems, have stumbled into this sector with limited purposeful planning, LDCs have to calculate how their domestic labour force can actually participate in these activities, the cost of upgrading domestic capabilities, and which international companies would they need to attract. LDCs and small economies have to be deliberate (perhaps even more deliberate than middle income countries) in identifying the interventions they invest to their limited public resources. They also have to be proactive in removing bottlenecks, facilitating diversification in industries, and enhancing infrastructure and skills. A general invitation and subsidy regime to attract any and all foreign investments without an accompanying industrial development plan by a small economy does not alleviate the “informational externality” facing the foreign investor (Reinert 2004). It might not even attract a sufficient number of foreign investors for the purpose of development. It might also be the case that the net foreign exchange impact of the entry of foreign invested activities, which tend to be more import-dependent, is small or could be negative. If only to economize on foreign exchange, developing countries seeking foreign investment should seek to do so within an industrial development programme. As an exercise in pragmatism, liberalization policies in developing countries need to evaluate the probabilistic prospects in attracting foreign investment as a result and be informed by realistic estimates based on the experiences of similarly situated countries.

This paper argues that a vision of industrial development suited to the specific conditions of each developing country is critical. If it is necessary to retain moral confidence among partners in Bretton Woods institutions and to sidestep the widespread conformism in views regarding trade and industrial development policies, then policy-makers in developing countries might consider embedding these plans within an overall effort to upgrade capabilities. This upgrade might start from general education to more specific skills which are consistent with national priorities. Developing countries might even consider avoiding the formal use of the term “industrial policy” altogether because - as explained the next section - the approach properly applies not just to manufacturing but, instead, to all activities characterized by constant or increasing returns to scale. The inherent feature of industrial policy as assistance for specific sectors could readily be justified on the grounds of limiting government support to a few strategic sectors.

## 2. Industrialization

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In defining 'industrial policy', Chang's (1996: 60) conceptualization is found to be most useful as a starting point. Industrial policy is defined as being one that is

aimed at *particular industries* (and firms as their components) to achieve outcomes that are *perceived by the state* to be efficient for *the economy as a whole*.

First of all, industrial policy must be characterized by selectivity as far as industries are concerned. Differential tariffs, financial support for specific sectors of industry, and tax and import privileges for specific sectors are examples of selective State policies. State policies that support an increase in capability of the whole economy, such as expenditures on education, are not properly part of industrial policy. State policies that benefit some specific sectors in a country's educational establishment in order to develop some specific industrial sector (for example, the design of electronic chips), would constitute industrial policy, even though the State expenditure for such policies would fall into the overall education budget of the State.

Many developing countries have targeted tariff and tax incentives toward foreign investments in chosen sectors. While these countries have claimed that they have dismantled their industrial policies, these kinds of tax and tariff incentives, because they privilege certain sectors, are instances of 'unconscious' industrial policy, motivated by the State's perception that foreign investment of particular types will be efficient for the economy as a whole (even though domestic investment in the same sectors might not be perceived to be efficient). Given the prevalence of such targeting of tariffs and tax incentives, it can be said that the dominant form of industrial policy that has been implicit since the 1980s has been directed toward foreign investors.

It is important to point out that, as has been the case in actual practice<sup>2</sup> in countries that have succeeded in industrializing, the use of the word 'industrial' in industrial policy does not mean that this type of policy can apply only to the manufacturing sector. Instead, what is important is the choice of specific industries that is subject to selective intervention. Within the mining and commodities exporting sector, for example, industrial policy

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<sup>2</sup> That 'industrial policy' is confined only to the manufacturing 'sector' is a common misconception on the part of critics. See, for example, the UNCTAD study by Bora *et al.* (2000), which argues against the efficacy of industrial policy and starts off by lamenting the fact that industrial policy does not include government policy in services and agriculture.

has, in practice, historically involved efforts to increase the domestic value-added of exports from these sectors. Industrial policy has had an important role in agriculture. On the input side, historically, increases in agricultural productivity have not been possible without the inputs from the industrial sector and the increased ability of manufacturing to absorb the underemployed in agriculture. On the output side, targeted efforts to increase agricultural processing for both domestic and external consumption would properly be classified as industrial policy. Industrial policies are targeted to firms or groups of firms; not to population groups. These firms or group of firms could be involved in any of the three major classic economic sectors—agriculture, industry, or services.

Present-day thinking<sup>3</sup> on industrial policy has identified a key principle in determining the appropriate production sectors for government intervention, namely whether the firm is in an industry with increasing returns to scale (Reinert 1996). The standard economic definition of decreasing returns to scale is quite specific—when one factor input to production is held constant, the yield from increasing the other factors exhibits a decreasing pattern. Decreasing returns are undefined when all<sup>4</sup> factors are increased simultaneously. In the lower ranges of output, agriculture and other resource-based industries are not expected to have decreasing returns, but when the limit of fertile land and resource are used these industries would be subject to diminishing returns to scale. Reinert (2005) locates the role of the concept of diminishing returns to scale. Diminishing returns is mathematically necessary for Samuelson's<sup>5</sup> (1948) proof that unfettered free trade<sup>6</sup> will equalize labour and capital incomes around the world and, therefore, will be 'good' for developing countries. Diminishing returns is a critical assumption to guarantee market clearing and thus the smooth transfer of production inputs from one economic sector to another. Reinert (2007) cautions that under globalization and the adherence by developing countries to standard policy regimes associated with globalization, countries will find<sup>7</sup> the Samuelson's convenient mathematical assumption becoming a reality, since these policies will limit their product mix to agricultural, resource-based, and other diminishing returns sectors.

It would be inappropriate to consider mature sectors of industry, which have little potential for learning and upgrading both in scale and in technological terms, as possible targets of industrial policy, even those conventionally classified as 'industry' by statisticians.

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<sup>3</sup> See Reinert (1996). Reinert (2007) presents an integrated account of the range of challenges associated with modern industrial policy.

<sup>4</sup> Over certain ranges of output, certain service industries would also not be subject to diminishing returns. For example, the business outsourcing industries could theoretically not be subject to one factor input being fixed as long as office space and telecommunications volume could be expanded easily. The key factor is English-speaking ability and there is evidence that the supply limit of this resource has been reached in some developing countries.

<sup>5</sup> In a recent paper that provoked instantaneous controversy, Samuelson (2004) disavowed the improper interpretation of his 1948 paper for purposes of policy advice. By incorporating technological dynamics, his 2004 paper demonstrated that under assumptions that most policy-makers would consider realistic, even the US economy itself might not benefit from unfettered free trade.

<sup>6</sup> This result is the well-known 'Heckscher–Ohlin–Samuelson' theorem and is the key conceptual justification for trade liberalization.

<sup>7</sup> Reinert (2007) terms this shift of industries towards these types of industries as the process of 'primitivization'.

These types of industries tend also to be subject to market competition of the type in which producers have to take prices as given; State intervention in these kinds of industries will amount to a pure subsidy on costs in favour of global consumers and will not result in advances in productivity.

'Regional' policy when not targeted to industrial sectors is excluded from industrial policy by Chang (1996). Also excluded is general infrastructure development, which would increase the competitiveness of the economy as a whole, but not targeted to specific sectors.

A key element in Chang's (1996) definition of industrial policy is the intention of the policy. First, the definition leaves open the possibility that the State's 'perception' justifying the intervention in a specific sector could be erroneous.<sup>8</sup> Second, the objective of policies that could be called 'industrial' is not equity<sup>9</sup> but efficiency. The policy intention is to benefit the economy as a whole, not the specific sector, and not a specific political constituency. Third, when the achievement of efficiency of a specific sector conflicts with achieving efficiency of the economy as a whole, the objective of efficiency in the whole<sup>10</sup> economy should be decisive.

Industrial policy, as a development-oriented intervention, is almost always justified as being in the national interest. Historically, the nation-state has been the basis for development during the capitalist era. The political structure of the nation-state has provided the 'capsule' within which poorer populations have changed their role in the international division of labour. The effectiveness of industrial and development policies depends on the context within which they are implemented. Do they favour capitalists and entrepreneurs more than workers? Are the policies dependent on the exploitation of the contributions of particular segments of the population? For example, historically, and in the current context of the economies of East Asia particularly, women have contributed enormously to efforts

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<sup>8</sup> The paper discusses in Section 2.2 some Southeast Asian examples of failures in industrial policy and the variety of reasons for their failure. The common approach is to decry the failures of the public sector in product planning and accept without comment similar mistakes by the private sector, ignoring the associated costs of inappropriate technology choices, employment dislocation, and obstacles to redeploying fixed capital to other uses from such failed private sector projects. We discuss later in this paper the political economy realities attending to private sector projects, which tend to result in a high incidence of public subsidy and/or protection in these kinds of projects. Industrial policy on the part of the public sector creates the capability inside the public sector to evaluate demands from the private sector for such subsidies.

<sup>9</sup> In many liberalization episodes, improving 'equity' has been a key justification. Import liberalization is supposed to be more equitable to consumers, as opposed to producers, and to small- and medium-scale firms as opposed to large firms. Theoretically, conceiving of households principally from the point of view of consumption ignores, for the purposes of equity, their interests as producers and workers whose livelihoods (especially in the rural areas) and jobs could be made vulnerable. Empirically, it has been difficult to evaluate the equity justification. The structure of consumer demand is heavily conditioned by inherited income inequality, which trade liberalization often exacerbates. When import liberalization has been accompanied by an overall economic slowdown and increased macroeconomic volatility, it is futile to try to estimate the equity impact of import liberalization. Instead, appeals are often made to the 'dynamic' impact of the trade policy, which is in effect a reversion to the long-term 'efficiency' justification. Trade liberalization is, therefore, another type of industrial policy based on a perception by the State that it would be efficient for the economy as a whole.

<sup>10</sup> This contrasts with views, such as that in Bora *et al* (2000), that the achievement of efficiency of the economy as a whole is impossible without achieving efficiency in each of the sectors of the economy separately.

to improve social and individual productivity and the international competitiveness of their economies.

Industrial policy affects the functional distribution of income, and its sustainability and success depends on the continual changing in the balance of benefits from this policy. In the long-run, farmers, workers, and women have a permanent interest in the industrial development of their nation-states, since it has the potential of not only improving their income and standard of living, but also expanding their economic freedom. Whether this actually happens depends on the design and configuration of industrial policy. In the quantitative test presented later in this paper, wage trends are taken as the key measure of the success of industrial policy.

## 2.1 Development strategies

In the post World War II era, some countries in East Asia have followed the strategies of the earlier 'late industrializers' such as France and Germany and, within a generation, changed the kinds of products produced by their economies. In Asia, Japan was the first late industrializer, undertaking classic industrial policy in 1920s to climb up the industrial ladder from a feudal, agricultural economy. In the interwar period, Japan demonstrated the possibilities of exploiting its trading relations, which required paying attention to the need for 'selective' protection. For example, Miyajima (1992: 271) notes that in Japan's industrial policy,

[a] pivotal consideration and constraint was that protection of a specific industry might jeopardize the benefits of trade. For example a dyestuffs tariff would affect the entire textile industry, and textiles were one of Japan's main exports.

The Republic of Korea started its development process in 1963 as a poor agricultural economy. The Japanese colonial period left behind some industries in the northern Korean region but the southern region remained mainly agricultural, serving as a food basket for the Japanese economy. Another well-regarded success is that of the economy of Taiwan (Province of China), another colony that had served as a food-supplying region for the Japanese economy. These economies protected new industries against imports and subsidized investments in specific sectors.

The economies of Malaysia and Thailand have also been generally considered as relatively successful. Until the Asian financial crisis of the late 1990s, other East Asian economies such as Indonesia had also been considered to be on the road to industrialization. The spectacular success of China and the growing success of even later latecomer countries, such as India and Viet Nam, are the latest development success stories of the Asian region.

China's share in world production of all manufacturing products increased from 1.7 percent in 1980 to 12.2 percent in 2003 (Table A1). Table A2 gives the breakdown of world industrial production by industry and country/region; the table confirms the dynamic growth of the share of China (from 0.9 percent in 1980 to 12.2 percent in 2003), South Korea (Republic of Korea) (from 0.7 percent in 1980 to 5.1 percent in 2003), Malaysia (from 0.2

percent to 1.7 percent in 2003), and Taiwan (Province of China) (from 1.1 percent in 1980 to 3.5 percent in 2003) in the world production of high-technology industries.<sup>11</sup>

East and Southeast Asian countries have generally been classified as export successes and as owing their development success to their engagement with the international economy. Particularly in comparison with Latin America, a region that, beginning in the 1980s undertook a thorough dismantling of its import-substitution motivated industrial policy and increased the role of external trade in the economy, the Asian region is considered to be relatively successful.

The development strategy that came into dominance beginning in the 1980s, often called 'the Washington Consensus', was based on a fundamental scepticism regarding the capacity of the State sector to intervene effectively in developing specific sectors. The State was considered to have a limited capacity to specify which products would have the greatest impact on growth and structural transformation. Even more damaging was an argument that was attractive to the populist imagination: The State, by its nature, was portrayed as being subject to an inherent weakness in the arena of politically-charged decision making, including corruption, which suggested an inherent deficiency in State capacity to implement development strategy. In light of the high social costs of State intervention and the many mistakes committed by State agencies during the import-substitution period, the proponents of the Washington Consensus have argued, the private sector would have to be relied upon in identifying the most promising sectors and developing them. Subjecting the private sector to the proper price ratios of outputs and inputs and eschewing subsidized finance for private investment would guarantee that the private sector would choose the correct 'winners' and internalize the cost of making mistakes if it made the mistake of choosing 'losers'. Only in this way can societies ensure a sustainable development path, it has been argued, embracing the view that industrial policy is a grievous mistake to be avoided.

The failure to experience growth, much less structural change, particularly in Latin America, where countries had 'gotten their macroeconomic and trade regimes much closer to the idealized consensus than the Asian countries',<sup>12</sup> has revived interest in industrial policy. From a mainstream economic analysis, there are three bases for why the Washington Consensus developmental approach of relying on price signals to private investment is misleading. The first is the existence of dynamic scale economies and knowledge spillovers. Second, some agency, such as the State, might be needed to address coordination failures in private investment activities. Third, there are important informational externalities in the process of industrial investment.

These three bases constitute the failings of private agents when restricted to market-mediated interactions. The underlying framework generates policy prescriptions that restore the equilibrium outcomes that would have been achieved if these failures did not

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<sup>11</sup> See also Tables A3–A7 for the breakdown of world high-technology industry production by country and by subsectors.

<sup>12</sup> Pack and Saggi (2006). Pack and Saggi provide a critique of the current 'understandable search for the *magic bullet* (emphasis added)' in a situation where 'many policy makers have expressed interest in some form or other of industrial policy' (p. 2).

exist. Implicit in the mainstream approach is the conception of an optimum social outcome, deviations from which impose social costs. Under this approach, industrial development, or development itself, is already inherent, built into the genes as it were, of any society seeking to overcome poverty, and closing the gap between the optimal social outcome and the current state of the economy is a matter of eliminating obstacles, such as State intervention and market failures. The mainstream view is based on a view that the gap between an ideal social outcome and the actual situation is definable in a non-controversial way and measurable; this is why the notion of equilibrium is indispensable.

An alternative view, to which we now turn, is that structural change is by nature a disequilibrium process.

## **2.2 Schumpeterian innovation patterns and industry structure (firm size based innovation theories)**

Schumpeter's (1934, 1942) studies on the patterns of capitalist growth provide the starting point of an alternative stream of analysis of industrial development. This framework sees development as a turbulent and cumulative process. Instead of measuring the development gap against a 'faith-based' putative optimum, this framework relies on analysing gaps in productive and institutional capabilities among existing countries, industries, and firms. The Schumpeterian approach emphasizes the role of competition among production agents and among nations. Differences in technological and organizational capacity determine the competitiveness of countries, production sectors, and firms. Development involves the replacement of less competitive production units by more competitive production units, at a higher level of technology and at a larger scale.

Used in a context at variance with the definition above, Schumpeter's phrase 'creative destruction' has achieved a 'romantic' status as a description of an idyllic state of economic affairs. In the mainstream framework, the elimination of any firm as a result of its inability to compete against foreign imports is an instance of creative destruction. Nothing new needs to be created in the process; the emphasis is on destruction and the ability to destroy is the basis of the creativity of the market. There is also no need to determine if the failed firm had a superior technology to the firms that produced the imports that destroyed it. However, the mainstream application is not consistent with Schumpeter's conception of 'creative destruction'. The word 'creative' has equal billing in the Schumpeterian process. Creative destruction only happens when something more advanced technologically or at a larger scale replaces an existing production activity.

Schumpeterian economists have a more practical view—new products, new production processes, new firms have to emerge if creative destruction is to occur. The closure of State-protected, State-subsidized firms could be destruction, but it is not creative, unless it is accompanied by the emergence of new economic activities with greater technological capability and the creation of possibilities to increase scale in the long run. Providing financial assistance to firms to help them adjust to import liberalization programmes without requiring technological upgrading would signify a less destructive intent but would not be inherently creative in the Schumpeterian sense. Particularly in line with export-led in-

dustrialization strategies in developing economies, governments implemented a variety of measures to maintain the international competitiveness of the industries in which they had 'comparative advantage'. The distribution of investment certificates, the provision of lower priced intermediate inputs produced by State economic enterprises, tax rebates and preferential interest rates in duty free importing opportunities, and the deregulation of labour markets exemplify such measures.

Active State policy, not just the passive provision of incentives for the private sector, is critical for industrial restructuring. In the case of Turkey, these kinds of State-provided benefits, while easing the impact of external competition, did not necessarily result in a greater incentive to invest for technological upgrading or even for investment in general (Memiş 2007). Memiş (2007) demonstrates that contrary to conventional expectations, the export performance of Turkish manufacturing was not found to lend itself to productivity increases, and could not be sustained as a viable strategy of export-led growth. Even though there was a high growth in exports these were based on an export structure that was highly dependent on imports. The share of both public and private investment in manufacturing share declined significantly after the implementation of the structural adjustment programme, which included trade liberalization and privatization. Particularly in the case of public investment, the share of investment eventually became negligible to a level probably representing only depreciation costs. This outcome was consistent with the effort to deliberately shrink the size of the public sector, in general, and the policy stance that considered industrialization to be no longer part of an export-led growth strategy, in particular. On the other side, the reason for the poor record of private investment is usually explained as the result of financial liberalization. Memiş (2007) indicates that the demand for real estate and consumer credits, which expanded after financial liberalization, squeezed out investment credits. Whenever there was a moderate recovery observed in private investment, this was mainly due to a rise in domestic demand and to a decrease in the price of imported capital goods as a result of the appreciation of the local currency (Memiş 2007: 47).

Schumpeterian economists busy themselves with understanding the way in which innovation, which replaces less competitive activities, occurs. They are concerned with patterns in changes in products and production methods. They analyse the different speeds at which new ideas are implemented and the trends in declining cost of production through the life cycle of a product.

In the Schumpeterian framework, there are three main theories of innovation: firm-based theories, industry life cycle theories and 'new evolutionary theories' (Keklik 2003: 157). Firm-based theories emphasize the role of the firm in the process of innovation and technological propagation. Competitive pressures compel firms to constantly reform their methods of production and change their product lines. Are smaller firms more innovative than larger firms? The answer depends on how 'new' a product is and the structure of the market for the product.

Industry life cycle theories emphasize the implications of important phases of the development of an industry—from invention to standardization, to maturity. New evolutionary theories call attention to the product specificity of innovation and industry development

patterns. 'Appropriability', which pertains to market conditions that permit innovators to appropriate returns from their profits, has a parallel in 'informational externality' of mainstream economics. However, appropriability is a broader concept, which can encompass situations of 'super profits' to first movers. Another key factor is basic capabilities in modern technology. This aspect calls for investments in basic skills, technical training, and the funding of research.

The sustainability of basic training and research through commercial application is a key social question, which both State and private actors have to address. Another key concept is cumulateness. The competitiveness of a firm or a nation depends on the stock of built-up capabilities. The development of technology and capability is path-dependent. While haphazard trade liberalization poses the danger that inherited capabilities will be dismantled, market forces cannot guarantee that these lost capabilities will be redeployed in other sectors in the national economy.

While the mainstream view is based on a fundamental faith in an abstractly imagined 'private sector' that will search out the best investments in response to the 'right prices', the Schumpeterian analytical approach focuses on the life-and-death struggles of actual firms, both private and public, which embody capabilities and exploit both economic and political advantages for their survival and growth. Shapiro (2006: 8) formulates the alternative view as follows:

In contrast to the passive price-taking firms of comparative statics, this literature portrays successful firms as those that create and maintain barriers to entry and the rents associated with them. By exploiting 'competitive' advantages based on innovation, firms are then not dependent on unsustainable cost advantages such as low wages or exchange rates.

In contrast to the mainstream view, the State's developmental role must involve the promotion of increased production capability of national firms and the management of private rents, ensuring that they are channelled to social ends. In the advanced countries, the private sector provides the bulk of financing for research and development (R&D). Table 1 indicates that in Japan, the private sector provided 73.9 percent of R&D funding in 2002 while the government contributed 18.2 percent, and higher education, which is mostly State-supported, provided 6.5 percent. Public sector involvement is greater in France where the underlying participation of the public sector in industry is also higher. The UK stands out in its ability to source funding from external sources.

