Chapter 3

CATCHING UP AND KNOWLEDGE GOVERNANCE

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Introduction

"There are general Maxims in Trade which are assented to by every body." So starts *British Merchant*, published in 1721 by Charles King. He continues, "That a Trade may be of Benefit to the Merchant and Injurious to the Body of the Nation, is one of these Maxims" (King 1721, 1). King proceeds to list varieties of trade that are either "good or bad" and thus he exemplifies perhaps the key feature of pre-Smithian economics: a taxonomic understanding of the economic world of production.[1] The pre-Smithian taxonomy of "good" and "bad" trade was based on the observation of the obvious urban bias of economic development that was found everywhere in Europe. Somewhat ironically, the current debate about international trade is coming back not only to a similar understanding, but also images and words are reminiscent of pre-Smithian taxonomies.[2] In essence, recent discussions about trade policy and globalization seem to come to the consensus that it is not simply the scale and scope of trade that is conducive to economic growth (as the classical post-Smithian Ricardian theory assumes), but rather the nature of trade and, more specifically, how much technological content (i.e., increasing returns activities) is traded with whom and how. That is, there is a growing understanding that trade policy is, or rather should be, a natural part of technology

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1 See Reinert (2007) for an excellent discussion.

2 Gomory and Baumol (2000) use, for instance, "the good, the bad and the mediocre" to denote various equilibria possible under globalization if one figures in the existence of increasing returns into comparative advantage models (20–21).

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policies and vice versa.[3] Perhaps the key conclusion is that trade models and policies that do not figure in technology and increasing returns (such as the Washington Consensus trade policies and the accompanying international governance system embodied by the World Trade Organization create an environment that undermines both developed and developing countries' attempts at sustainable growth. Thus, the emerging consensus admits not only to theoretical shortcomings, but also to the fact that the global trade system under currently existing conditions makes catching up a rare occasion.[4]

Interestingly, in parallel to the above-mentioned developments in international trade theory, evolutionary economics in general and national-innovation-systems literature in particular is reaching a similarly widespread consensus that innovation systems theory has largely failed to take into account the impact of vastly changed macroeconomic conditions for developing countries under the Washington Consensus and WTO policies.[5] Indeed, a lack of macroeconomic theorizing can be seen as one of the major weaknesses of evolutionary economics.[6] In essence, innovation systems literature, either in its narrow scope (focusing on codified knowledge, such as scientific and R&D output in terms of patents, publications, etc.) or its broad scope (focusing on tacit and experience-based knowledge such as routines, networks, etc.) have had precious little to say about development and poor countries on the theoretical level (Lundvall et al. 2009).

Trade policy and innovation systems discourses seem to converge towards a mutual understanding even if it takes place at a relatively slow pace. To simplify: both discourses agree that knowledge, in codified and tacit forms (leading to increasing returns in whatever activity), is essential for growth.

Yet, there is also a common blind spot. Neither trade theory nor innovation systems literature is particularly good at explaining the financing of growth and development. While in theory, both trade and innovation systems theorists can agree that diversification of domestic economy is key for sustained growth and catching up, the financing of that growth seems to be a secondary and even independent issue. Or rather, financial liberalization is taken as a given and, consequently, developing countries can and should rely on foreign savings. Yet, financial globalization has not brought growth (Rodrik and Subramanian 2008), and on the other hand, capital management seems to work well for growth (Ocampo and Stiglitz 2008). Increased vulnerability to financial flows via the footloose nature of portfolio investments and also of FDI, transformation of domestic banking and many other features of financing of growth in developing countries suggests that the nature of

3 See discussions by Samuelson (2004), Krugman (2008 and 2009), Gomory and Baumol (2000 and 2004), and Palley (2006).

4 For a discussion of state failure in this context, see Wade (2005) and Reinert and Kattel (2010).

5 See discussons by Cimoli, Dosi and Stiglitz (2009), Lundvall et al. (2009 and 2010), Chaminade et al. (2009). There are number of interesting discussions from this viewpoint in the Latin American (more or less) structuralist tradition; see, for instance, Cimoli (2000), Palma (2005), and Cimoli, Ferraz and Primi (2005); Primi (2009) provides a recent summary of this tradition.

6 See Kattel, Drechsler and Reinert (2009) for a brief discussion; further Kregel and Burlamaqui (2005 and 2006).

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the financing of demand is a substantial and systemic feature of knowledge creation and evolution. Thus, it is safe to assume that any successful catching-up strategy would need to be based on strategic policymaking in which trade, finance and innovation form pieces of the same puzzle. While there are ample historical examples how this has been done,[7] it is equally safe to assume that there are no one-size-fits-all solutions that can easily be copied into the twentieth century. The specific policy mix that worked for East Asia in the 1960s and 1970s, or that is working for China as we speak, is not necessarily a model to be emulated. In particular, the international governance of global economy has changed drastically in the last two decades. The emergence of TRIPS and other global governance mechanisms of innovation, finance and trade change the context for today's catching-up strategies. So does, naturally, the ongoing change in the technoeconomic paradigm and incessant slicing of production, services and, more recently, also of R&D value chains (see Perez 2002 and 2006). Clearly, there are also bound to be massive sectoral and country differences – manufacturing car