**Table 1: International R&D expenditures for selected countries, by performing sector and source of funds: Selected years, 2002–2004**

| Country and R&D performer                                       | Source of R&D funds |            |            |                  |                   |        |
|---|---------------------|------------|------------|------------------|-------------------|--------|
|   | Total               | Industry   | Government | Higher education | Private nonprofit | Abroad |
| <b>Canada (2004) (millions of Canadian dollars)</b>             |                     |            |            |                  |                   |        |
|   | 24,487              | 11,314     | 8,672      | 1,781            | 787               | 1,933  |
| Percent distribution, sources                                   | 100.0               | 46.2       | 35.4       | 7.3              | 3.2               | 7.9    |
| <b>France (2002) (millions of euros)</b>                        |                     |            |            |                  |                   |        |
|   | 34,527              | 17,990     | 13,244     | 242              | 295               | 2,756  |
| Percent distribution, sources                                   | 100.0               | 52.1       | 38.4       | 0.7              | 0.9               | 8.0    |
| <b>Germany (2003) (millions of euros)</b>                       |                     |            |            |                  |                   |        |
|   | 54,310              | 35,910     | 16,910     | 0                | 230               | 1,260  |
| Percent distribution, sources                                   | 100.0               | 66.1       | 31.1       | 0.0              | 0.4               | 2.3    |
| <b>Japan (2002) (billions of yen)</b>                           |                     |            |            |                  |                   |        |
|   | 15,551,513          | 11,486,713 | 2,830,142  | 1,004,191        | 171,032           | 59,435 |
| Percent distribution, sources                                   | 100.0               | 73.9       | 18.2       | 6.5              | 1.1               | 0.4    |
| <b>Russian Federation (2003) (billions of rubles)</b>           |                     |            |            |                  |                   |        |
|   | 169,862             | 52,257     | 101,252    | 807              | 278               | 15,268 |
| Percent distribution, sources                                   | 100.0               | 30.8       | 59.6       | 0.5              | 0.2               | 9.0    |
| <b>South Korea (Republic of Korea) (2003) (billions of won)</b> |                     |            |            |                  |                   |        |
|   | 19,068,682          | 14,113,599 | 4,548,933  | 256,825          | 70,467            | 78,858 |
| Percent distribution, sources                                   | 100.0               | 74.0       | 23.9       | 1.3              | 0.4               | 0.4    |
| <b>United Kingdom (2002) (millions of pounds)</b>               |                     |            |            |                  |                   |        |
|   | 19,568              | 9,138      | 5,268      | 196              | 963               | 4,003  |
| Percent distribution, sources                                   | 100.0               | 46.7       | 26.9       | 1.0              | 4.9               | 20.5   |
| <b>United States (2003) (millions of U.S. dollars)</b>          |                     |            |            |                  |                   |        |
|   | 284,584             | 179,615    | 88,778     | 7,944            | 8,247             | NA     |
| Percent distribution, sources                                   | 100                 | 63         | 31         | 3                | 3                 | NA     |

Source: OECD (2005). *Science and Engineering Indicators 2006*.

Notably, in the US, direct government contribution to R&D was as high as 31 percent of the total in 2003. The figures in Table 1 suggest that advanced countries themselves invest in R&D not because they can afford to, but because they cannot afford not to do so. Being cut off from the potential applications of the results of basic research represents a clear danger in terms of losing industrial competitiveness in the world economy. Hausmann and Klinger (2006) map technology possibilities in terms of the proximity of related technologies and suggest that having an economy whose production activities are too ‘far away’ from other technologies is a key indicator of poor international competitiveness. Moreover, a large portion of technological knowledge is tacit, which means that it is not possible to buy all the technological capability off the shelf (Hausmann and Rodrik 2006). Domestic investment in technological development is therefore indispensable, if only to create the domestic capability to absorb the ‘tacit’ content of technology from overseas.

In the 1950s and 1960s and at a lower level of technology, the State in the Republic of Korea and Taiwan (Province of China) found it necessary to intervene to assist its textile manufacturers attain competitiveness *vis-à-vis* the textile industry of Japan in order to themselves be competitive exporters of garments, instead of being dependent on imports

of Japanese textiles. The key aspect of technological advance in a large number of cases is production capability and project execution capability, not the invention of new materials and processes.

In Southeast Asia particularly, some specific projects undertaken in the name of industrial policy have been controversial. Mention can be made here of the Proton car project, of Malaysia the aircraft manufacturing associated with former Indonesian president B. Habibie, and the 11 major industrial projects<sup>13</sup> associated with the final years of the Marcos regime in the Philippines. Specific evaluation of the nature of the drawbacks is beyond the scope of this paper. Industrial policy projects, because they often require the rechanneling of significant tax revenues and projects, are easily criticized as mainly fulfilling the 'vanity' of its proponents or as costly expressions of nationalism. While vanity is a legitimate category of political argument, the interest in this paper is to set out the key conceptual issues in evaluating a public policy that is implemented by States in a variety of ways.

As in other public programmes, the necessary consideration in evaluating these programmes would be costs or net benefits. Specific industrial projects, such as these, are typically accompanied by specific costing of projects [for example, see Table 4 in Dohner and Intal (1989) for the costing of the above-mentioned 11 major industrial products in the Philippines]. It is important, as in other public costing exercises, to ensure that all indirect costs are included. Even just considering direct costs, the costs of many other interventions tend not to be as comprehensively and explicitly estimated. For example, tax holidays for foreign investment constitute tax expenditure in terms of foregone tax revenues and these cost estimates are very rarely reported.

In evaluating net costs or benefits, the design of the industrial policy project is important. The Malaysia car project explicitly incorporated the need to have sufficient volume and the planning and implementation of the project included the development of export markets (notably Australia, Singapore, and the UK) from the very start.

The East Asian industrial projects were designed and implemented at a particular time and in the particular context in the East Asian region—when all the countries were searching to upgrade their industrial capacities (Browning 1981). In the same period, the Republic of Korea was undertaking its Heavy and Chemical Industry (HCI) programme. The integrated steel mill project and the materials industry that were established in the Republic of Korea at that time have become extremely successful. Because it had no existing capability, it is well-known that Koreans undertook a lot of 'shadow' training (with workers play acting before imaginary machines marked out on the ground) before the actual steel making equipment arrived. Social capability is critical to the success of industrial policy, just as it is for other social policies. Social capability is built up from project implementation experience, since it cannot be learned otherwise. Building social capability is a project of many years. In the case of the Philippine projects, quite apart from the abrupt disappearance of international financing with the onset of the global debt crisis after the Mexican

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<sup>13</sup> An integrated steel mill and a copper smelting plant were two of the 11 projects.

default of 1982, the industrial policy projects were launched two years before the regime was overthrown.

These projects also exemplify the dilemmas of specific product choices involved in industrial policy. Should Malaysia have sought, as it did, to build a complete car, instead of becoming competitive in automobile parts? In technical terms, certain automotive parts require more advanced technology and are subject to more rapid change, but this is the kind of choice of capability building that has to be made. Malaysia's foreign partner, Mitsubishi, withdrew as the project stabilized and the project has not succeeded in finding an alternative foreign partner. In the meantime, there has been renewed interest on the part of other foreign companies to start up automobile manufacturing production in Malaysia. In Indonesia, the specific choice of the propeller-driven aircraft, the 'NS250', is another example which speaks to choice of technology, and the size and location of markets.

Evaluating the upgrading of domestic capabilities and technological externality are important ingredients in the choice of projects. Undertaking industrial development projects in order to boost domestic demand or to increase access to foreign capital and lending have often proved counterproductive. It is more effective to choose specific projects as a part of an overall industrial plan, assuming that the government is willing to undertake explicit industrial policy.

### **2.3 Investment and industrialization**

In both the mainstream and alternative approaches, investment plays a critical role, since it is the means by which new activities and new capabilities emerge. In the mainstream view, with the private sector in the lead, the financing of investment—the securing of savings and the decision to invest them—is theoretically a separate activity, even if it takes place within the same firm. Because, at least hypothetically, investing is viewed as a separate activity, the development of domestic financial sectors is a well-defined policy objective in the mainstream view. Establishing a private financial sector, increased access to foreign finance, and increased capability to evaluate, design, and package the funding of development projects is critical, according to this view.

Keynesian-style macroeconomics, a deviation from the laissez faire framework of that era and which was born during the deep economic depression of the 1930s, begins from a view that in a growing economy the act of savings, i.e. the act of setting aside the resources for investment, cannot be divorced from the decision to invest. In its simplified version, Keynesian macroeconomic models take investment as an exogenous variable, determined outside the system. The level of investment determines growth, and the level of savings is determined at the end of the whole process, instead of at the start. Economies that are not growing are so not because they do not have sufficient savings to invest, but because investment opportunities are too limited to encourage private actors to set aside resources to invest in them. Providing a 'climate' that motivates the private sector to maintain high rates of investment becomes a responsibility of the public sector.

In the 1980s, when trade liberalization became the dominant economic strategy in developing countries, the rate of investment stagnated or fell<sup>14</sup> perceptibly, except in the East Asian countries (APTII 2005). Economic growth rates have consequently been lower during this period.

### 2.3.1 Composition of investment

It is not only the level of investment that is critical. It is also important that investment in future production be directed towards the sectors that have the best potential for long-term growth and structural transformation. Worldwide, high technology industries have been growing much faster than other manufacturing activities (Table 2). Trade in high technology industries also shows higher growth rates compared to all manufacturing industries (Table 3). Poor countries that seek to grow faster at the same time as they integrate with the international economy must find a path to higher technology production, recognizing that they must push off from an inherited set of capabilities and domestic enterprises.

**Table 2: Average annual growth rate of world Industry production, by selected industry: Selected years, 1980–2003**

| Industry and country/economy                   | (Percent) |           |           |           |           |           |
|--|-----------|-----------|-----------|-----------|-----------|-----------|
|  | 1980-1985 | 1986-1990 | 1991-1995 | 1996-2000 | 2001-2002 | 2002-2003 |
| All manufacturing industries                   | 2.1       | 3.5       | 1.7       | 3.9       | 1.5       | 3.3       |
| High technology industries                     | 5.2       | 5.9       | 2.8       | 13.6      | 3.4       | 8.3       |
| Aircraft                                       | 0.5       | 4.9       | -3.8      | 4.2       | -2.3      | -0.1      |
| Pharmaceuticals                                | 3.6       | 6.2       | 3.5       | 4.8       | 5.3       | 4.9       |
| Office and computing machinery                 | 13.7      | 9.1       | 6.8       | 19.8      | -1.9      | 14.7      |
| Communication equipment                        | 9.9       | 7.6       | 5.8       | 23.4      | 7.7       | 9.2       |
| Medical, precision,<br>and optical instruments | 3.7       | 2.8       | 0.5       | 3.4       | -2.9      | 4.9       |
| Other manufacturing industries                 | 1.8       | 3.2       | 1.6       | 2.6       | 1.1       | 2.3       |

Source: OECD (2005). *Science and Engineering Indicators 2006*.

<sup>14</sup> For all developing countries, investment as a share of GDP fell from an average level of 20.1 percent in the 1970s, to 18.3 percent in the 1990s (APTII 2005: 50, Table 9). If China is excluded, the decline is from 20.6 percent in the 1970s to 17.6 percent in the 1990s. Among African countries, there was a corresponding decline from 14.7 percent to 8.4 percent, and among developing countries in Latin America, from 22.6 percent to 16.4 percent. The Asian average showed a contrary trend, with an increase from 16.8 percent in the 1970s to 19.9 percent in the 1990s.

**Table 3: Annual average growth rates in world industry exports and imports, by industry: 1980–2003**

| Industry and country/economy   | (Percent) |           |           |           |           |           |
|--------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
|                                | 1980-1985 | 1986-1990 | 1991-1995 | 1996-2000 | 2001-2002 | 2002-2003 |
| <b>Exports</b>                 |           |           |           |           |           |           |
| All manufacturing industries   | 0.3       | 9.0       | 6.6       | 5.9       | 3.5       | 9.1       |
| High technology industries     | 6.8       | 12.9      | 11.8      | 17.0      | 4.1       | 15.5      |
| Other manufacturing industries | -0.4      | 8.4       | 5.7       | 3.3       | 3.2       | 6.7       |
| <b>Imports</b>                 |           |           |           |           |           |           |
| All manufacturing industries   | 0.8       | 9.5       | 6.7       | 6.0       | 3.6       | 9.2       |
| High-technology industries     | 7.3       | 13.2      | 12.1      | 18.1      | 5.7       | 16.3      |
| Other manufacturing industries | 0.1       | 8.9       | 5.8       | 3.2       | 2.7       | 6.4       |

Source: OECD (2005). *Science and Engineering Indicators 2006*.

### 2.3.2 Public versus private investment

'Few phrases elicit such strong reactions from economists and policy-makers as *industrial policy*' (italics in the original) (Pack and Saggi 2006: 2). In the last two decades, the debate on industrial development has revolved around the issue of whether the State should be involved in a significant way in economic investment. That the State should be involved in social investment—health, education, and poverty reduction—has been less controversial. Even in the case of social investment, the responsibilities of the State have been sacrificed in the pursuit of macroeconomic stability. Development Committee (2006), written by the staff from the IMF and the World Bank, indicate that there has been an overshooting in the reduction of the State role in investment, particularly in the case of investment in basic infrastructure. Insufficient State investment in basic utilities, roads, transportation, and port facilities has undermined the prospects for growth in many low- and middle-income developing countries. Infrastructure investment is a basic component of industrial development. For instance, in a study of the initial and long-run effects of public investment expenditure on economic growth, relative to the effects of private investment, over the period 1970–1990 for 48 developing countries, Odedokun (1997) suggests that infrastructural public investment facilitates private investment, especially in the long run. Odedokun (1997) also finds that the long-term effects of public investment tend to be much more positive than the short-term effects on growth, efficiency, and private investments. The question of whether the State should be involved beyond social and infrastructure investment is fraught with controversy.

While State spending for basic research can be justified on the grounds of underprovision, each society has to design the scale and the approach of such investment. A second ground is related to the issue of coordination failure. The need to coordinate investment, when each of the private parties involved is separately unable to recover their individual investment, is demonstrated in Murphy *et al.* (1989). State involvement in investment was not only a very crucial part of industrialization, as was the case in the Latin American countries and, even more so, in the East Asian countries. The provision of intermediate products was a key role played by State corporations in supporting export sectors by supplying these

sectors with cheaper inputs for those strategies launched in late 1970s and 1980s in many developing countries. Import liberalization, which was a cornerstone of the development strategy in the 1980s, has led to a dismantling of the significant State role in investment in intermediate goods production.

Worldwide, the intermediate goods sector has been growing rapidly and those few developing countries that have seen fit to continue to provide State support to the sector have benefited. One example is the Brazilian automobile parts manufacturing sector. The early investment of the Malaysian government in microchip production is another example. These interventions were necessarily selective, as opposed to sector-neutral State intervention, involving subsidies and protection for specific intermediate products.

Successful countries have undertaken a variety of strategies in building international competitiveness. In the Republic of Korea, the State support through the channel of financing encouraged efforts by private companies to be competent in a broad range of technologies. In Taiwan (Province of China), an approach focused in building the capabilities of firms to be suppliers to international firms ultimately created companies that could supply their own products under their brand names internationally. While in the 1980s, Taiwan (Province of China) used to import 70 percent of laptop components, by engaging in import-substitution to produce domestic inputs it is now able to market its own branded laptops internationally. The Taiwanese approach, consisting of 'licensing foreign technologies, negotiating the licensing on behalf of Taiwanese firms, and granting subsidies to encourage local firms to enter high technology markets' (Fuller 2002: 2), was circumscribed by the tightness of the State budget constraint for these types of interventions.

## **2.4 Globalization and industrialization**

Since the 1980s, external trade as a proportion of output of developing countries has increased to a large extent because of the widespread adoption of outward-oriented development strategies. For developing countries as a group, the level of exports<sup>15</sup> of goods and services as a share of the gross domestic product (GDP) increased from 21 percent in the 1970s to 29.6 percent in the 1990s. Imports increased faster, from 19.7 percent in the 1970s to 30.2 percent<sup>16</sup> in the 1990s. These proportions were stagnant for Africa but dramatically increased in both Latin America and Asia.

The experience of the last 25 years indicates that the growth rate of exports, even manufactured exports, is a poor indicator of the role of trade in economic development. Instead the growth of manufacturing value-added (MVA) is a more suitable indicator. In the 1990s, Mexico's manufactured exports grew at an annual rate of 30 percent. However, 'its corresponding growth rate of MVA did not exceed 4 percent as against an average of 7.5 percent for Malaysia, Thailand, Indonesia and Singapore' (Shafaeddin 2005: 165, Table 2.1).

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<sup>15</sup> Figures taken from APTII (2005), Tables 5 and 6.

<sup>16</sup> The more rapid increase in imports is consistent with a greater incidence balance-of-payments difficulty, increasing debt burdens, and an increased import elasticity of growth in many developing countries.

Industrial policy is required in order to productively attract and utilize foreign investment, as illustrated by the recent experience of the Latin American countries. Latin America has seen more foreign direct investment (FDI) per capita than other regions (Ocampo 2003), but continues to lag behind in technology. Since the beginning of the 1990s, most of the FDI to Latin America has flowed into the services sector rather than manufacturing (except in Bolivia where 60 percent of FDI is to primary resources based sectors) (Table 4). When an economy serves as an export platform, foreign investment can improve a country's international competitiveness, based on conventional measures. Investments into new productive activities are known to have generally greater human development impact than investment through mergers and acquisitions. However, if these investments have weak linkages with the local economy, a successful export policy will not be followed by the development of the local industrial base, as has been the case in Mexico, Costa Rica, and Honduras (Ocampo 2003: 10).

**Table 4: Breakdown of FDI to Latin America by sectors**

|   | Sector distribution of FDI<br>(stocks or accumulated flows over nearest period) |               |                        |
|---|---|---------------|------------------------|
|   | Primary: Agriculture,<br>Mining and Petroleum                                   | Manufacturing | Services and<br>others |
| Argentina (1992-1994)                           | 14  | 35            | 51                     |
| Bolivia (1992-1997)                             | 60  | 12            | 28                     |
| Brazil (stock in 1995 + flows in 1996 and 1997) | 2   | 30            | 68                     |
| Chile (1974-2001)                               | 35  | 13            | 52                     |
| Colombia (1994-2000)                            | 9   | 23            | 69                     |
| Paraguay (1995-200)                             | 5   | 25            | 70                     |
| Peru (1993-1999)                                | 17  | 13            | 70                     |

Source: Velde (2003): 21, Table 7.

Two Latin American countries, Argentina and Chile, followed a different pattern in focusing on FDI in natural resource extraction or in manufactures based on natural resources. These types of investment can contribute to increased domestic value-added, while still not providing self-reinforcing linkages to local industry. While this approach appears to be moderately successful, the share of these types of products in world trade is declining. Countries that rely too heavily on such a strategy have to exert greater effort to improve their international competitiveness because for those products whose markets are not expanding, increasing market share requires taking away the share of other countries. A further difficulty is that the outputs of investments in natural resource extraction have been vulnerable to large price swings, which have strong macroeconomic impact on the domestic economy.

In Argentina, Brazil, Chile, and Peru, there have been significant inflows in various services sectors since the start of their structural adjustment programmes. Foreign investment into services, such as in the banking sector, has generated an upgrading of these services. Upgrading would benefit the systemic competitiveness of the economy, even though the actual results indicate that, in terms of quality and cost, these services are not yet close to

international best practice. Investment into services does not directly generate an increase in exports. Weak regulatory and competition policies in the receiving countries, often aggravated by defects in privatization programmes, could increase a receiving country's vulnerability to balance-of-payments difficulties.

While FDI has a potentially valuable role in technological upgrading, it is important, however, that domestic policy is geared to take advantage of technological opportunities. Lall (2000) emphasizes the point that the 'localization' of foreign technology requires much more than a passive opening up to the entry of foreign investment. Liberalization can lead to the freezing of domestic comparative advantage. Technology does not transfer automatically as a result of opening up to foreign trade and capital flows since it is not completely embodied in machines, documented in licences, or residing in specific people. Time, investment, and effort are required by the receiving country to understand, adapt, and use the technology in building new domestic capabilities. These kinds of efforts are normally subject to pervasive market failures, even within firms and certainly much more in private markets. Overcoming these failures require proactive policies on the part of the government.

## 3. Trade, investment and growth

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### 3.1 Investment accumulation, and growth

Successful East Asian industrializers have relied on an 'export-investment' nexus (Akyüz et al. 1999: 9). Industrial policy, particularly in the Republic of Korea, implicitly guaranteed high rates of return to private companies based on meeting export targets.

The previous discussions suggest that domestic investment and domestic technological upgrading are critical to industrialization. Opening to external markets and capital is not a sufficient condition for either greater investment or technological upgrading and might not even be a necessary condition. If a country were to accept the objective of competing globally, it would be necessary that the technology of those activities competing externally be near the 'best practice' level (Lall 2000). Efforts to come closer to best practice have to contend with increasing returns to scale, strong agglomeration economies, and market and coordination failures.

#### 3.1.1 *Investment–profit nexus*

In East Asia, the actual industrial policy utilized was such that, through a combination of policies, including protection from foreign competition and financial subsidies, the State guaranteed a higher-than-normal rate of return for economic activities identified as priority sectors. The State monitored the application of these 'super profits' to ensure that these would be reinvested in expanded output and/or better technology and lower costs. This strategy was necessitated by the absence of broad financial markets at the start of development, but, through the strong motivation for internal reinvestment, it also permitted enterprises to take advantage of scale economies to attain international competitiveness in the sectors that they participated in. In the longer run, state control over the investment–profit nexus, which required that profits to be directly invested in greater output or better technology in targeted sectors, prevented the natural development of private domestic financial markets. In exchange for a possibly premature sophistication in the financial industry, these countries achieved increasing labour productivity and international competitiveness.

Akyüz (1996) characterized this process as the 'management of economic rents'. As Chang (1996) points out, State leadership is necessary in order to avoid the danger that in the long run the State-created advantages of industrial policy would weaken entrepreneurship and hamper productivity growth. An important consideration is that in the case of industrial products that are meant for world markets, the number of enterprises that could competitively participate would be quite limited. Whether or not mediated by the State,

the existence of rents would be unavoidable in any process of entering new industries. The policy question that arises is whether the private sector on its own, responding to market forces, can reinvest sufficiently to sustain competitiveness and its technological position. Especially when enterprises are small and inexperienced relative to international competitors, it is likely that a State role in the investment–profit nexus is indispensable.

### ***3.1.2 Jobless versus employment enhancing growth***

The widespread liberalization of trade lies behind the significant expansion of trade and capital flows in the last three decades. This expansion, coupled with the collapse of the Soviet Union in 1989, has considerable implications for global labour markets. The total number of workers producing for goods alone rose from around 300 million in 1980 to almost 800 million at the turn of the millennium (Akyüz 2006b: 1). In this global trend, developing countries also have increased their share in the world trade in manufactures, effectively lowering the average skill level of workers participating in world trade. Many of the new entrants to the global goods market, including China and India, produce with lower capital inputs. With the entry of these producers, the global capital–labour ratio could have fallen by as much as 50 percent. The expansion of trade and the accompanying expansion of the global labour force participating in world trade tend to disadvantage labour. Production with less capital means lower productivity and lower wages. Moreover, there is an increased intensity of competition among workers in the global goods market.

In comparison with the previous period, the current era of more liberalized trade is characterized by inadequate level of capital formation at the national level to absorb the unemployed in developing countries (Somel 1996). Increased trade has not necessarily translated into increased investment in developing countries. The drawing into global markets of workers from developing countries is not necessarily associated with increased international integration of national labour markets. A significant proportion of export goods are produced in production enclaves.

Within a global regime in which labour mobility is highly restricted, developing country governments are unable to avoid the question of how international integration will impact the stability of domestic employment and the growth of household earnings. Under the current rules of globalization, industrial policy is not just a question of industrial choice and development but also that of sustaining incomes for the majority of the local population. Recent research<sup>17</sup> indicates that even in East Asia, the employment elasticity of the growth in trade has declined significantly. The phenomenon of jobless growth afflicts even successful exporting countries. The key dilemma facing policy-makers is that created by succeeding at winning export markets at the cost of maintaining low investment, low wages, and poor employment growth at the national level.

In order to translate successes at global integration into more productive employment and higher household incomes, either the market in its natural state or the State has to promote backward linkages between externally related activities and the rest of the

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<sup>17</sup> Some references to research on 'jobless growth' in UNDP Regional Centre in Colombo (2006).

economy. Efforts to increase value addition in commodity exporting sectors suggest that the State has an indispensable role to stimulate forward linkages and to assist the private sector in identifying the financing necessary for the effort. Industrial policy as a way to set priorities in this regard is the duty of any State committed to reducing poverty.

In Asia, the number of jobs created fell from 337 million in the 1980s to 176 million in the 1990s (Palanivel 2006), in a period when both trade and growth were accelerating. The reduction in job creation was particularly severe in the East Asian sub-region, which is generally recognized as the most 'competitive' internationally and the region that received the greatest increase in foreign investment. In East Asia, 273 million new jobs were created in the 1980s, while in the 1990s only 104 million were created. The employment elasticity of growth fell from 0.56 percent in the 1980s to 0.15 percent in the 1990s (Palanivel 2006). In South Asia, there was an increase from 64 million new jobs created in the 1980s to 72 million in the 1990s.

This pattern underlines the impact of international competitive pressures on the industrial development of developing countries, particularly those that rely heavily on international trade. The labour intensity of manufacturing declined steeply in East Asia, especially for China and Malaysia (UNIDO 2004), through changes in the kinds of products produced by the sector. Competitive pressures arising from relying on foreign markets also induced changes in the production technology toward greater capital intensity.

As will be discussed in the following section, national competitiveness is not measured in terms of export growth or the balance of trade, but in the rising productivity, particularly of the labour force, and domestic living standards. Increased capital intensity of manufacturing will increase the productivity of the employed labour force, but not necessarily of the national labour force. In the extreme case, though this did not happen in East Asia, there would be no increase in national labour force productivity if there were large job losses as a result of changes in the manufacturing product mix and/or diminished labour intensity. Industrial policy can be applied toward paying greater attention to building domestic incomes and enlarging the size of the domestic market, avoiding prematurely sharp changes in the structure and production methods in the manufacturing sector. In fact, reversing the sharp reorientation away from labour-intensive manufacturing experienced in the 1990s, should it be desirable, will require industrial policy. Increased international protectionism or lower global growth in the next decade could make industrial policy not only desirable but unavoidable.

### **3.2 International competitiveness**

There are three levels of international competitiveness—at the level of the firm, industry, and the nation. For the firm and the industry, competitiveness is the ability to deliver products and services as or more effectively and efficiently than other firms and other industries. If the product is traded internationally, the relevant competitors are international. At the level of industry, competitiveness depends on the effectiveness of production networks among firms in the domestic industry and/or with other firms internationally. Firms have the first and foremost responsibility for their own competitiveness, which depends on their tech-

nological choices, their deployment of profits, and policies toward the raising of firm-level productivity. Individual firms cannot attribute their uncompetitiveness to failures of State policy; it is not the responsibility of the State to guarantee the competitiveness of any firm. In the Schumpeterian framework, one reason for the uncompetitiveness of firms is the lack of competition in the aspects of technology and productivity. In markets with decreasing costs and tendencies toward monopolization, State policies to force competitive behaviour to improve productivity are necessary. Depending on the structure of the industry, this could require competition policy and regulations against price collusion or the promotion of mergers among firms, either subsequently regulated by the State or required to export their production, in order to better exploit economies of scale.

At the industry level, competitiveness is the ability of the country's firms to successfully deliver products and services compared to similar industries in other countries without protections or subsidies. One indicator of the competitiveness of an industry is its trade balance as an industry; another is the level of inflow of foreign investment into the industry. Industry competitiveness depends on the effectiveness of networks among domestic firms and the effectiveness of State industrial policy. Competitiveness can be said to improve if the level of protection and subsidy required for competing against foreign entities declines.

The Organisation for Economic Co-operation and Development (OECD 1997: 1) provides a generally accepted definition of national competitiveness:

National competitiveness refers to a nation's ability to produce, distribute, and service goods in the international economy in competition with goods and services produced in other countries, and to do so in a way that earns a rising standard of living. The ultimate measure of success is not a 'favorable' balance of trade, a positive current account, or an increase in foreign exchange reserves: it is an increase in the standard of living.<sup>18</sup>

Rising wages and higher standards of living are therefore the key indicators of a country's competitiveness. National competitiveness does not require competitiveness in every industry; what is needed is a configuration of industries that permits rising productivity that is translated into higher living standards.

In line with the recent emphasis on diminishing returns industries in line with conceptions of competitiveness arising from the Washington Consensus, competitiveness has recently been associated with low wage costs. *Maquila* industries or industries in export processing zones are able to supply products in international markets mainly through the use of low cost labour in developing countries. These successes do not indicate national competitiveness, based on the OECD definition, and could unnecessarily encourage State policies to be oriented toward maintaining low domestic wages in the name of national competitiveness.

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<sup>18</sup> See Scott (1985: 14–15).

### **3.2.1 Links between unit labour costs, income distribution, and accumulation**

The analysis of unit labour costs has become the dominant approach in analysing the international competitiveness of countries. This section exposes the weaknesses of this approach. It provides a measure of the cost of labour deflated by the productivity of labour; higher unit labour costs would be associated with reduced international competitiveness under the view that these costs increase the domestic cost of production. Higher wages could still be consistent with lower unit costs if the productivity of labour is correspondingly higher. In making cross-country comparisons, unit labour costs is the product of two elements, namely the ratio of labour cost to productivity, which can be called the 'pure' effect, and the 'price adjustment' effect, which derives from the overall domestic inflation adjusted to exchange rate effects (Felipe 2005a).

In the case of the 'pure' effect, the cost of labour per unit is the wage rate and labour productivity is measured as output per unit of labour input. At the very basic level, unit labour cost is therefore the ratio between the wage rate and output per worker. This quantity is numerically equivalent to the share of the value of output that is devoted to wage payments (Felipe 2005b). Using unit labour costs as the sole indicator of competitiveness thus associates with the increasing share of output of one of the factor inputs, labour, and the whole weight of a country's international competitiveness. In developing countries, and in fact in most economies, there are many other important inputs—notably capital and land, which are remunerated by profits and rent. This leads to the question of why the increasing shares of these other factors should not also be associated with increasing cost of production and affecting international competitiveness. A higher labour share need not be associated with a less competitive economy. Given the equivalence, there might as well be a measure of unit capital cost, which would associate the responsibility for competitiveness to capital.

Felipe (2005a) demonstrates that in the case of the Philippines, the capital share has been increasing much more rapidly than the labour share. This indicates that, aside from price and exchange rate effects, Philippine losses in international competitiveness might be more easily associated with increased profit margins, instead of increased labour costs. If competitiveness is dependent on unit labour costs, the fact that this measure is equivalent to the wage share means that competitiveness, instead of being a purely technical cost concept, is determined by social relations, which in all societies, social relations control the distribution of the total value of production among the different factors of production.

Careful and comprehensive<sup>19</sup> measurement of unit labour costs suggests that the labour share in the value of output in developing countries could be about the same, or only slightly lower, as that in developed countries, where this share fluctuates around 70 percent. This discussion underlines the importance of understanding the impact of wage and capital shares on overall growth, even within the narrow ranges in which they might fluctuate. An increase in the wage share could increase domestic consumption and overall economic growth, and through the accelerator, investment. An increase in capital share could also increase investment, and through increased investment, long-term growth.

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<sup>19</sup> The cost of informal labour and earnings of the otherwise self-employed is often not incorporated in the estimates of labour payments.

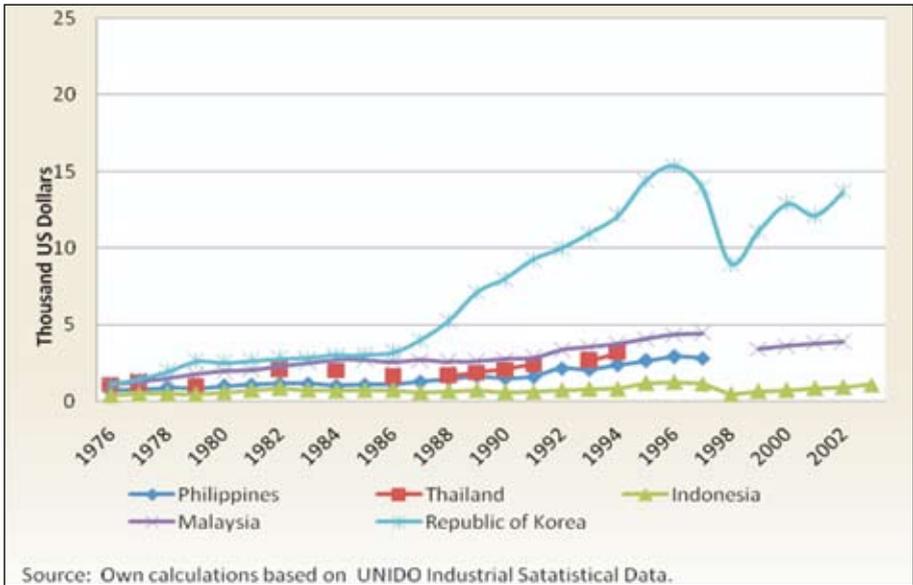
### ***3.2.2 Wage growth as an indicator of the performance of industrial policy***

The analysis of the patterns of wage growth provides a potential measure of the success of industrial policy. If workers earn industry-specific rents, which can be observed through wage payments (Katz and Summers 1989; Galbraith and Calmon 1990), then wage patterns would track the relative performance of industries among countries. For this, the analysis of the evolution of the wage patterns in each country by different industry groups is required. As a result, the change in wages must reflect the changing relative performance of industries (Galbraith and Kim 2001). Based on this framework, constantly rising wage rates would be consistent with increasingly rising rents in the corresponding industry.

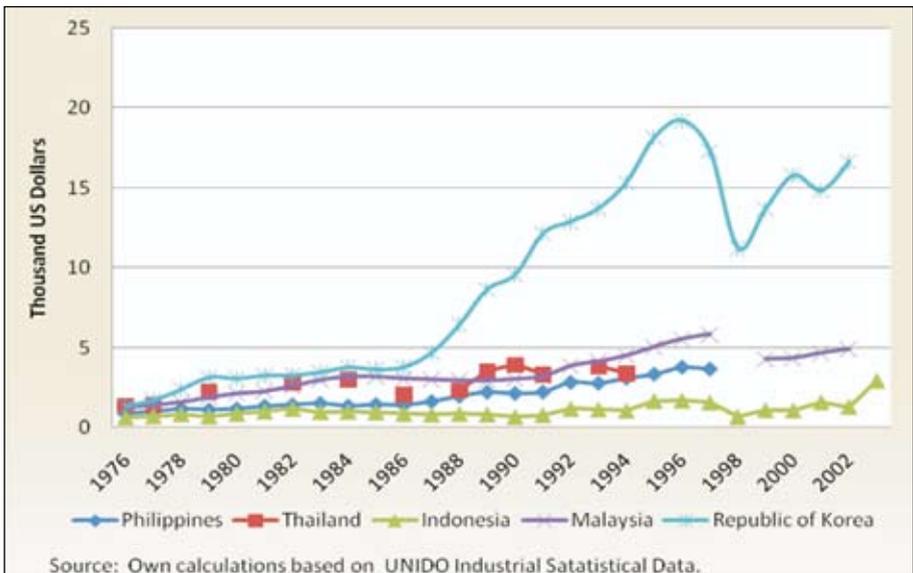
The authors have used industry groupings according to the OECD's (1997) method for classifying the OECD countries' industrial sectors and manufactures by level of technology (see Table A1 in Annex A). As the main data source, the Industrial Statistics Database of the United Nations Industrial Development Organization (UNIDO) is used. The authors have used 2003 data. The most recent data available is 2004, but it is not available for the range of countries that were selected for the study. The authors also believe, as evident in the subsequent graphs, that the industrial data of considerable interest is reasonably stable. This database provides information on number of establishments, employment, wages and salaries, output, value added, gross fixed capital formation, number of female employees, and production indexes by country and year at the 3-digit level of ISIC (Rev. 2), which includes 29 industries in the manufacturing sector from 1976 to 2003 (the length of the time series differs among countries due to problems in data availability).

Figures 1–4 present yearly wages per employees in low-technology (low-tech.), medium–low technology (medium–low tech.), medium–high technology (medium–high tech.), and high-technology (high-tech.) industries respectively in five countries, namely Indonesia, the Republic of Korea, Malaysia, Thailand, and the Philippines. A common pattern observed in all the figures is that wage patterns in the Republic of Korea exhibit the most dynamic pattern among all the countries in the sample. Until the year 1996, which marks the eve of the Asian financial crisis, South Korean wages rose ten-fold from 1976 to 1997 in high-technology industries, four-fold in medium–high technology, five-fold in medium–low technology, and eight-fold in low-technology industries.

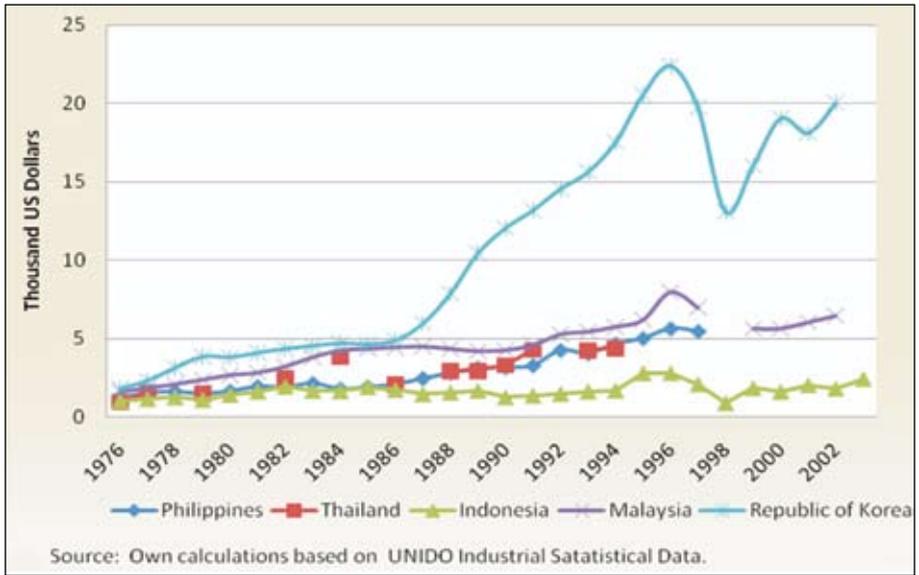
**Figure 1: Yearly wages per employee in low-tech. Industries: Selected countries, 1976–2003**



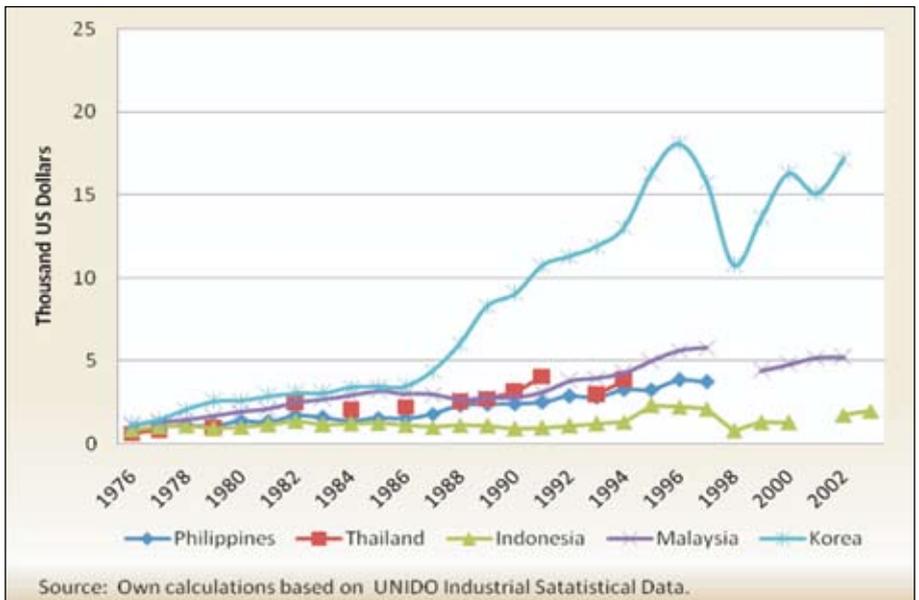
**Figure 2: Yearly wages per employee in medium–low tech. Industries: Selected countries, 1976–2003**



**Figure 3: Yearly wages per employee in medium–high tech. Industries: Selected countries, 1976–2003**



**Figure 4: Yearly wages per employee in high-tech. Industries: Selected countries, 1976–2003**



The authors present a comparative analysis over time of the dynamic wage structure across different countries<sup>20</sup> and regions. A comparison of the real wage trends of the Republic of Korea against different regions of the world beyond the Southeast Asian countries can indicate where the Republic of Korea stands relative to the advanced economies such as in Europe. For this purpose the authors looked at the trends in real wages in different regions over time and juxtaposed them with the Republic of Korea's real wage trends in high-technology and medium-high technology industries. Figures 5 and 6 show the substantive transformation in the structure of wages in the Republic of Korea, which cannot be observed anywhere else. Even though at the beginning of the period of analysis the Republic of Korea's real wage is at the same level as other countries in Southeast Asia, after the outstanding growth, particularly in the period following mid-1980s, the authors observe that the real wage level in Korean high-technology and medium-high technology reaches almost up to the levels of real wage in the same sectors in countries such as Greece, Portugal, and Spain in the European region.<sup>21</sup>

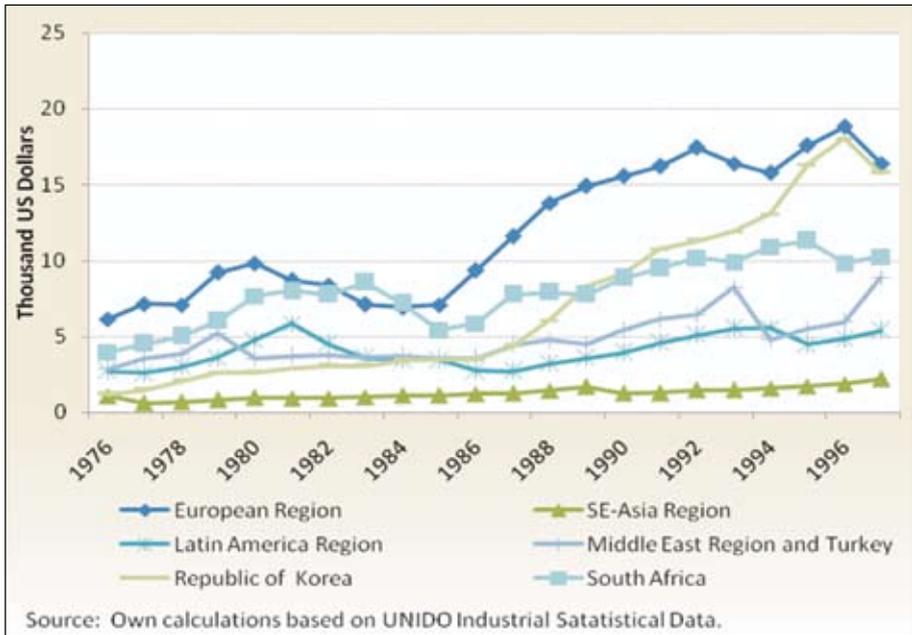
In all the figures above, the authors observe that the real wage trends in the Republic of Korea by industry exhibit a different pattern compared to other countries in the South and Southeast Asian region as well as compared to other regions in the world. Following this first step, the next step is to statistically test whether the Republic of Korea can be singled out in terms of the structure of the wage patterns. If so, this could theoretically provide empirical evidence on the performance of the Korean industrial policy. It is important to mention here that finding evidence of an effective Korean industrial policy does not necessarily invalidate the effects of other historical forces.

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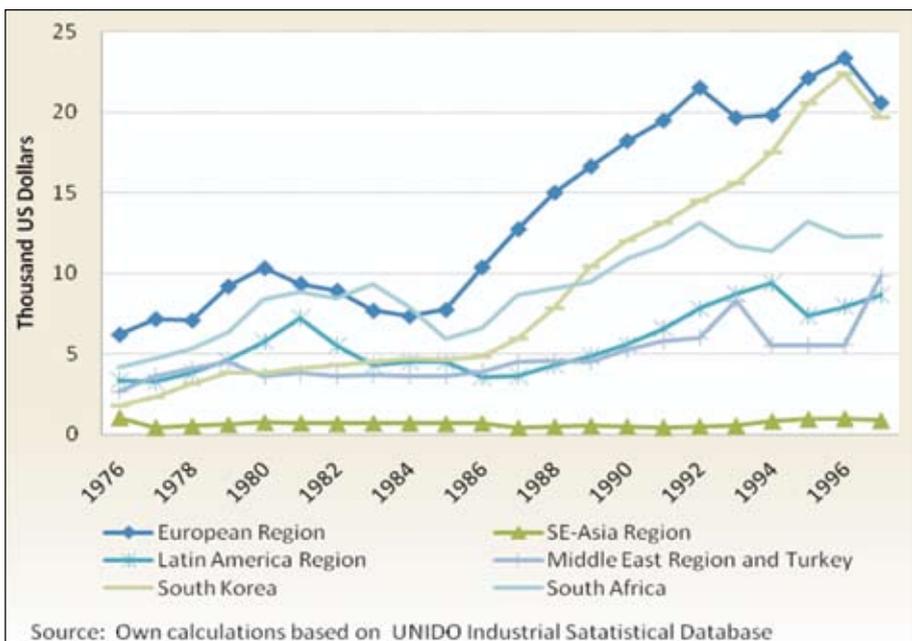
<sup>20</sup> The deficiencies of cross-country analysis have been criticized in the literature. The key problem is that cross-country estimates implicitly assume a common data structure across countries. This would invalidate inferences, particularly policy inferences when right-hand side variables are policy-determined. In our application, we compare across countries, but do not need a common structure to all countries. Our analysis requires that the classification among high-, medium-, and low-technology sectors be reasonably comparable across countries.

<sup>21</sup> See Table B2 in Annex B for the list of the countries included in region classification. The consideration in choosing these countries in the list was to include the ones with GDP growth rates similar to Korea, around 5 percent in the last decade on average.

**Figure 5: Yearly wages per employee in high-tech. Industries: Selected countries and regions, 1978-1997**



**Figure 6: Yearly real wages per employee in medium-high tech. Industries: Selected countries and regions, 1976-1997**



In order to detect the similarities and/or differences in the wage patterns through time the authors apply cluster analysis, a statistical tool introduced by Berner and Galbraith (2001) that permits one to identify the fundamental structure in time series data, based on patterns of behaviour over time. Its usefulness in this study comes from its ability to be applied to the rates of dispersion of the wage data over time. For the study's purposes, the authors chose the deviation of yearly wage cost per labour within each country from the weighted average of all the countries as the best possible indicator of different wage patterns. The percentage difference is useful because it provides a unit-free measure. The specific calculations on the data and the statistical clustering method are explained in Annex C.

The results for high-technology industries confirm the observations in the figures above. Figure C1 shows the dendogram presenting the results of clustering analysis applied to high-technology industries. The wage pattern in the Republic of Korea is not grouped among any of the groups; rather it is singled out as carrying sufficiently different dynamics from the ones in other countries which are found to be clustered in three groups (Figure C1).

## 4. Political economy of industrial policy

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Industrial policy, like any other policy, is an outcome of a country's political economy, which could derive from many sources, including from the technical ambitions emanating from (often a subset of) the government bureaucracy, from the net result of lobbying by different groups in the private sector, as political outcomes of legislation, and pressures from social groups such as farmers and workers. States could be unconsciously undertaking interventions that would appear to be industrial policy, as when they provide tax and tariff incentives to foreign investment. Such 'unconscious' industrial policy, justified as encouraging foreign investors to improve the efficiency of the whole economy, benefits specific sectors.

Chang (1996: 89) suggests that industrial policy 'can be firmly anchored in economic theory if we...take seriously the issues of institutional diversity and technical change'. Industrial policy involves bureaucratic 'meddling' into economic processes; the standard view is that such intervention is unnecessary and harmful because markets are superior in 'choosing' the best outcomes by coordinating the decisions of many disparate parties through competition. However, the standard view depends on a set of assumptions that are rarely present. Coordination through competition within the market mechanism requires that the technology of participants be characterized by decreasing returns to scale, for example. Constant returns to scale or increasing returns to scale (which is quite prevalent in manufacturing where there are significant fixed costs) impels all participants to each expand their production, not taking into account the output of others, resulting in losses for everyone in the industry and the exit of most participants. In real life, these kinds of vulnerabilities encourage private actors to find a way to coordinate among themselves and, failing that, to call upon or acquiesce to the government regulation of entry and providing the means for more *ex ante* coordination. Because even this is often not sufficient to maintain orderly production at reasonable prices, government regulations have also played the role of restraining or augmenting profit-seeking behaviour. When the intervention of government through these mechanisms is completely the outcome of political pressures, these pressures, in effect, result in 'unconscious' industrial policy.

If market competition is not an effective coordinator of production, perhaps it contributes 'dynamic' effects by releasing private sector energy for innovation. The argument for market competition, cited by Chang (1996: 72) is that even if the government is indispensable in solving the static coordination problem, its interference will stifle technological progress and obstruct the 'natural selection' of firms. Chang (1996) argues that the 'natural selection' metaphor is alluring except for the fact that, unlike biological natural selection, the firms

that are caught up in the process have the facility to consciously shape their participation in the selection process. Firms have the capacity to intentionally 'mutate', in the Schumpeterian sense and to build upon existing advantages. These strategies could include capturing market dominance, which could be for an inferior<sup>22</sup> technology.<sup>23</sup> The interdependence among firms has been highlighted in recent years by competing groupings among private companies to set standards for various media formats, such as the format for the DVD, high definition TV, and so on. These negotiated standards are attempts at *ex ante* coordination within the private sector, a coordination that unfortunately the 'market' by itself is unable to furnish.

Firms in those developing countries that have the ambition to integrate with the world economy have the additional burden of having to compete with the technological and market capabilities of global firms. Governments in these ambitious developing countries risk the destruction of built-up domestic capabilities and decimation of the domestic private sector if they rely on external market competition to stimulate dynamic innovation. In the successful East and Southeast Asian countries, governments have been able to assist the domestic private sector in accessing foreign technology, coordinating entry and exit into industrial sectors, and moderating the role of foreign competition.

As the domestic private sector, particularly those with significant roles in the economy, have greater access to State decision-making, governments have often found themselves implementing industrial policy of the unconscious kind. Because of uncertainties in technological development, there is no guarantee that such interventions, even when conscious and intended to benefit the whole economy, will succeed. The Japanese failed effort in stimulating 'Fifth Generation' computer technology, which was overtaken by advances in microprocessing, can be contrasted with the earlier maligned but ultimately successful Korean push into heavy and chemical industry (HCI) in the late 1970s and early 1980s. Often, even 'inadvertent' decisions can lead to a 'successful' outcome. Pack and Saggi (2006: 36), who are unsympathetic to 'pro-active' industrial policy, cite the case where nationalistic rules led to IBM's (the dominant manufacturer of mainframe computers) shutdown of Indian operations in 1977, which inadvertently forced domestic programmers to gain competence in UNIX, which could be run on more open and cheaper computer platforms. The government, which used to purchase half of all computers sold in India, also standardized on UNIX. When US firms migrated away from mainframe platforms, India found itself with a comparative advantage of providing programming in UNIX.

The current dominant view is that that States should eschew having pro-active industrial policy. This stance is politically convenient to the extent that it exempts States from having to referee among the competing segments within the private sector<sup>24</sup> and having

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<sup>22</sup> Chang (1996) gives the example of the QWERTY keyboard arrangement, which is universally seen to be inferior to other proposed key arrangements.

<sup>23</sup> Two examples of these are: (i) the videocassette recording format of Sony, which was technically superior but lost out to VHS and (ii) the original Microsoft disk operating system (DOS) for the IBM PC which was technically inferior to other operating systems at the time of its introduction.

<sup>24</sup> In practice, these kinds of States are providing tariff and tax benefits to foreign investors.

to play a role in ensuring orderly markets in labour and essential goods. The reality is that States find themselves ensnared in industrial policy decisions, even after structural adjustment-motivated reform processes. The Turkish experience since the early 1980s, analysed in Memis (2007), illustrates this reality and the pressures.

As a matter of political economy, the structural adjustment<sup>25</sup> approach can be seen as a style of industrial policy that consciously upholds the decisive primacy of the private sector<sup>26</sup> in technological development and in entry and exit in product markets, both domestic and global. Ideally, within this approach, structural changes in economic production and international economic integration are the outcome of individual private decisions. It is an approach that is sparing of State capability and susceptible to the type of coordination within the private sector discussed earlier in this section.

The activity of industrial policy, when the State consciously chooses to be actively involved, is composed of (i) planning, identification, and strategy formation, (ii) implementation (trade regime, subsidies, regulation of entry and exit), and (iii) evaluation and strategy adaptation. Capability in each of these activities needs to be created and built within the State. As explained earlier, even if the State does not have these capabilities, often private sector pressures require the State to make selective decisions. A robust private sector is an advantage, and there are important examples in which the private sector has been indispensable in the planning and identification stage (Pack and Saggi 2006: 40), when State support started only after some success in some sectors became evident.

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<sup>25</sup> This approach has metamorphosed into various versions, including 'enhanced structural adjustment', and 'poverty reduction strategy'.

<sup>26</sup> As can be seen in the Turkish case, this approach does not exempt the State from addressing the question of profitability and survivability of the domestic private sector.

## 5. 'Powerless state': Myth or historical fact?

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Is industrial policy still feasible in the current technological context and within the internationally agreed policy restrictions in the world trade system? Pack and Saggi (2006: 44) suggest that in the context of international production networks, rapidly changing product characteristics, and rapid innovation with dramatic declines in product prices, it 'may be beyond the competence of any government to help their domestic firms foresee and successfully deal with more than a small fraction of the unknowable changes that will affect their future'. Other analysts, such as Shafaeddin (1998), take the opposite of this fatalistic view and emphasize the opportunities for selective intervention to assist domestic firms in inserting themselves into production networks (as Taiwan, or Province of China has demonstrated for a string of products) and in exploiting 'second mover' advantages in rapidly changing product configurations. These analysts do not assume that the private sector has an inherent advantage in knowledge about 'unknowable changes'.

Due to social demands on the State, emanating from both domestic and external sources, States in all levels of economic development undertake interventions to foster or hinder selective economic industries, as indicated earlier. In the most recent fashion of development strategy, the focus has shifted to interventions required to meet the MDGs, in which the first seven goals are a set of specific targets in the social sectors, such as reducing the maternal mortality ratio by three-quarters. Even if economies were to grow at double the rates they have been doing in the last 25 years (UNCTAD 2005), growth as a means of generating the resources to meet the MDGs, by itself is not enough. States must also implement specific, sectoral policies that will meet the specific requirements of the seven goals. To reduce maternal mortality, States must erect and maintain a medical establishment that will ensure that deaths from childbirth are reduced to meet the target by 2015 and preferably, permanently so. With limited resources to alleviate poverty, States are being called upon to target their interventions. The required capabilities of identification, selectivity, technological upgrading are the same kind of capabilities required for industrial policy.

### 5.1 Is industrial policy still feasible? The need for new social capabilities

Due to the international community's commitment, the policy space of States for MDG-directed interventions are relatively unhindered, even though there have recently been controversial macroeconomic questions regarding the extent to which aid-funded domestic

spending would be allowed to breach Poverty Reduction and Growth facility ceilings<sup>27</sup> in sub-Saharan Africa. The policy space for industrial policy is being constrained by domestic reforms as elements of structural adjustment programmes (Chang 2005) and by international trade agreements.

Sustained economic growth is a necessary condition for poverty reduction. Since the Industrial Revolution in England, all historical experiences of sustained economic growth have relied on the rise and upgrading of a set of institutions, complementary behavioural norms, and public policies (Cimoli *et al.* 2006: 2). 'Discretionary public policies' were major ingredients of national development strategies, especially in the catching-up countries, throughout the history of modern capitalism. The current prescription is to focus on reforms in the legal system in developing countries to better approximate the structures of rights and responsibilities in Western countries. This focus ignores the need for the complementary institutions and norms needed to make them effective. The Western legal system, which was also developed during the period when States were undertaking discretionary policies to pursue industrial policy, presupposes a particular relationship between the State and private markets that might not be appropriate for developing countries. Undertaking effective industrial policy requires not only advances in the technological capabilities, but also improvements in institutions of State policy and norms of behaviour in the private sector. Industrial policy thus represents a challenge to existing domestic governance capabilities at the same time that it provides the opportunity to improve them.

The standard analytical framework from economics neglects the 'dynamic processes related to innovation and learning when analysing economic growth and economic development' (Lundvall 2007: 2). Under the aegis of the OECD (1997), policy-makers in advanced industrial economies have explicitly considered approaches to promoting and managing innovation under the framework of 'national systems of innovation (NSIs), which refers to the network of institutions, including private firms and universities, and the regulatory framework (such as patent protection). Research in this area has concentrated on analysing existing NSIs, and understanding the reasons for their relative effectiveness between countries. For developing countries, the discussion has 'to be shifted in the direction of system construction and promotion' (Lundvall 2007: 14), since in a catch-up mode, innovation policy needs to be a deliberate activity. Researchers in the field also suggest a better understanding of the role of power relationships in innovation systems to throw light on situations in which class privileges block learning opportunities and destroy existing competencies.

For least developed countries and small island states it would be economical in shaping the development of institutions of research and universities to explicitly consider their role in the national system of innovation as part of industrial policy. These objectives should help them determine how to support the sending of scholars abroad and negotiate with industrial countries the kind of educational assistance and scholarships that are of highest priority. Many small countries, such as in the Caribbean and the Pacific share university facilities. Based in its own vision of industrial upgrading, individual countries can consider developing specific areas of expertise grounded in their own industrial policy.

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<sup>27</sup> See IMF Independent Evaluation Office (2007). The ceilings are limits on government expenditure.

## 5.2 Policy space: A historical perspective

Except possibly for a brief period in the decades following World War II, restrictions on policy space in developing countries have been quite widespread. During the colonial period, unequal treaties such as those obtained by Britain in Latin America (starting with Brazil in 1810) and China limited the maximum tariff rates (Chang 2005). Latin America regained tariff autonomy in the 1880s. The US–Japan treaty of 1853 included a five percent maximum Japanese tariff rate; even though Japan was still subject to this restriction, it imposed the same kind of tariff restrictions on the Republic of Korea when the latter became its colony. Countries such as China and Turkey were able to obtain tariff autonomy as late as in the late 1920s only. In addition, prohibitions against high value-added activities, such as those imposed by Britain on its American colonies, bans on exports of competing goods from colonial territories, and incentives to expand primary production were also part of the economic relations during the colonial period.

Developing countries experienced their most rapid rates of growth in the 1960s and 1970s, a period associated with high tariffs and industrial protection. Per capita growth rates in the three percent range (compared to a rate of 1–1.5 percent over decades for countries participating in the Industrial Revolution in the nineteenth century) were quite common. Chang (2005) notes that the rate of economic growth of the Asian colonies and semi-colonies was much slower in the period 1900–1950. For example, the Bangladesh–India–Pakistan region and Indonesia grew at -0.1 percent during this period. After 1980, per capita growth rates have once again declined.

A system of bilateral, regional, and multilateral (notably the World Trade Organization) trade treaties now shapes the system of international economic relations. Especially since the Uruguay Round of trade talks, there has been a marked trend of increasing restrictions on domestic policy space in developing countries (UNDP, RBF *et al.* 2003).

These diminutions of policy space through international restrictions have also been justified as a necessary tool toward constricting a domestic elite from rapaciously expropriating and wasting<sup>28</sup> a nation's resources. Submitting to international restrictions is certainly one possible tool to improve 'domestic governance', just as international treaties on human rights help to protect individuals through external standards. If development and economic markets were particularly free of imperfections, such as increasing returns to scale,<sup>29</sup> and inherited disadvantages in capabilities that markets do not naturally address, this additional governance tool would not be harmful to development itself. If, however, the opposite would be the case, the prospects of development would be sacrificed at the altar of good governance. Governance weaknesses are best addressed through means that are themselves consistent with good governance—such as expanded participation and improved mechanisms of transparency and accountability. Commitments by governments

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<sup>28</sup> This would be consistent with a weak or non-existent investment demand on the part of the domestic private sector, which could indeed be the case if the trade and industrial regime imposed enormous uncertainty on private investment.

<sup>29</sup> As pointed out earlier, regulatory interventions are in fact necessary to prevent rent-seeking behaviour; restrictions on State intervention are, therefore, inappropriate.

in international agreements and in structural adjustment programmes when undertaken by a narrow constituency (such as the export sector) undermine progress in good governance. Good governance is also undermined when the conditions in these structural adjustment programmes are non-transparent, and the failures of the programmes do not result in political costs to policy-makers.

In historical perspective, the developing country policy space first created after World War II, which has diminished since then, is still quite significant in comparison to the period before World War II. Amsden (2005), among others, has discussed how developing countries might find spaces to undertake industrial policy under the current WTO rules.

### **5.3 Multilateral rules on trade and investment limiting policy space**

The outcome of the Uruguay Round in 1994 introduced additional international commitments, which have the potential of restricting policy tools that had been applied to great success by late industrializers from Asia. The WTO Agreement on Subsidies and Countervailing Measures restricts targeted subsidies to domestic industries. This agreement prohibits subsidies to be paid to firms 'upon export performance' (except agricultural goods) or 'upon use of domestic over imported inputs' (Shafaeddin 2006: 10). The Agreement on Trade-Related Investment Measures (TRIMs) agreement prohibits the use of 'performance requirements' on foreign investors such as local content, minimum export targets, and trade balances. With the extension of the principle of 'national treatment' to government procurement, the TRIMs Agreement limits 'national preference' for domestic products in government purchases. The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) severely restricts the ability of developing countries to utilize foreign technology without compensation, except for social causes such as health objectives.

Rasiah's (2003) analysis of the Irish, Malaysian, and Singaporean experiences indicates quite forcefully that relying on FDI as a natural means of industrial upgrading is illusory and, therefore, States would need to retain tools to impose performance requirements on foreign investors to upgrade domestic skills and technology.

### **5.4 WTO subsidies agreement and policy space**

The WTO Agreement on Subsidies and Countervailing Measures provides a categorization of the different kinds of subsidies and to some extent protects some policy space for countries to intervene in the areas of poverty reduction, technological development, and environmental improvement (Aguayo Ayala and Gallagher 2005). This agreement creates a category of government subsidy called 'non-actionable', which is allowed because the subsidy corrects for market failures. The agreement recognizes three areas of market failure, the first being research and development. Governments can provide assistance to firms, to higher education, and to research agencies contracted by firms to research activities. The second area is regional development; all industries in a region<sup>30</sup> can be subsidized as part of

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<sup>30</sup> Regions that can be subsidized cannot have per capita GDP more than 85 percent of the country average or must have unemployment rates over 110 percent of the country average, measured over a three-year period.

an overall regional development programme. The third area is the environment and permits government subsidies for upgrading facilities to conform to new environmental requirements that impose financial burdens on firms. These subsidy exemptions were in place until the end of 1999. The revisiting of these exemptions was one of the conditions that developing countries insisted upon in agreeing to the Doha development round. The possibility of re-authorizing these subsidies depends on the success of the current trade round.

### **5.5 The tradeoff between market access and policy space in bilateral and regional trade agreements**

The extensive reorientation of developing countries toward external markets has intensified competition among these countries for access to developed country markets. Shadlen (2006) analyses how the pressure among Latin American countries to improve their access to the US market, in view of, and to make up for, their competitive disadvantage relative to the East Asian economies, has imposed a rush toward free trade negotiations/agreements with the US. Domestically, the export sectors in these Latin American countries provide strong pressure to accede to these agreements. These agreements, however, trade market access in exchange for a loss in policy space, since US bilateral agreements consistently require stronger intellectual property protection, access to key service sectors, such as the financial sector, and commitments to renounce certain policy instruments, such as capital controls in the case of the US–Chile free trade agreement. These restrictions in policy space could lock-in the domestic structure into those sectors getting market access and cut off the possibilities for faster industrial upgrading.

## 6. The potential for state intervention

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### 6.1 Role of state in influencing the pace and path of capital accumulation

The discussion in Section 2.3 identified the indispensable role that the State would have to play in investment and capital accumulation in addressing sectoral development and overcoming coordination failures in private markets. Even when determined to avoid it, governments often find themselves undertaking selective intervention to maintain orderly supply outcomes and in response to political pressure. Particularly in economies that have increased their engagement with the world economy, States are 'doomed to choose'<sup>31</sup> priorities among firms and modern sectors in their economy.

#### 6.1.1 Fiscal policies to channel profits into sustainable investments

Maintaining strong and stable economic growth rates is necessary to sustain accumulation and investment. States have the duty to protect against financial instability and respond to boom–bust cycles in capital flows (Akyüz 2006a: 46). States have to restore the tools and their role in utilizing fiscal policy with a countercyclical dimension. Over the economic cycle, States have to establish the capability to run deficits during contractions and store surpluses during expansions. Building a more diversified and buoyant tax system is vital. Putting in place macroprudential regulations is necessary to prevent excessive risk taking funded from external liabilities.

For many States, a more active fiscal policy will require recovering fiscal autonomy and the elimination of chronic structural deficits. Akyüz (2006b) points out that, for many states, fiscal autonomy cannot be restored under the existing stock of debt and, therefore, there is a need for orderly programmes to reduce the burden of both the debt service and the potential instability that could arise due to a sudden stop in new financing and rollovers.

#### 6.1.2 Policies at the sectoral level

States in developing countries require rational principles to guide their sectoral interventions, to be able to respond to political pressures and market failures in a deliberate way. An industrial development plan that identifies priority sectors and the types of interventions that would be required is necessary. These plans have to be specific with regard to products. These plans have to recognize the implications of chosen priorities on how greater value-added and competitiveness can be achieved. As explained above, using for example the methodology of Hausmann and Klinger (2006) countries can attempt to identify (i) products that poorer countries should aspire to eventually produce and (ii) the 'closeness' between products, so that planning can proceed on where countries might start their industrial up-

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<sup>31</sup> Hausmann and Rodrik (2006).

grading. Hausmann and Klinger find that countries that have been growing slowly are those whose products have a large 'distance' from more advanced products. Sectoral industrial policy will involve a choice of products and sectors to reduce these gaps.

At a level above the sectoral level, government management is indispensable in public investment and FDI. Decades of public investment cutbacks in the name of fiscal stabilization have resulted in glaring gaps in infrastructure (transportation and energy, for example) in many developing countries. Because of these shortfalls, domestic private investment is stymied, countries find domestic production internationally uncompetitive, and medium-term growth prospects<sup>32</sup> are restricted. The conception in the 1980s that the private sector could substitute for the public sector in the provision of infrastructure has proven to be unfounded. The public sector has an indispensable role to play in financing projects in sectors where the private returns cannot capture the externalities generated by infrastructural projects.

Foreign direct investment policies should be consistent with the country's development priorities and be an element of a broader strategy to raise productive investment and the development of skills and technology. An approach that seeks only to maximize the annual amount of foreign investment irrespective of the sector in which it is undertaken is implicitly a sectoral choice to base the country's development only on those sectors where it already has a good deal of comparative advantage. Successful late-industrializing countries have found the promotion of backward production linkages between foreign affiliates and domestic firms to be very important. State engagement helps to overcome what Lall (2000) calls information failures from inadequate knowledge, on the part of investors, of conditions of investment in developing countries.

## **6.2 Other capability enhancing and developing policies**

Lall (2000: 339) suggests that 'getting prices right' provides an insufficient incentive for firms to upgrade their technical capabilities in a globalized production context. Comparative advantage depends on a 'national ability to master and use technologies' rather than on 'factor endowments in the usual sense'. In Lall's view, all exporting, including those of simple products, requires investments in capabilities such as procurement, production, engineering, design, and marketing. The assistance of governments to firms to develop these capabilities and to assist in coordinating investments in 'vertically linked activities or undertake collective learning' (Lall 2000: 356) is critical. Transnational companies have advantages in these activities and can be encouraged to contribute to the national effort, but these cannot be counted on to sustain the effort in the long term or across product lines. Governments must either provide steady assistance to domestic firms or promote the entry of higher quality FDI as domestic capabilities are upgraded. Moreover, assistance to small and medium enterprises and the development of flexible domestic capabilities will continue to be the responsibility of domestic authorities.

A strategy of liberalization plus investment in general education, leaving to markets the identification of comparative advantage, could exploit existing advantages in simple production activities and would support growth in what Lall (2000) calls the 'easy stage manufacturing' stage. To advance beyond this stage would require costly learning and building specific skills, otherwise the country will not be able to participate in dynamic export growth, which

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<sup>32</sup> See Development Committee (2006).

is associated with a steadily changing structure of exports. The government has an important role in capability upgrading beyond general education.

In recent years, the potential of services exports have been highlighted by the growth of information technology and business process outsourcing. Realistically, these growth sectors have benefited only a small number of countries. In the case of India, a long tradition of advanced engineering universities, originally motivated by its own import-substituting industrialization strategy, played a key role in the development of these services exports. In the case of business process outsourcing, a domestic capability in office procedures, specific skills in information technology, and accounting are often required. Developing countries seeking to develop these service exports have to undertake investment in these specific skills and realistically take into account the size of their populations to take advantage of scale economies and the lead time involved to create these capabilities.

Historically, the most robust services exports have involved construction services and specialized services such as oil drilling and security services. In the case of the Republic of Korea, government support for construction services permitted their firms to bid for international construction contracts. For the Republic of Korea, the learning-by-doing aspect of this activity was as important, if not more important than, the foreign exchange earnings. In order to undertake services exports of this type, domestic capabilities in organizing logistics internationally are necessary.<sup>33</sup> The recent growth of medical tourism is also of interest. In this case, joint public-private efforts in producing specialized medical skills are required (as is also the case in industrial economies). If countries are installing the domestic capacity to achieve the health objectives of the MDGs (an exercise in industrial policy by itself) they can then consider expanding the volume of the health sector to enter into exporting medical services.

In reality, the most significant service export earnings of countries derive from the remittances of its overseas workers. As a matter of human rights and to safeguard the timely receipt of these personal earnings, developing country governments have been called upon to facilitate remittances. While this is strictly beyond the scope of this paper, governments might consider motivating people who remit to invest their earnings in national development banks and through these augment the resources that can be used to fund industrial projects. Many overseas workers return with specific industrial skills and governments could consider whether it wants to assist the private sector in mechanisms to aggregate these skills in order to advance industrialization efforts. While it has never happened historically, could a country with many seafaring workers create an international shipping services industry? Noting that workers may seek employment abroad in services, a few other developing countries have invested in upgrading the skills of their workers, such as in operating certain types of machinery for example, so that they are able to obtain higher paying jobs abroad. This is an indirect way of increasing domestic capability to promote industrialization.

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<sup>33</sup> In reality, recent episodes of services liberalization by developing countries have resulted in the entry of banking, tourism, and logistics services into these countries. Unless these countries are already strong exporters of tangible products, the advantages of the entry of these services could mainly benefit the importing sector. In reality, the most significant service export earnings of countries derive from remittance earnings of its overseas workers. As a matter of human rights and to safeguard the timely receipt of these personal earnings, developing country governments have been called upon to facilitate remittances. See Development Committee (2006).

## 7. Role of international institutions in widening the policy space

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States undertake their trade and industrial policy in the context of international rules, their assistance engagements with donors, and their loans with international financial institutions. Each of these engagements imposes constraints on the kinds of policies that countries can undertake to pursue their development. The United Nations International Conference on Financing for Development, held in 2002 at Monterrey, Mexico, asserted that:

Each country has primary responsibility for its own economic and social development, and the role of national policies and development strategies cannot be overemphasized.<sup>34</sup>

Each government needs to evaluate the trade-off between the advantages of accepting and complying with international rules and commitments and the limitations imposed by the loss of policy space. The considerations that the paper has posed above should inform this choice.

Most critically, international rules and treaties are the outcomes of negotiations and treaties that countries create among themselves. It is important to realize that the nature of these commitments is shaped by perspectives about development policy and within that industrial policy. If, indeed, policy space is an essential ingredient to overcoming poverty, international institutions and regulations should first of all recognize that countries do indeed have the primary responsibility for their development and that these rules should provide the needed policy space that countries need to fulfil this responsibility.

In March 2005, the signatories<sup>35</sup> to the Paris Declaration on Aid Effectiveness committed to the principle that national development strategies, which are constructed and designed by the recipient countries, will be the basis for donor assistance. If this principle is truly implemented, donors should provide assistance consistent with the development plans and strategies of the recipient countries. The real constraint lies in the capability of developing countries to undertake development planning that is consistent with their needs. If these principles are genuinely adhered to, it will require donors to alter their practices, consider more effective approaches, such as expanding the use of budget support, as opposed to project support, since in theory the government budget is the expression of a country's current development programme. While this agenda has generated strong interest on the part of the donor community, which had initiated it, developing countries are not fully active in its development and conceptual discussions. At the present time, the 'aid ef-

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<sup>34</sup> United Nations (2003), p. 5.

<sup>35</sup> Signatories included all the member countries of the OECD and some international financial institutions such as the World Bank.

fectiveness' effort is mainly driven by donors. It is important for developing countries, acting in the international sphere, with an understanding of what kind of policy space is required for their development, to begin to define the partnership between donors and recipients, starting with the definition of what should be counted as 'aid' to developing countries.

The international community launched the Doha Round of trade negotiations in November 2001. The agreement to launch the round was based on two premises: to exhibit solidarity with United States, a proponent of the round, after the attacks on major buildings of September 2001; and to undertake a 'development round' in order to reform the rules and processes of the WTO to make them development-friendly. Developing countries now constitute the overwhelming majority of WTO Members. Their support for the Doha round was based on the view that the round would be an opportunity to improve the international trading system.

Through the WTO and other international commitments, the international community manages international trade, in the first place, through agreements on tariffs, subsidies, and product standards. While the average tariff of industrial countries are quite low compared to those in developing countries, their tariffs for products for which developing countries are most competitive, such as garments, are high. There should be a limitation of these so-called tariff peaks. The current proposal in the Doha Round being negotiated under the aegis of Non-Agricultural Market Access (NAMA) applies a compression formula on the tariff rates of Member countries. This will affect the tariff peaks in developed country tariffs, but depending on the parameters of the formula, it could also drastically reduce the level of all tariffs that developing countries can impose.

Since most of the tariffs of developed countries are already at low levels, this will not cause their economies much harm. However, it could severely restrict the ability of developing countries to develop industries by preventing them from having high tariffs for industries promoted by them. There is acceptance of the principle that the parameters of the formula should be different between developed and developing countries, but there is continued disagreement over how different the levels should be. There are also controversies over whether certain sectors can be excluded from the application of the formula and the grounds on which these can be excluded.

Countries that have succeeded in industrializing have utilized variable tariff levels through their development. For sectors where they are still uncompetitive, implementing low or zero tariff levels provide their domestic industries a competitive access to these products, especially if they are inputs to production. For those specific sectors where the country would like to build up a competitive capability, high tariffs have been applied while economies of scale have been exploited and learning-by-doing was taking place. Eventually, when the sector was internationally competitive, tariffs protecting the sector have been reduced dramatically or eliminated. The progression from first protecting resource-using industries, to labour-intensive, to technology-intensive products has been used by many countries, but the actual pattern will depend on the resource endowments of the country and the capabilities of its labour force. This means that when the country is still developing its resource-using industries, for example, tariffs could be low or zero for labour-intensive

and advance technology products, but at a later stage the pattern could be reversed. In the context of this historical pattern, developing countries need an industrial development plan to determine their tariff negotiating strategies both at the multilateral and bilateral arenas. Without industrial policy, developing country negotiators will find themselves confined to protecting *existing* industries, where they already have some international competitiveness, instead of negotiating with a view to ensuring that future industrial sectors can be developed.

The danger that the proposed NAMA approach poses is that it will impose ceilings on tariff rates to **all** industrial products **forever** and prevent countries from implementing variable tariff rates appropriate to its level of development. The current negotiating proposals in the WTO exempt least developed countries for a fixed period. However, when this period is over, these countries would also be subject to the same restrictions for all time and prevent them from applying variable tariffs for different stages of development.

For the least developed countries, there has been progress toward providing them with duty-free and quota-free access to developed country markets. However, a limitation was introduced in the December 2005 WTO ministerial meeting in Hong Kong (SAR, China), which exempted three percent of the goods being imported by rich countries. Since least developed countries have a narrow industrial base, the three percent exception could constitute all the products they could possibly export to rich country markets.

Beyond tariffs and trade-related commitments, the WTO and other trade treaties have begun to include limitations on country policies, as noted earlier. The TRIMs Agreement severely reduces the ability of countries to impose performance requirements, such as domestic value-added, on foreign investors. While these restrictions are certainly to the advantage of multinational companies, the overwhelming majority of which come from developed countries, they are also justified as 'being good' for developing countries, because they are thought to improve the investment climate by imposing reduced conditionalities on foreign investors. In actual practice, international investment flows have been highly concentrated in a few developing countries. The countries that have seen strong investment interest are not necessarily those that have imposed the least restrictions. In view of the range of policies that would be required for development, it would be important for countries to seek to redefine which restrictions should be the subject of international agreements and which should be the province of national authorities. Additional restrictions on investors due to environmental issues have been the most controversial. However, States have many other social and economic pressures, to deal with which their ability to regulate investment is important.

Developing country governments have expanded the creation of caucuses and groupings in line with the Doha development round negotiations, taking stances that are consistent with the interest that trade rules do not inhibit capital accumulation and the building up of international competitiveness. This effort is necessary if the outcome of the Doha negotiations is truly developmental.

## 8. Conclusion

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It is useful here to summarize the key points of this paper. Industrial policy is the application of selective government interventions to favour certain sectors so that their expansion benefits the productivity of the economy as a whole.

The authors have made the point that because of the frequency of increasing returns to scale, information externalities, and other market imperfections, States are called upon to regulate and intervene in private markets. In the case of developing countries, markets particularly cannot be relied upon in ensuring the capability upgrading that is required to overcome poverty. They also emphasized that because the economies of developing countries are now more directly attached to the international economy as compared to the past, it becomes even more critical for social interventions toward specific increases in capability in specific areas. Otherwise, the economy will remain uncompetitive and condemned to underdevelopment. States are 'doomed to choose' to undertake 'industrial policy', whether consciously or otherwise. The more dependent countries are on exports and the international economy, the more unavoidable is industrial policy because of specific features in technology when undertaking effort in capability building. In the last few decades, when it became the fashion for States to stop providing protection for their domestic enterprises, the array of policies encouraging and providing implicit or explicit subsidies for foreign investment constituted a specific configuration of industrial policy.

The argument is, therefore, that States in developing countries would be better off having a deliberate and explicit industrial policy, consistent with their natural endowments, their stage of development, and their political arrangements. Industrial policy involves the configuration and management of relations between the State, on the one hand, and investors, capitalists, and firms, on the other. At the risk of slighting the built-in technological and capabilities dimensions, one shorthand way of describing 'industrial policy' is that it is the State policy toward 'industrialists'. Industrial policy is effective if the outcome of this relationship is in the interest of the whole nation. When development is redefined as the reduction of poverty, effective industrial policy occurs when the ongoing relationship of firms and production units to the State results in risk-taking, technical upgrading, investment, and growth that reduces poverty.

The paper then explored the required capacities that States need for industrial policy, addressing the observations that governments do not have the knowledge and tools to intervene and that the international rules severely constrict the space of governments to do

so. The authors presented some quantitative evaluation of the relative success of countries in undertaking industrial policy. Toward the end of the paper we discussed the current challenges, both domestic and external, that need to be overcome in undertaking industrial policy. We discussed the role of policy space and the kind of reforms in the international arena that are needed to permit countries to be truly responsible for their own development.

Thus, developing countries should consider the following approaches in regard to industrial policy:

- Development policy making should include a realistic assessment of the industrial capabilities of a country. This assessment should include an assessment of technological capabilities in different industries. There should also be a shift in the discourse on competitiveness, focusing toward productivity and away from the aspect of wage competitiveness.
- Governments should upgrade their capabilities in dealing with the private sector and industry associations in terms of understanding technical issues and market structures to better evaluate requests and resist pressures for subsidy and protection. Some of these capabilities do not have to reside within the staff; governments can rely on domestic and foreign consultants on an *ad hoc* basis.
- Taking into account the need to upgrade governance capabilities, Governments would benefit strongly from explicit approaches and plans for industrial development.
- States should expand the alignment between their educational and technological development strategies with their industrial development strategies.
- Trade policies, including the stances toward trade negotiations, should be consistent with the national industrial development strategies. Developing countries should limit the loss of policy space from international commitments and treaties.

## References

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- Aguayo Ayala, F. and Kevin P. Gallagher (2005). "Preserving Policy Space for Sustainable Development: The Subsidies Agreement at the WTO." Geneva: Trade Knowledge Network, International Institute for Sustainable Development, [http://www.tradeknowledgenetwork.net/pdf/tkn\\_policy\\_space.pdf](http://www.tradeknowledgenetwork.net/pdf/tkn_policy_space.pdf), accessed 4 December 2007.
- Akyüz, Y. (2005). "Trade, Growth and Industrialization: Issues, Experience, and Policy Challenges." Working paper. Edited version of paper first presented at UNDP/North-South Institute/Third World Network Conference on "Trade: Contribution to Growth, Human Development, and Poverty Reduction in Asia," Penang, 22-24 November. Geneva, January.
- (2006a). "From Liberalization to Investment and Jobs: Lost in Translation." Working paper prepared for the International Labour Organization. Geneva: ILO.
- (2006b). "Multilateral Disciplines and the Question of Policy Space." Working paper originally prepared as background paper for United Nations Conference on Trade and Development (UNCTAD) *Trade and Development Report 2006*. Geneva: UNCTAD.
- Akyüz, Y., H. Chang, and R. Kozul-Wright (1999). "New Perspectives on East Asian Development," in Yilmaz Akyüz (ed.), *East Asian Development: New Perspectives*. London: Frank Cass, pp. 4-36.
- Albo, G. (1997). "A World Market of Opportunities? Capitalist Obstacles and Left Economic Policy." *The Socialist Register*, Vol 33, pp. 5-47.
- Amsden, A. H. (2001). *The Rise of the "The Rest": Challenges to the West from Late Industrializing Economies*. Oxford: Oxford University Press.
- Amsden, A. H. (2005). "Promoting Industry under WTO Law," in Kevin P. Gallagher (ed.), *Putting Development First: The Importance of Policy Space in the WTO and International Financial Institutions*. London: Zed Books, pp. 216-232.
- Bhagwati, Jagdish (2004). *In Defense of Globalization*. Oxford: Oxford University Press.
- Berner, M. and J. K. Galbraith (eds.) (2001). *Inequality and Industrial Change A Global View*. New York: Cambridge University Press.

- Bora, B., P. Lloyd, and M. Pangestu (2000). "Industrial Policy and the WTO." Policy Issues in International Trade and Commodities. United Nations Conference on Trade and Development (UNCTAD) Study Series No. 6. Geneva: UNCTAD.
- Browning, E. S. (1981). "East Asia in Search of a Second Economic Miracle." *Foreign Affairs*, Vol. 60, No. 1 pp. 45-62, Fall.
- Chang, H. (1996). *The Political Economy of Industrial Policy*. London: Macmillan Press Ltd.
- (ed.) (2003). *Rethinking Development Economics*. London: Anthem Press.
- (2005). "Policy Space in Historical Perspective—with Special Reference to Trade and Industrial Policies." Talk presented at Tufts University, Boston, 7 October.
- Cimoli, M., G. Dosi, R. R. Nelson, and J. Stiglitz (2006). "Institutions and Policies Shaping Industrial Development: An Introductory Note." Laboratory of Economics and Management (LEM) Working Paper 2006/02. Scuola. Superiore Sant' Anna, Pisa, <http://econpapers.repec.org/paper/ssalemwps/>, accessed 25 October 2007.
- Development Committee (2006). "Fiscal Policy for Growth and Development: An Interim Report." Washington, D.C.: Development Committee, <http://econpapers.repec.org/paper/ssalemwps/>, accessed 25 October 2007.
- Dohner, Robert S., and Ponciano Intal, Jr. (1989). "The Marcos Legacy: Economic Policy and Foreign Debt in the Philippines," in J. Sachs and S. Collins (eds.), *Developing Country Debt and Economic Performance*, Volume 3. Chicago: University of Chicago Press, pp. 154-172.
- Felipe, J. (2005a). "A Note on Competitiveness, Unit Labor Costs and Growth: Is 'Kaldor's Paradox' a Figment of Interpretation?" Working Paper 6/2005. Canberra: Centre for Applied Macroeconomic Analysis (CAMA), Australian National University, May.
- (2005b). "The Diverging Patterns of Profitability, Investment and Growth of China and India, 1980-2003." Working Paper 22/2005 Centre for Applied Macroeconomic Analysis (CAMA), The Australian National University, Canberra. June.
- Fuller, D. B. (2002). "Globalization for Nation-Building: Industrial Policy for High Technology Products in Taiwan." Working Paper 02.02. Cambridge, Massachusetts: Massachusetts Institute of Technology (MIT) Japan Program, <http://mit.edu/mit-japan/outreach/work-papers/WP0202.pdf>, accessed 4 December 2007.
- Galbraith, J. K., and P. D. P. Calmon (1990). "Relative Wages and International Competitiveness in U.S. Industry," Working Paper No. 56. Austin, Texas: Lyndon B. Johnson School of Public Affairs, University of Texas at Austin.
- Galbraith, J. K., and J. Kim (2001). "The Legacy of the HCI: An Empirical Analysis of Korean Industrial Policy," in J. K. Galbraith and M. Berner (eds.), *Inequality and Industrial Change: A Global View*. New York: Cambridge University Press.

- Galbraith, J. K., and Jiaking Lu (2001). "Cluster and Discriminant Analysis on Time-Series as a Research Tool," in J. K. Galbraith and M. Berner (eds.), *Inequality and Industrial Change: A Global View*, New York: Cambridge University Press.
- Gallagher, Kevin P. (ed.). (2005). *Putting Development First: The Importance of Policy Space in the WTO and International Financial Institutions*. London: Zed Books.
- Hausmann, R., and B. Klinger (2006). "Structural Transformation and Patterns of Comparative Advantage in Product Space." Working Paper No. 128. Boston: Center for International Development, Harvard University, August.
- Hausmann, R., and D. Rodrik (2006). "Doomed to Choose: Industrial Policy as a Predicament." Paper prepared for the first Blue Sky seminar. Boston: Center for International Development, Harvard University, 2 September.
- International Monetary Fund (IMF) Independent Evaluation Office (2007). "The IMF and Aid to Sub-Saharan Africa." Washington, D.C., March, <http://www.ieo-imf.org/eval/complete/pdf/03122007/report.pdf>, accessed 20 June 2007.
- Katz, L., and L. Summers (1989). "Industry Rents: Evidence and Implications." *Brookings Papers on Economic Activity, Microeconomics Annual*, pp. 209-75.
- Kaufman, L., and P. J. Rousseeuw (1990). *Finding Groups in Data: An Introduction to Cluster Analysis*. New York: John Wiley.
- Keklik, M. (2003). *Schumpeter, Innovation and Growth: Long Cycle Dynamics in the Post WWII American Manufacturing Industries*. Aldershot: Ashgate.
- Lall, S. (2000). "The Technological Structure and Performance of Developing Country Manufactured Exports, 1985–98." *Oxford Development Studies*, Vol. 28, No. 3, pp. 337-69.
- (2002). "The Employment Impact of Globalization in Developing Countries." Working Paper No. 93. Oxford: Queen Elizabeth House.
- (2005). "Rethinking Industrial Strategy: The Role of the State in the Face of Globalization," in Kevin P. Gallagher (ed.), *Putting Development First: The Importance of Policy Space in the WTO and International Financial Institutions*. London: Zed Books, pp. 33-68.
- Lall, S., M. Albaladejo, and M. M. Moreira (2004). "Latin American Industrial Competitiveness and the Challenge of Globalization." Integration and Regional Programs Department, Washington DC: Inter-American Development Bank, June.
- Lundvall, B. (2007). "National Innovation Systems—Analytical Concept and Development Tool," [http://findarticles.com/p/articles/mi\\_qa3913/is\\_200702/ai\\_n18737244](http://findarticles.com/p/articles/mi_qa3913/is_200702/ai_n18737244), accessed 5 November 2007.

- Marshall, A. (1920). *Industry and Trade*. London: Macmillan.
- Memiş, E. (2007). "Inter and Intra-class Distribution of Income in Turkish Manufacturing, 1970–2000." Unpublished Dissertation. Salt Lake City, Utah: Department of Economics, University of Utah.
- Miyajima, H. (1992). "Japanese Industrial Policy during the Interwar Period: Strategies for International and Domestic Competition." *Business and Economic History*, Second Series, Volume 21, pp. 270-79.
- Murphy, KM, Shleifer A and Vishny RW (1989). "Industrialization and the Big Push." *Journal of Political Economy*, 97(5).
- Ocampo, J. A. (2003). "Latin America's Growth Frustrations: The Macro and Meso-economic Links." Paper presented at the Seminar on Management of Volatility, Financial Liberalization and Growth in Emerging Economies, Economic Commission for Latin America and the Caribbean (ECLAC) Headquarters, Santiago, Chile, 14-25 April.
- Odedokun, M. O. (1997). "Relative Effects of Public versus Private Investment Spending on Economic Efficiency and Growth in Developing Countries." *Applied Economics*, Vol. 29, No. 10, pp. 1325–36.
- Organisation for Economic Cooperation and Development (OECD) (1997). *National Innovation Systems*. Paris: OECD.
- (2005). Special Tabulations. *Science and Engineering Indicators 2006*. Paris: OECD.
- Pack, H., and N. Marcus (2003). *Industrial Policy in an Age of Globalization*. Washington D.C.: Institute for International Economics.
- Pack, H., and K. Saggi (2006). "The Case for Industrial Policy: A Critical Survey." World Bank Policy Research Working Paper 3839. Washington, D.C.: World Bank, February.
- Palanivel, T. (2006). "Linkages between International Trade and Employment." Background Paper. UNDP Regional Centre in Colombo: Sri Lanka.
- Rasiah, R. (2003). "Investment Policy and Human Development - Country Study: Malaysia." Paper in the UNDP Asia Pacific Regional Initiative on Trade, Economic Governance and Human Development Collection, Hanoi, December, <http://www.undprcc/Publications.asp#4535>, accessed 4 December 2007.
- Reekie, W. D. (1997). "Industrial Policy: A Critique." Monograph No. 16. Sandton, South Africa: The Free Market Foundation.
- Reinert, E. S. (1996). "Diminishing Returns and Economic Sustainability: The Dilemma of Resource-Based Economies under a Free Trade Regime." Oslo: University of Oslo, SUM-Centre for Development and the Environment, <http://www.othercanon.org/SUM%20paper%20diminishing%20returns.doc>, accessed 4 December 2007.

- (1999). "The Role of the State in Economic Growth." *Journal of Economic Studies*, Vol. 26, Nos. 4 & 5, pp. 268–326.
- (ed.) (2004). *Globalization, Economic Development and Inequality*. Cheltenham, UK: Edward Elgar.
- (2005). "Development and Social Goals: Balancing Aid and Development to Prevent 'Welfare Colonialism.'" *Post-Autistic Economics Review*, Issue No. 30, 21 March, <http://www.paecon.net/PAEReview/issue30/Reinert30.htm>.
- (2007). *How Rich Countries Got Rich ... And Why Poor Countries Stay Poor*. New York: Public Affairs.
- Rodrik, D. (2006). "Industrial Development: Some Stylized Facts and Policy Directions," <http://ksghome.harvard.edu/~drodrik/industrial%20development.pdf>, accessed 27 January 2007.
- Samuelson, P. A. (1948). "International Trade and Equalisation of Factor Prices." *Economic Journal*, Vol. 58, June, pp. 163–84.
- (2004). "Where Ricardo and Mill Rebut and Confirm Arguments of Mainstream Economists Supporting Globalization." *Journal of Economic Perspectives*, Vol. 18, No. 3: pp. 135–46, Summer.
- Schumpeter, J. A. (1934) 1<sup>st</sup> edition, (1961) 2<sup>nd</sup> edition. *The Theory of Economic Development*. Cambridge, Massachusetts: Harvard University Press; New York: Oxford University Press.
- Schumpeter, J. A. (1942). *Capitalism, Socialism, and Democracy*. New York: Harper and Brothers.
- Scott, Bruce. (1985). "U.S. Competitiveness: Concepts, Performance, and Implications," in B. R. Scott and G. Lodge (eds.), *U.S. Competitiveness in the World Economy*. Boston: Harvard Business School Press, pp. 14-15.
- Shadlen, K. (2006). "Globalization, Power, and Economic Integration in the Americas." Paper prepared for presentation at the conference on "Responding to Globalization in the Americas: The Political Economy of Hemispheric Integration," Development Studies Institute, London School of Economics, London, May.
- Shafaeddin, M. (1998). "How Did the Developed Countries Industrialize? The History of Trade and Industrial Policy: The Cases of Great Britain and the USA." Discussion paper. UNCTAD/OSG/DP/139, December.
- (2005). "Trade Liberalization and Economic Reform in Developing Countries: Structural Change or De-Industrialization," in Alberto Paloni and Maurizio Zanardi (eds.), *The IMF, the World Bank and Policy Reform*. London: Routledge, pp. 162-190.

- (2006). "Is Industrial Policy Relevant in the 21<sup>st</sup> Century?" Paper prepared for presentation at conference on "New Approaches to the Design of Development Policies," Arab Planning Institute, Beirut, 20-21 March.
- Shapiro, Helen (2005). "Industrial Policy and Growth." November, [http://www.un.org/esa/policy/backgroundpapers/Industrial\\_policy\\_growth.pdf](http://www.un.org/esa/policy/backgroundpapers/Industrial_policy_growth.pdf), accessed 4 December 2007.
- Somel, C. (1996). "Globalization and Unemployment," *Private View*, Vol.1, No. 2: pp. 53-58, Spring-Summer.
- United Nations (2003). *The Monterrey Consensus of the International Conference on Financing for Development*. New York: United Nations.
- United Nations Development Programme (UNDP), Rockefeller Brothers Fund (RBF) *et al.* (2003). *Making Global Trade Work for People*. London: Earthscan.
- UNDP Asia-Pacific Trade and Investment Initiative (APTII) (2005). *People, Trade and Development: Learning from Asia-Pacific. Policy Paper*. UNDP Regional Centre in Colombo: Sri Lanka, December. (Written by Manuel Montes and Emel Memiş).
- UNDP Regional Centre in Colombo (2006). *Trade on Human Terms*. Colombo: UNDP Regional Centre.
- UNIDO (United Nations Industrial Development Organisation) (2004). *Industrial Development Report 2004: Industrialisation, Environment and the Millennium Development Goals in Sub-Saharan Africa—The New Frontier in the Fight Against Poverty*. Vienna: UNIDO.
- US National Science Board. *Science and Engineering Indicators*. Arlington, Virginia, <http://www.nsf.gov/nsb/>
- Velde, D. W. te (2003). "Foreign Direct Investment and Income Inequality in Latin America: Experiences and Policy Implications." Briefing Paper. Instituto de Investigaciones Socio-Económicas (IISEC): Overseas Development Institute, Universidad Católica Boliviana, La Paz, [http://www.odi.org.uk/IEDG/Meetings/FDI\\_feb2003/dwvte\\_briefing\\_paper.pdf](http://www.odi.org.uk/IEDG/Meetings/FDI_feb2003/dwvte_briefing_paper.pdf), accessed 4 December 2007.
- Ward, Joe Henry Jr. (1963). "Hierarchical Grouping to Optimize an Objective Function." *Journal of the American Statistical Association*, Vol. 58: pp. 236-244.
- World Bank (2007). "Fiscal Policy for Growth and Development: Further Lessons from Country Case Studies." Background paper for the Development Committee, Washington, D.C., 22 March.



## Annex A

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**Table A1: Share in world production of all manufacturing industries, by selected country/economy: Selected years, 1980–2003 (percent)**

| Industry and country/economy      | 1980 | 1985 | 1990 | 1995 | 2000 | 2001 | 2002 | 2003 |
|-----------------------------------|------|------|------|------|------|------|------|------|
| All manufacturing industries      |      |      |      |      |      |      |      |      |
| United States                     | 22.1 | 21.9 | 21.0 | 22.7 | 24.6 | 23.9 | 23.5 | 22.8 |
| Canada                            | 2.2  | 2.2  | 2.0  | 2.0  | 2.2  | 2.1  | 2.1  | 2.0  |
| Mexico                            | 1.5  | 1.4  | 1.4  | 1.3  | 1.5  | 1.5  | 1.5  | 1.4  |
| Brazil                            | 4.1  | 3.5  | 2.9  | 2.9  | 2.5  | 2.6  | 2.5  | 2.4  |
| Chile                             | 0.2  | 0.1  | 0.2  | 0.2  | 0.2  | 0.2  | 0.2  | 0.2  |
| Costa Rica                        | 0.0  | 0.0  | 0.0  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  |
| Argentina                         | 1.1  | 0.9  | 0.7  | 0.8  | 0.7  | 0.6  | 0.6  | 0.6  |
| Peru                              | 0.2  | 0.2  | 0.1  | 0.2  | 0.1  | 0.1  | 0.1  | 0.1  |
| Austria                           | 0.6  | 0.6  | 0.6  | 0.6  | 0.7  | 0.7  | 0.7  | 0.7  |
| Belgium                           | 1.3  | 1.2  | 1.1  | 1.0  | 1.0  | 1.0  | 1.0  | 1.0  |
| Denmark                           | 0.4  | 0.5  | 0.4  | 0.4  | 0.4  | 0.4  | 0.4  | 0.4  |
| France                            | 5.9  | 5.6  | 5.3  | 4.7  | 4.4  | 4.5  | 4.4  | 4.2  |
| Finland                           | 0.5  | 0.5  | 0.5  | 0.5  | 0.6  | 0.6  | 0.6  | 0.6  |
| Germany                           | 9.4  | 8.7  | 8.5  | 7.7  | 7.3  | 7.4  | 7.2  | 7.0  |
| Greece                            | 0.4  | 0.3  | 0.3  | 0.2  | 0.2  | 0.2  | 0.2  | 0.2  |
| Ireland                           | 0.1  | 0.2  | 0.2  | 0.3  | 0.5  | 0.6  | 0.6  | 0.6  |
| Italy                             | 5.7  | 5.0  | 4.9  | 4.7  | 4.1  | 4.1  | 3.9  | 3.7  |
| Netherlands                       | 1.7  | 1.4  | 1.3  | 1.2  | 1.1  | 1.2  | 1.1  | 1.1  |
| Portugal                          | 0.4  | 0.4  | 0.4  | 0.4  | 0.3  | 0.4  | 0.4  | 0.3  |
| Spain                             | 2.4  | 2.2  | 2.1  | 2.0  | 2.0  | 2.0  | 1.9  | 1.9  |
| Sweden                            | 0.9  | 0.9  | 0.9  | 0.9  | 0.9  | 0.9  | 0.9  | 0.9  |
| United Kingdom                    | 5.2  | 4.7  | 4.6  | 4.3  | 3.7  | 3.7  | 3.5  | 3.4  |
| European Union-15                 | 34.9 | 32.0 | 31.1 | 29.0 | 27.1 | 27.5 | 26.8 | 25.9 |
| Czech Republic                    | 0.5  | 0.5  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  |
| Hungary                           | 0.3  | 0.3  | 0.2  | 0.2  | 0.3  | 0.3  | 0.3  | 0.3  |
| Poland                            | 0.9  | 0.7  | 0.5  | 0.5  | 0.6  | 0.6  | 0.6  | 0.7  |
| Slovakia                          | 0.1  | 0.2  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  |
| Expanded European Union countries | 1.8  | 1.7  | 1.2  | 1.1  | 1.3  | 1.3  | 1.4  | 1.4  |
| Japan                             | 17.6 | 18.5 | 19.1 | 16.6 | 14.1 | 13.3 | 12.9 | 12.9 |
| China                             | 1.7  | 2.5  | 3.1  | 6.2  | 8.7  | 9.7  | 10.8 | 12.2 |
| Republic of Korea                 | 0.9  | 1.3  | 2.0  | 2.8  | 3.5  | 3.5  | 3.8  | 3.8  |

| Industry and country/economy | 1980 | 1985 | 1990 | 1995 | 2000 | 2001 | 2002 | 2003 |
|------------------------------|------|------|------|------|------|------|------|------|
| Taiwan (Province of China)   | 1.0  | 1.2  | 1.4  | 1.6  | 1.7  | 1.6  | 1.7  | 1.8  |
| Singapore                    | 0.2  | 0.2  | 0.3  | 0.4  | 0.4  | 0.4  | 0.4  | 0.4  |
| Hong Kong (SAR, China)       | 0.3  | 0.2  | 0.3  | 0.2  | 0.1  | 0.1  | 0.1  | 0.1  |
| India                        | 0.8  | 1.0  | 1.2  | 1.5  | 1.6  | 1.7  | 1.8  | 1.8  |
| Malaysia                     | 0.1  | 0.2  | 0.2  | 0.4  | 0.5  | 0.5  | 0.5  | 0.5  |
| Thailand                     | 0.3  | 0.4  | 0.5  | 0.7  | 0.7  | 0.7  | 0.7  | 0.8  |
| Philippines                  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  |
| Indonesia                    | 0.2  | 0.4  | 0.6  | 1.0  | 0.7  | 0.7  | 0.6  | 0.7  |
| South Africa                 | 0.8  | 0.7  | 0.6  | 0.6  | 0.5  | 0.5  | 0.5  | 0.5  |

Notes: Seventy countries or economies included. High-technology sectors cover aerospace; computers and office machinery; communications equipment; pharmaceuticals; and medical, precision, and optical instruments.

Source: Calculated using OECD (2005) Science and Engineering Indicators 2006 provided by US, National Science Board <http://www.nsf.gov/nsb/>

**Table A2: Share in world production of high-technology industries, by selected country/economy: Selected years, 1980–2003 (percent)**

| Industry and country/economy      | 1980 | 1985 | 1990 | 1995 | 2000 | 2001 | 2002 | 2003 |
|-----------------------------------|------|------|------|------|------|------|------|------|
| High-technology Industries        |      |      |      |      |      |      |      |      |
| United States                     | 27.9 | 26.0 | 24.6 | 24.7 | 37.8 | 38.7 | 39.5 | 38.9 |
| Canada                            | 1.3  | 1.2  | 1.4  | 1.6  | 1.7  | 1.3  | 1.1  | 1.1  |
| Mexico                            | 1.9  | 1.3  | 1.3  | 1.3  | 1.8  | 1.7  | 1.5  | 1.3  |
| Brazil                            | 8.0  | 4.2  | 3.5  | 2.7  | 1.4  | 1.4  | 1.3  | 1.2  |
| Chile                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Costa Rica                        | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Argentina                         | 0.7  | 0.4  | 0.3  | 0.3  | 0.2  | 0.2  | 0.2  | 0.2  |
| Peru                              | 0.1  | 0.1  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Austria                           | 0.4  | 0.4  | 0.4  | 0.5  | 0.4  | 0.4  | 0.4  | 0.3  |
| Belgium                           | 0.9  | 0.9  | 0.7  | 0.6  | 0.5  | 0.5  | 0.5  | 0.6  |
| Denmark                           | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  |
| France                            | 8.7  | 7.9  | 6.2  | 5.6  | 4.1  | 4.2  | 4.2  | 3.9  |
| Finland                           | 0.2  | 0.2  | 0.3  | 0.5  | 0.8  | 0.8  | 0.9  | 0.8  |
| Germany                           | 7.7  | 7.2  | 6.3  | 5.8  | 4.5  | 4.6  | 4.4  | 4.2  |
| Greece                            | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  |
| Ireland                           | 0.1  | 0.2  | 0.3  | 0.6  | 1.0  | 1.2  | 1.1  | 1.0  |
| Italy                             | 4.4  | 4.6  | 3.6  | 3.1  | 1.8  | 1.7  | 1.6  | 1.4  |
| Netherlands                       | 1.2  | 1.0  | 1.1  | 1.0  | 0.8  | 0.8  | 0.6  | 0.5  |
| Portugal                          | 0.3  | 0.2  | 0.2  | 0.2  | 0.1  | 0.2  | 0.1  | 0.2  |
| Spain                             | 2.6  | 1.6  | 1.3  | 1.1  | 0.7  | 0.7  | 0.6  | 0.6  |
| Sweden                            | 0.8  | 0.8  | 0.9  | 1.2  | 1.1  | 1.1  | 1.0  | 0.9  |
| United Kingdom                    | 5.4  | 4.9  | 5.1  | 5.4  | 4.0  | 4.1  | 3.5  | 3.3  |
| European Union-15                 | 33.0 | 30.5 | 26.7 | 26.1 | 20.2 | 20.6 | 19.1 | 18.0 |
| Czech Republic                    | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.2  | 0.2  | 0.2  |
| Hungary                           | 0.3  | 0.3  | 0.2  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  |
| Poland                            | 0.4  | 0.3  | 0.2  | 0.2  | 0.2  | 0.2  | 0.2  | 0.2  |
| Slovakia                          | 0.1  | 0.1  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Expanded European Union countries | 0.8  | 0.7  | 0.5  | 0.4  | 0.4  | 0.5  | 0.5  | 0.5  |
| Japan                             | 14.8 | 23.0 | 25.3 | 21.8 | 13.9 | 12.6 | 10.9 | 10.8 |
| China                             | 0.9  | 1.5  | 1.9  | 3.8  | 6.8  | 8.0  | 10.1 | 12.2 |
| Republic of Korea                 | 0.7  | 1.2  | 2.5  | 4.1  | 4.8  | 4.8  | 5.2  | 5.1  |
| Taiwan (Province of China)        | 1.1  | 1.6  | 2.3  | 3.1  | 3.1  | 2.9  | 3.2  | 3.5  |
| Singapore                         | 0.6  | 0.8  | 1.6  | 2.4  | 2.1  | 1.8  | 1.7  | 1.6  |
| Hong Kong (SAR, China)            | 0.5  | 0.4  | 0.5  | 0.5  | 0.2  | 0.2  | 0.1  | 0.1  |
| India                             | 0.2  | 0.2  | 0.4  | 0.6  | 0.5  | 0.5  | 0.5  | 0.5  |
| Malaysia                          | 0.2  | 0.2  | 0.6  | 1.9  | 1.8  | 1.6  | 1.6  | 1.7  |
| Thailand                          | 0.1  | 0.1  | 0.3  | 0.3  | 0.2  | 0.2  | 0.2  | 0.2  |
| Philippines                       | 0.1  | 0.1  | 0.1  | 0.2  | 0.3  | 0.3  | 0.3  | 0.3  |
| Indonesia                         | 0.0  | 0.1  | 0.2  | 0.3  | 0.2  | 0.2  | 0.2  | 0.2  |
| South Africa                      | 0.3  | 0.2  | 0.2  | 0.2  | 0.1  | 0.1  | 0.1  | 0.1  |

Source: Same as Table A1.

**Table A3: Share in world aircraft industry production, by selected country/economy:  
Selected years, 1980–2003 (percent)**

| Industry and country/economy      | 1980 | 1985 | 1990 | 1995 | 2000 | 2001 | 2002 | 2003 |
|-----------------------------------|------|------|------|------|------|------|------|------|
| <b>Aircraft</b>                   |      |      |      |      |      |      |      |      |
| United States                     | 46.6 | 49.6 | 51.7 | 44.2 | 39.5 | 39.6 | 35.1 | 32.8 |
| Canada                            | 2.0  | 1.6  | 2.3  | 2.6  | 3.3  | 2.9  | 2.7  | 2.6  |
| Mexico                            | 0.0  | 0.0  | 0.0  | 0.1  | 0.1  | 0.1  | 0.1  | 0.2  |
| Brazil                            | 16.0 | 8.9  | 9.2  | 9.7  | 6.4  | 6.3  | 6.8  | 6.6  |
| Chile                             | 0.0  | 0.0  | 0.0  | 0.0  | 0.1  | 0.0  | 0.0  | 0.0  |
| Costa Rica                        | 0.0  | 0.0  | 0.0  | 0.1  | 0.0  | 0.0  | 0.0  | 0.0  |
| Argentina                         | 0.1  | 0.1  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Peru                              | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Austria                           | 0.1  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Belgium                           | 0.4  | 0.5  | 0.5  | 0.3  | 0.5  | 0.5  | 0.4  | 0.4  |
| Denmark                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| France                            | 13.7 | 14.2 | 9.1  | 10.4 | 10.1 | 10.1 | 12.5 | 12.5 |
| Finland                           | 0.0  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  |
| Germany                           | 6.1  | 6.8  | 6.6  | 7.1  | 6.4  | 6.3  | 7.0  | 7.6  |
| Greece                            | 0.0  | 0.0  | 0.0  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  |
| Ireland                           | 0.0  | 0.0  | 0.1  | 0.1  | 0.2  | 0.2  | 0.1  | 0.2  |
| Italy                             | 2.2  | 2.8  | 2.8  | 2.1  | 2.2  | 2.3  | 2.1  | 2.0  |
| Netherlands                       | 0.5  | 0.5  | 0.6  | 0.6  | 0.7  | 0.6  | 0.6  | 0.6  |
| Portugal                          | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Spain                             | 0.7  | 0.8  | 0.6  | 0.6  | 0.9  | 0.9  | 0.8  | 0.9  |
| Sweden                            | 0.6  | 0.8  | 0.7  | 0.8  | 0.5  | 0.5  | 0.4  | 0.4  |
| United Kingdom                    | 5.2  | 5.3  | 7.4  | 7.6  | 9.8  | 8.6  | 6.9  | 7.8  |
| European Union-15                 | 29.7 | 31.9 | 28.4 | 29.8 | 31.5 | 30.3 | 31.2 | 32.6 |
| Czech Republic                    | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  |
| Hungary                           | 0.0  | 0.0  | 0.0  | 0.0  | 0.1  | 0.1  | 0.1  | 0.1  |
| Poland                            | 0.3  | 0.2  | 0.2  | 0.2  | 0.1  | 0.1  | 0.1  | 0.1  |
| Slovakia                          | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Expanded European Union countries | 0.4  | 0.4  | 0.2  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  |
| Japan                             | 1.0  | 1.6  | 1.7  | 3.0  | 3.7  | 4.0  | 5.1  | 5.1  |
| China                             | 0.4  | 0.9  | 1.0  | 4.6  | 10.1 | 11.0 | 13.0 | 14.3 |
| Republic of Korea                 | 0.0  | 0.1  | 0.2  | 0.3  | 1.0  | 1.1  | 1.0  | 0.8  |
| Taiwan (Province of China)        | 0.2  | 0.2  | 0.1  | 0.2  | 0.4  | 0.5  | 0.7  | 0.7  |
| Singapore                         | 0.1  | 0.3  | 0.3  | 0.5  | 0.5  | 0.5  | 0.6  | 0.6  |
| Hong Kong (SAR, China)            | 0.1  | 0.1  | 0.1  | 0.1  | 0.2  | 0.2  | 0.3  | 0.2  |
| India                             | 0.0  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  |
| Malaysia                          | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Thailand                          | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Philippines                       | 0.1  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Indonesia                         | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| South Africa                      | 0.4  | 0.3  | 0.2  | 0.3  | 0.2  | 0.2  | 0.2  | 0.2  |

Source: Same as Table A1.

**Table A4: Share in world pharmaceuticals industry production, by selected country/economy: Selected years, 1980–2003 (percent)**

| Industry and country/economy      | 1980 | 1985 | 1990 | 1995 | 2000 | 2001 | 2002 | 2003 |
|-----------------------------------|------|------|------|------|------|------|------|------|
| Pharmaceuticals                   |      |      |      |      |      |      |      |      |
| United States                     | 23.2 | 23.4 | 24.1 | 24.5 | 26.3 | 27   | 26.6 | 24.6 |
| Canada                            | 1.19 | 1.31 | 1.29 | 1.24 | 1.33 | 1.59 | 1.78 | 1.76 |
| Mexico                            | 1.61 | 1.12 | 1.1  | 1.14 | 1.39 | 1.36 | 1.35 | 1.31 |
| Brazil                            | 8.62 | 6.11 | 4.62 | 3.42 | 2.58 | 2.44 | 2.37 | 2.09 |
| Chile                             | 0.07 | 0.08 | 0.14 | 0.19 | 0.14 | 0.13 | 0.13 | 0.12 |
| Costa Rica                        | 0.04 | 0.06 | 0.04 | 0.04 | 0.02 | 0.02 | 0.02 | 0.02 |
| Argentina                         | 2.42 | 1.64 | 1.21 | 1.06 | 0.92 | 0.86 | 0.65 | 0.71 |
| Peru                              | 0.41 | 0.22 | 0.13 | 0.15 | 0.11 | 0.11 | 0.1  | 0.11 |
| Austria                           | 0.33 | 0.38 | 0.45 | 0.58 | 0.72 | 0.56 | 0.56 | 0.55 |
| Belgium                           | 1.21 | 1.98 | 1.8  | 1.84 | 1.9  | 1.89 | 1.98 | 2.67 |
| Denmark                           | 0.36 | 0.61 | 0.56 | 0.65 | 1.09 | 1.14 | 1.14 | 1.04 |
| France                            | 7.64 | 8.98 | 8.09 | 7.56 | 8.27 | 7.89 | 7.47 | 7.64 |
| Finland                           | 0.26 | 0.29 | 0.24 | 0.16 | 0.12 | 0.11 | 0.09 | 0.09 |
| Germany                           | 7.89 | 7.29 | 6.31 | 6.89 | 5.61 | 5.6  | 5.71 | 5.67 |
| Greece                            | 0.16 | 0.15 | 0.17 | 0.14 | 0.24 | 0.3  | 0.33 | 0.34 |
| Ireland                           | 0.13 | 0.22 | 0.27 | 0.8  | 1.95 | 2.4  | 2.75 | 2.51 |
| Italy                             | 4.82 | 5.69 | 5.49 | 4.89 | 4.29 | 3.85 | 3.89 | 3.68 |
| Netherlands                       | 1.38 | 1.37 | 1.25 | 1.55 | 1.63 | 1.66 | 1.74 | 1.73 |
| Portugal                          | 0.67 | 0.4  | 0.51 | 0.35 | 0.3  | 0.26 | 0.24 | 0.24 |
| Spain                             | 2.93 | 2.24 | 1.98 | 2.21 | 2.1  | 2.01 | 2.13 | 2.15 |
| Sweden                            | 0.58 | 0.63 | 0.65 | 1.1  | 1.22 | 1.3  | 1.38 | 1.51 |
| United Kingdom                    | 2.36 | 2.45 | 3.14 | 5.23 | 3.88 | 4.39 | 4.56 | 4.55 |
| European Union-15                 | 30.7 | 32.7 | 30.9 | 34   | 33.3 | 33.4 | 34   | 34.4 |
| Czech Republic                    | 0.26 | 0.22 | 0.12 | 0.1  | 0.07 | 0.06 | 0.06 | 0.06 |
| Hungary                           | 0.56 | 0.65 | 0.44 | 0.24 | 0.27 | 0.23 | 0.24 | 0.23 |
| Poland                            | 0.48 | 0.39 | 0.21 | 0.18 | 0.13 | 0.13 | 0.14 | 0.14 |
| Slovakia                          | 0.09 | 0.08 | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |
| Expanded European Union countries | 1.38 | 1.33 | 0.81 | 0.57 | 0.53 | 0.49 | 0.49 | 0.47 |
| Japan                             | 15.2 | 15.7 | 17.8 | 17.3 | 14.9 | 14.1 | 13.4 | 12.8 |
| China                             | 1.73 | 2.08 | 2.52 | 3.73 | 5.75 | 6.04 | 6.32 | 8.19 |
| Republic of Korea                 | 0.98 | 1.5  | 2.53 | 3.01 | 3.56 | 3.66 | 3.83 | 4.17 |
| Taiwan (Province of China)        | 0.23 | 0.29 | 0.43 | 0.49 | 0.53 | 0.43 | 0.41 | 0.44 |
| Singapore                         | 0.21 | 0.38 | 0.7  | 0.45 | 1.01 | 1.03 | 1.31 | 1.42 |
| Hong Kong (SAR, China)            | 0.09 | 0.04 | 0.04 | 0.07 | 0.05 | 0.05 | 0.04 | 0.04 |
| India                             | 0.76 | 0.74 | 1.07 | 1.7  | 1.39 | 1.34 | 1.34 | 1.33 |
| Malaysia                          | 0.01 | 0.03 | 0.04 | 0.05 | 0.06 | 0.05 | 0.04 | 0.05 |
| Thailand                          | 0.17 | 0.22 | 0.21 | 0.25 | 0.29 | 0.29 | 0.29 | 0.32 |
| Philippines                       | 0.3  | 0.27 | 0.24 | 0.28 | 0.33 | 0.35 | 0.3  | 0.3  |
| Indonesia                         | 0.04 | 0.23 | 0.31 | 0.44 | 0.27 | 0.26 | 0.28 | 0.3  |
| South Africa                      | 0.71 | 0.46 | 0.48 | 0.41 | 0.23 | 0.22 | 0.22 | 0.19 |

Source: Same as Table A1.

**Table A5: Share in world office and computing machinery production, by selected country/economy: Selected years, 1980–2003 (percent)**

| Industry and country/economy      | 1980 | 1985 | 1990 | 1995 | 2000 | 2001 | 2002 | 2003 |
|-----------------------------------|------|------|------|------|------|------|------|------|
| Office and computing machinery    |      |      |      |      |      |      |      |      |
| United States                     | 3.59 | 7.38 | 9.66 | 19.9 | 35.7 | 35.5 | 33.2 | 32.7 |
| Canada                            | 0.06 | 0.18 | 0.39 | 1.19 | 1.31 | 1.16 | 1.01 | 0.85 |
| Mexico                            | 0.46 | 0.34 | 0.51 | 1.22 | 1.4  | 1.44 | 1.32 | 1.09 |
| Brazil                            | 2.94 | 1.03 | 1.06 | 1.04 | 0.74 | 0.81 | 0.79 | 0.68 |
| Chile                             | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Costa Rica                        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Argentina                         | 0.18 | 0.13 | 0.08 | 0.07 | 0.04 | 0.03 | 0.03 | 0.03 |
| Peru                              | 0.01 | 0.01 | 0.01 | 0.01 | 0    | 0    | 0    | 0    |
| Austria                           | 0.15 | 0.08 | 0.06 | 0.03 | 0.06 | 0.1  | 0.09 | 0.08 |
| Belgium                           | 0.19 | 0.11 | 0.08 | 0.09 | 0.1  | 0.09 | 0.06 | 0.04 |
| Denmark                           | 0.19 | 0.14 | 0.1  | 0.1  | 0.07 | 0.09 | 0.07 | 0.09 |
| France                            | 2.83 | 1.84 | 1.24 | 3.32 | 2.09 | 2.03 | 1.76 | 1.63 |
| Finland                           | 0.2  | 0.27 | 0.26 | 0.33 | 0.07 | 0.04 | 0.03 | 0.02 |
| Germany                           | 9.21 | 8.99 | 6.57 | 4.29 | 3.86 | 3.78 | 3.47 | 2.91 |
| Greece                            | 0.08 | 0.05 | 0.02 | 0    | 0    | 0    | 0.01 | 0    |
| Ireland                           | 0.57 | 0.41 | 0.5  | 0.76 | 0.81 | 0.8  | 0.65 | 0.69 |
| Italy                             | 8.82 | 7.9  | 2.17 | 1.91 | 0.59 | 0.59 | 0.41 | 0.25 |
| Netherlands                       | 2.62 | 1.93 | 0.86 | 0.79 | 0.39 | 0.4  | 0.31 | 0.23 |
| Portugal                          | 0.11 | 0.14 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |
| Spain                             | 16.4 | 6.13 | 3.04 | 1.07 | 0.45 | 0.33 | 0.2  | 0.11 |
| Sweden                            | 0.96 | 0.81 | 0.54 | 0.21 | 0.09 | 0.08 | 0.06 | 0.06 |
| United Kingdom                    | 3.12 | 4.07 | 4.75 | 6.78 | 5.32 | 6.04 | 5.24 | 4.43 |
| European Union-15                 | 45.5 | 32.9 | 20.2 | 19.7 | 13.9 | 14.4 | 12.4 | 10.6 |
| Czech Republic                    | 0.05 | 0.03 | 0.02 | 0.08 | 0.04 | 0.18 | 0.43 | 0.38 |
| Hungary                           | 0.06 | 0.04 | 0.02 | 0.03 | 0.02 | 0.02 | 0.01 | 0.01 |
| Poland                            | 0.2  | 0.09 | 0.06 | 0.05 | 0.07 | 0.08 | 0.09 | 0.13 |
| Slovakia                          | 0.08 | 0.05 | 0.03 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 |
| Expanded European Union countries | 0.38 | 0.21 | 0.13 | 0.19 | 0.15 | 0.29 | 0.55 | 0.54 |
| Japan                             | 35.5 | 46.4 | 49.9 | 31.8 | 14.7 | 12.6 | 10.1 | 8.53 |
| China                             | 1.15 | 0.65 | 0.71 | 2.21 | 12.3 | 14.8 | 20.3 | 26.3 |
| Republic of Korea                 | 0.43 | 0.64 | 1.79 | 3.25 | 5.24 | 5.45 | 6.34 | 5.51 |
| Taiwan (Province of China)        | 2.6  | 3.24 | 4.31 | 6.62 | 6.36 | 6.03 | 6.88 | 7.08 |
| Singapore                         | 2.91 | 3.59 | 7.59 | 8.42 | 5.69 | 4.8  | 4.61 | 3.97 |
| Hong Kong (SAR, China)            | 0.42 | 0.34 | 0.66 | 0.82 | 0.27 | 0.23 | 0.18 | 0.12 |
| India                             | 0.03 | 0.03 | 0.21 | 0.29 | 0.37 | 0.42 | 0.49 | 0.46 |
| Malaysia                          | 0.04 | 0.04 | 0.16 | 1.34 | 0.6  | 0.58 | 0.48 | 0.37 |
| Thailand                          | 0.01 | 0.01 | 0.02 | 0    | 0    | 0    | 0    | 0    |
| Philippines                       | 0.01 | 0.01 | 0.01 | 0.11 | 0.12 | 0.16 | 0.13 | 0.13 |
| Indonesia                         | 0.01 | 0.01 | 0.02 | 0.03 | 0    | 0    | 0.01 | 0.01 |
| South Africa                      | 0.03 | 0.01 | 0.01 | 0    | 0    | 0    | 0.01 | 0    |

Source: Same as Table A1.

**Table A6: Share in world communications equipment production, by selected country/economy: Selected years, 1980–2003 (percent)**

| Industry and country/economy      | 1980 | 1985 | 1990 | 1995 | 2000 | 2001 | 2002 | 2003 |
|-----------------------------------|------|------|------|------|------|------|------|------|
| Communication equipment           |      |      |      |      |      |      |      |      |
| United States                     | 11.3 | 8.27 | 6.15 | 11.4 | 40.4 | 42.8 | 46.4 | 46   |
| Canada                            | 1.52 | 1.7  | 1.76 | 1.98 | 1.81 | 0.99 | 0.75 | 0.7  |
| Mexico                            | 5.66 | 3.2  | 2.93 | 1.87 | 2.48 | 2.3  | 1.8  | 1.55 |
| Brazil                            | 4.74 | 2.27 | 1.67 | 1.67 | 0.52 | 0.52 | 0.4  | 0.37 |
| Chile                             | 0.01 | 0.01 | 0    | 0.01 | 0    | 0    | 0    | 0    |
| Costa Rica                        | 0.04 | 0.01 | 0.02 | 0.01 | 0    | 0    | 0    | 0    |
| Argentina                         | 0.48 | 0.25 | 0.12 | 0.12 | 0.06 | 0.05 | 0.11 | 0.12 |
| Peru                              | 0.09 | 0.03 | 0.01 | 0    | 0    | 0    | 0    | 0    |
| Austria                           | 1    | 0.85 | 0.84 | 0.81 | 0.49 | 0.46 | 0.39 | 0.32 |
| Belgium                           | 1.7  | 1.15 | 0.78 | 0.5  | 0.35 | 0.33 | 0.24 | 0.23 |
| Denmark                           | 0.4  | 0.28 | 0.24 | 0.23 | 0.16 | 0.16 | 0.17 | 0.14 |
| France                            | 7.33 | 5.75 | 4.64 | 3.47 | 2.29 | 2.26 | 1.97 | 1.78 |
| Finland                           | 0.24 | 0.27 | 0.37 | 0.95 | 1.59 | 1.58 | 1.64 | 1.48 |
| Germany                           | 5.81 | 4.72 | 3.84 | 3.63 | 2.62 | 2.74 | 2.32 | 2.33 |
| Greece                            | 0.12 | 0.08 | 0.05 | 0.04 | 0.05 | 0.05 | 0.03 | 0.02 |
| Ireland                           | 0.14 | 0.25 | 0.38 | 0.69 | 0.85 | 0.94 | 0.73 | 0.58 |
| Italy                             | 4.56 | 4.59 | 3.77 | 2.77 | 1.07 | 0.98 | 0.74 | 0.65 |
| Netherlands                       | 1.67 | 1.16 | 1.78 | 1.43 | 0.78 | 0.74 | 0.36 | 0.31 |
| Portugal                          | 0.46 | 0.43 | 0.32 | 0.33 | 0.18 | 0.22 | 0.2  | 0.24 |
| Spain                             | 1.41 | 0.8  | 0.93 | 0.88 | 0.36 | 0.31 | 0.23 | 0.19 |
| Sweden                            | 1.14 | 1.08 | 1.07 | 1.66 | 1.37 | 1.39 | 1.1  | 0.87 |
| United Kingdom                    | 7.39 | 5.61 | 4.76 | 4.04 | 2.43 | 2.15 | 1.68 | 1.54 |
| European Union-15                 | 33.4 | 27   | 23.8 | 21.4 | 14.6 | 14.3 | 11.8 | 10.7 |
| Czech Republic                    | 0.09 | 0.08 | 0.05 | 0.09 | 0.13 | 0.22 | 0.26 | 0.24 |
| Hungary                           | 0.36 | 0.26 | 0.1  | 0.09 | 0.02 | 0.03 | 0.03 | 0.04 |
| Poland                            | 0.58 | 0.39 | 0.28 | 0.17 | 0.14 | 0.16 | 0.16 | 0.15 |
| Slovakia                          | 0.08 | 0.05 | 0.04 | 0.03 | 0.02 | 0.03 | 0.04 | 0.04 |
| Expanded European Union countries | 1.11 | 0.79 | 0.48 | 0.37 | 0.32 | 0.44 | 0.49 | 0.47 |
| Japan                             | 26.6 | 40.4 | 40.1 | 31.5 | 16.3 | 15.1 | 12.4 | 13   |
| China                             | 1.17 | 2.64 | 3.26 | 5.31 | 5.26 | 6.34 | 8.3  | 9.24 |
| Republic of Korea                 | 1.18 | 2.02 | 4.9  | 7.46 | 6.22 | 6.27 | 6.65 | 6.49 |
| Taiwan (Province of China)        | 3.06 | 3.53 | 4.78 | 5.1  | 3.61 | 3.34 | 3.77 | 4.09 |
| Singapore                         | 1.2  | 0.88 | 1.37 | 2.27 | 1.71 | 1.34 | 1.17 | 1.24 |
| Hong Kong (SAR, China)            | 1.57 | 0.9  | 0.91 | 0.56 | 0.15 | 0.15 | 0.1  | 0.07 |
| India                             | 0.06 | 0.15 | 0.45 | 0.53 | 0.37 | 0.39 | 0.37 | 0.37 |
| Malaysia                          | 0.63 | 0.61 | 1.77 | 4.41 | 3.47 | 3.04 | 3.12 | 3.28 |
| Thailand                          | 0.06 | 0.06 | 0.66 | 0.58 | 0.32 | 0.25 | 0.28 | 0.29 |
| Philippines                       | 0.23 | 0.18 | 0.24 | 0.33 | 0.42 | 0.47 | 0.5  | 0.51 |
| Indonesia                         | 0.11 | 0.11 | 0.44 | 0.63 | 0.33 | 0.36 | 0.28 | 0.26 |
| South Africa                      | 0.35 | 0.22 | 0.16 | 0.13 | 0.06 | 0.05 | 0.04 | 0.04 |

Source: Same as Table A1.

**Table A7: Share in world medical, precision, and optical instruments production, by selected country/economy: Selected years, 1980–2003 (percent)**

| Industry and country/economy                | 1980  | 1985 | 1990 | 1995 | 2000 | 2001 | 2002 | 2003 |
|---|-------|------|------|------|------|------|------|------|
| Medical, precision, and optical instruments |       |      |      |      |      |      |      |      |
| United States                               | 37.83 | 40.6 | 39.8 | 43.4 | 42.2 | 41.1 | 39.9 | 40.7 |
| Canada                                      | 0.766 | 0.65 | 0.62 | 0.7  | 0.93 | 0.94 | 0.96 | 0.99 |
| Mexico                                      | 0.971 | 0.76 | 0.81 | 0.93 | 1.37 | 1.47 | 1.55 | 1.39 |
| Brazil                                      | 4.701 | 2.84 | 1.88 | 1.12 | 0.88 | 0.88 | 0.84 | 0.76 |
| Chile                                       | 0.006 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |
| Costa Rica                                  | 0.012 | 0    | 0.01 | 0.02 | 0    | 0    | 0    | 0    |
| Argentina                                   | 0.416 | 0.24 | 0.18 | 0.12 | 0.1  | 0.07 | 0.08 | 0.09 |
| Peru  | 0.009 | 0.01 | 0    | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Austria                                     | 0.202 | 0.29 | 0.36 | 0.4  | 0.56 | 0.59 | 0.64 | 0.64 |
| Belgium                                     | 0.544 | 0.53 | 0.32 | 0.4  | 0.36 | 0.38 | 0.42 | 0.45 |
| Denmark                                     | 0.292 | 0.38 | 0.36 | 0.48 | 0.63 | 0.66 | 0.62 | 0.59 |
| France                                      | 8.131 | 7.98 | 7.51 | 6.74 | 6.08 | 6.31 | 6.68 | 6.53 |
| Finland                                     | 0.167 | 0.26 | 0.32 | 0.37 | 0.46 | 0.52 | 0.54 | 0.45 |
| Germany                                     | 10.19 | 9.72 | 9.88 | 9.64 | 10.5 | 10.7 | 10.8 | 10.7 |
| Greece                                      | 0.088 | 0.06 | 0.04 | 0.04 | 0.03 | 0.04 | 0.04 | 0.05 |
| Ireland                                     | 0.131 | 0.2  | 0.25 | 0.43 | 1.31 | 1.84 | 1.76 | 2.03 |
| Italy                                       | 4.471 | 3.54 | 3.07 | 3.43 | 3.23 | 3.12 | 3.42 | 2.95 |
| Netherlands                                 | 0.835 | 0.33 | 0.27 | 0.24 | 0.33 | 0.48 | 0.49 | 0.46 |
| Portugal                                    | 0.158 | 0.14 | 0.12 | 0.14 | 0.09 | 0.09 | 0.08 | 0.07 |
| Spain                                       | 0.77  | 0.59 | 0.94 | 0.92 | 0.89 | 0.81 | 0.67 | 0.69 |
| Sweden                                      | 0.627 | 0.72 | 1.17 | 1.56 | 1.54 | 1.58 | 1.86 | 1.81 |
| United Kingdom                              | 6.641 | 6.14 | 5.69 | 5.71 | 4.78 | 5.12 | 4.87 | 4.82 |
| European Union-15                           | 33.25 | 30.9 | 30.3 | 30.5 | 30.8 | 32.2 | 32.9 | 32.2 |
| Czech Republic                              | 0.083 | 0.08 | 0.09 | 0.21 | 0.25 | 0.26 | 0.3  | 0.31 |
| Hungary                                     | 0.287 | 0.32 | 0.3  | 0.13 | 0.16 | 0.18 | 0.18 | 0.18 |
| Poland                                      | 0.264 | 0.25 | 0.22 | 0.29 | 0.37 | 0.4  | 0.4  | 0.42 |
| Slovakia                                    | 0.076 | 0.07 | 0.06 | 0.06 | 0.07 | 0.07 | 0.08 | 0.08 |
| Expanded European Union countries           | 0.709 | 0.72 | 0.68 | 0.69 | 0.86 | 0.91 | 0.95 | 0.99 |
| Japan                                       | 9.461 | 12.6 | 13.8 | 10.1 | 8.7  | 7.82 | 7.2  | 6.81 |
| China                                       | 0.287 | 0.67 | 0.66 | 1.62 | 3.2  | 3.52 | 4.37 | 4.87 |
| Republic of Korea                           | 0.933 | 0.95 | 1.39 | 1.7  | 1.9  | 1.94 | 2.07 | 2.05 |
| Taiwan (Province of China)                  | 0.397 | 0.46 | 0.64 | 0.7  | 0.86 | 0.75 | 0.94 | 1.01 |
| Singapore                                   | 0.212 | 0.11 | 0.16 | 0.33 | 0.51 | 0.51 | 0.54 | 0.51 |
| Hong Kong (SAR, China)                      | 0.282 | 0.28 | 0.42 | 0.52 | 0.31 | 0.28 | 0.22 | 0.16 |
| India                                       | 0.124 | 0.1  | 0.32 | 0.32 | 0.37 | 0.41 | 0.42 | 0.43 |
| Malaysia                                    | 0.24  | 0.19 | 0.27 | 0.36 | 0.43 | 0.35 | 0.38 | 0.41 |
| Thailand                                    | 0.015 | 0.1  | 0.05 | 0.1  | 0.1  | 0.1  | 0.11 | 0.12 |
| Philippines                                 | 0.003 | 0.01 | 0    | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 |
| Indonesia                                   | 0.024 | 0.12 | 0.19 | 0.17 | 0.04 | 0.02 | 0.02 | 0.02 |
| South Africa                                | 0.104 | 0.13 | 0.1  | 0.09 | 0.06 | 0.06 | 0.07 | 0.07 |

Source: Same as Table A1.

**Table A8: Share in world production of other manufacturing industries, by selected country/economy: Selected years, 1980–2003 (percent)**

| Industry and country/economy      | 1980  | 1985 | 1990 | 1995 | 2000 | 2001 | 2002 | 2003 |
|-----------------------------------|-------|------|------|------|------|------|------|------|
| Other manufacturing industries    |       |      |      |      |      |      |      |      |
| United States                     | 21.62 | 21.5 | 20.6 | 22.4 | 22   | 21   | 20.3 | 19.3 |
| Canada                            | 2.238 | 2.3  | 2.05 | 2.07 | 2.28 | 2.27 | 2.31 | 2.26 |
| Mexico                            | 1.505 | 1.44 | 1.37 | 1.29 | 1.46 | 1.44 | 1.44 | 1.39 |
| Brazil                            | 3.701 | 3.43 | 2.81 | 2.92 | 2.72 | 2.78 | 2.77 | 2.71 |
| Chile                             | 0.166 | 0.13 | 0.19 | 0.25 | 0.22 | 0.23 | 0.23 | 0.24 |
| Costa Rica                        | 0.034 | 0.04 | 0.04 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 |
| Argentina                         | 1.16  | 0.94 | 0.75 | 0.85 | 0.79 | 0.74 | 0.65 | 0.74 |
| Peru                              | 0.228 | 0.19 | 0.15 | 0.18 | 0.17 | 0.17 | 0.17 | 0.17 |
| Austria                           | 0.615 | 0.58 | 0.6  | 0.61 | 0.72 | 0.75 | 0.74 | 0.75 |
| Belgium                           | 1.286 | 1.19 | 1.15 | 1.07 | 1.05 | 1.07 | 1.08 | 1.03 |
| Denmark                           | 0.427 | 0.47 | 0.43 | 0.43 | 0.41 | 0.42 | 0.42 | 0.41 |
| France                            | 5.668 | 5.33 | 5.18 | 4.56 | 4.51 | 4.6  | 4.43 | 4.28 |
| Finland                           | 0.515 | 0.53 | 0.5  | 0.49 | 0.54 | 0.55 | 0.54 | 0.53 |
| Germany                           | 9.603 | 8.88 | 8.81 | 7.97 | 7.84 | 7.96 | 7.79 | 7.59 |
| Greece                            | 0.375 | 0.33 | 0.29 | 0.26 | 0.25 | 0.25 | 0.25 | 0.24 |
| Ireland                           | 0.135 | 0.15 | 0.18 | 0.25 | 0.39 | 0.43 | 0.48 | 0.5  |
| Italy                             | 5.842 | 5.03 | 5.01 | 4.89 | 4.52 | 4.56 | 4.42 | 4.26 |
| Netherlands                       | 1.693 | 1.45 | 1.36 | 1.27 | 1.23 | 1.24 | 1.25 | 1.18 |
| Portugal                          | 0.367 | 0.38 | 0.44 | 0.4  | 0.38 | 0.4  | 0.39 | 0.38 |
| Spain                             | 2.422 | 2.25 | 2.23 | 2.14 | 2.21 | 2.21 | 2.2  | 2.18 |
| Sweden                            | 0.945 | 0.92 | 0.9  | 0.87 | 0.85 | 0.85 | 0.86 | 0.87 |
| United Kingdom                    | 5.132 | 4.66 | 4.53 | 4.12 | 3.62 | 3.6  | 3.52 | 3.44 |
| European Union-15                 | 35.03 | 32.2 | 31.6 | 29.3 | 28.5 | 28.9 | 28.4 | 27.6 |
| Czech Republic                    | 0.494 | 0.52 | 0.36 | 0.34 | 0.31 | 0.34 | 0.34 | 0.35 |
| Hungary                           | 0.33  | 0.32 | 0.24 | 0.19 | 0.31 | 0.33 | 0.34 | 0.35 |
| Poland                            | 0.934 | 0.75 | 0.52 | 0.58 | 0.69 | 0.7  | 0.71 | 0.76 |
| Slovakia                          | 0.154 | 0.16 | 0.14 | 0.12 | 0.12 | 0.13 | 0.14 | 0.15 |
| Expanded European Union countries | 1.912 | 1.75 | 1.25 | 1.22 | 1.43 | 1.5  | 1.52 | 1.61 |
| Japan                             | 17.82 | 18   | 18.4 | 15.9 | 14.1 | 13.4 | 13.4 | 13.4 |
| China                             | 1.774 | 2.6  | 3.3  | 6.56 | 9.12 | 10.1 | 10.9 | 12.2 |
| Republic of Korea                 | 0.901 | 1.33 | 1.98 | 2.61 | 3.25 | 3.3  | 3.49 | 3.58 |
| Taiwan (Province of China)        | 1.017 | 1.2  | 1.29 | 1.42 | 1.45 | 1.36 | 1.42 | 1.43 |
| Singapore                         | 0.148 | 0.11 | 0.11 | 0.11 | 0.07 | 0.1  | 0.14 | 0.13 |
| Hong Kong (SAR, China)            | 0.237 | 0.2  | 0.23 | 0.21 | 0.14 | 0.14 | 0.12 | 0.11 |
| India                             | 0.873 | 1.1  | 1.34 | 1.57 | 1.87 | 1.95 | 2.03 | 2.13 |
| Malaysia                          | 0.121 | 0.15 | 0.19 | 0.22 | 0.26 | 0.28 | 0.28 | 0.29 |
| Thailand                          | 0.348 | 0.38 | 0.57 | 0.79 | 0.75 | 0.78 | 0.84 | 0.92 |
| Philippines                       | 0.36  | 0.28 | 0.29 | 0.29 | 0.31 | 0.34 | 0.33 | 0.34 |
| Indonesia                         | 0.2   | 0.46 | 0.7  | 1.07 | 0.82 | 0.82 | 0.74 | 0.75 |
| South Africa                      | 0.847 | 0.76 | 0.61 | 0.6  | 0.56 | 0.58 | 0.6  | 0.58 |

Source: Same as Table A1.

# Annex B

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**Table B1: Industry classification**

**Low-tech industries**

- 311 Food products
- 313 Beverages
- 314 Tobacco
- 321 Textiles
- 322 Wearing apparel, except footwear
- 323 Leather products
- 324 Footwear, except rubber or plastic
- 331 Wood products, except furniture
- 332 Furniture, except metal
- 341 Paper and products
- 342 Printing and publishing
- 390 Other manufactured products

**Medium-lowtech industries**

- 353 Petroleum refineries
- 354 Misc. petroleum and coal products
- 355 Rubber products
- 356 Plastic products
- 361 Pottery, china, earthenware
- 362 Glass and products
- 369 Other non-metallic mineral products
- 371 Iron and steel
- 372 Non-ferrous metals
- 381 Fabricated metal products

**Medium-hightech industries**

- 351 Industrial chemicals
- 352 Other chemicals
- 382 Machinery, except electrical
- 384 Transport equipment

**High-tech industries**

- 383 Machinery, electric
- 385 Professional & scientific equipment

**Consumption good industries**

- 311 Food products
- 313 Beverages
- 314 Tobacco
- 321 Textiles
- 322 Wearing apparel, except footwear

**Intermediate good industries**

- 323 Leather products
- 324 Footwear, except rubber or plastic
- 331 Wood products, except furniture
- 332 Furniture, except metal
- 341 Paper and products
- 342 Printing and publishing
- 351 Industrial chemicals
- 352 Other chemicals
- 353 Petroleum refineries
- 354 Misc. petroleum and coal products
- 355 Rubber products
- 356 Plastic products
- 361 Pottery, china, earthenware
- 362 Glass and products
- 369 Other non-metallic mineral products
- 371 Iron and steel
- 372 Non-ferrous metals

**Investment good industries**

- 381 Fabricated metal products
- 382 Machinery, except electrical
- 383 Machinery, electric
- 384 Transport equipment
- 385 Professional & scientific equipment
- 390 Other manufactured products

Source: The United Nations Statistical Division (UNSD).

**Table B2: List of countries included in region classification**

**European Region**

Greece  
Portugal  
Spain

**Middle East Region and Turkey**

Egypt  
Jordan  
Turkey

**South-East Asia Region**

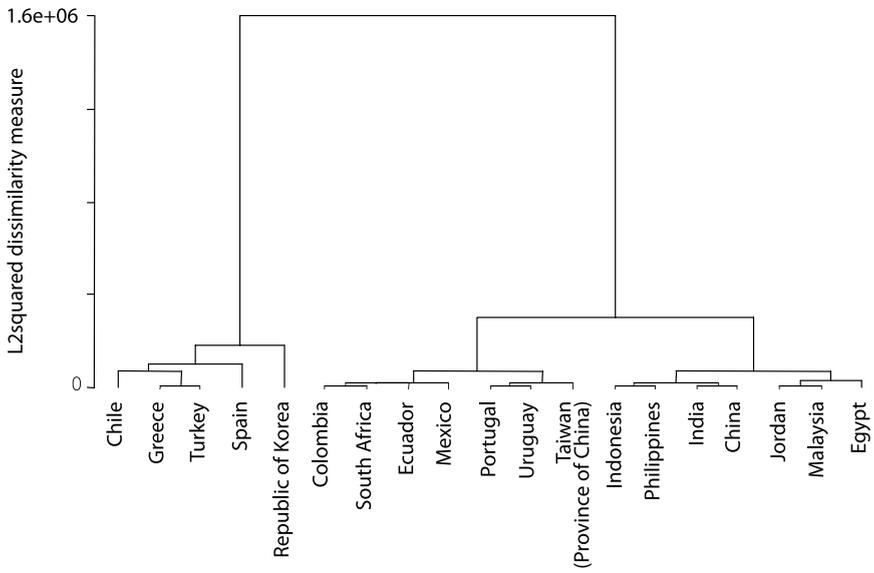
China  
India  
Indonesia  
Malaysia  
Philippines (the)  
Taiwan (Province of China)

**Latin America Region**

Chile  
Colombia  
Ecuador  
Mexico  
Uruguay

# Annex C

**Figure C1: Dendrogram for clwar1 cluster analysis**



| Clusters | Members                    |
|----------|----------------------------|
| 4        | Philippines                |
| 1        | Greece                     |
| 1        | Chile                      |
| 1        | Spain                      |
| 1        | Turkey                     |
| 4        | Indonesia                  |
| 2        | Republic of Korea          |
| 4        | India                      |
| 3        | Ecuador                    |
| 3        | Uruguay                    |
| 3        | Portugal                   |
| 3        | Mexico                     |
| 3        | Taiwan (Province of China) |
| 3        | South Africa               |
| 3        | Colombia                   |

### Calculation of yearly wage deviations and the Clustering Methodology

The average yearly wage ( $w_{it}$ ) is calculated by dividing the total yearly payments ( $W_{it}$ ) to workers by the total number of employees ( $L_{it}$ ) for each industry group in each country. The calculations can be expressed as follows:

The average yearly wage for country  $i$  at time  $t$  is  $w_{it} = W_{it} / L_{it}$ .

Then, mean deviation of wage ( $dev_{it}$ ) for country  $i$  at time  $t$  is the percentage difference of the average yearly wage from the weighted average wage for all the countries at time  $t$  ( $\bar{w}_t$ ), and is calculated as:

$$dev_{it} = ((w_{it} - \bar{w}_t) / \bar{w}_t) * 100.$$

The weighted average wage for all countries is calculated as:

$$\bar{w}_t = \sum_t (L_{it} / L_t) w_{it},$$

where the share of the number of employees for each industry in total manufacturing is used as the weights. Next, using Ward's (1963) method, we applied the clustering procedure. Ward's method performs clustering by seeking at each step the minimum ratio within clusters to the total variance in whole differences set and the existing cluster means. Ward's method is a hierarchical type of agglomerative nesting method, which follows iterative steps. At the first step, it treats all industries as separate clusters. Then, checking the dissimilarity among the industries according to an index formed based on their distance from the centroid of the cluster, either some industries are merged or not. This iterative step goes on until all the industries are members of clusters. At each step, cluster numbers are reduced from  $N$  to 1 in a way to minimize the specified objective function. The objective function Ward used is the increase in total sum of squares or the geometric distance from each data point to the centre of its cluster. Here the error sum of squares (ESS) for cluster  $c$  is:

$$ESS_c = R_c - 1/m_c \sum_t D_{ct}^2,$$

where  $D_{ct} = \sum_i dev_{itc}$  and  $R_c = \sum_t \sum_i dev_{itc}^2$ .

$R_c$  is the sum of squared mean deviations in all years for all industries in the  $c^{th}$  cluster,  $D_{ct}$  is the sum of mean deviations of wages at time  $t$  for industries in the  $c^{th}$  cluster,  $m_c$  is the number of industries in cluster  $c$ , and  $dev_{itc}$  is the mean deviation of wage at time  $t$  for the  $i$ th industry among industries in the  $c^{th}$  cluster.

Following these, in order to test whether Ward's clustering method gives appropriate results the average linkage method is applied for comparison. Since both methods give the same results it can be concluded that the results passed the assessments tests.<sup>36</sup>

<sup>36</sup> For more details, see Galbraith and Lu (2001) and Kaufman and Rousseeuw (1990).





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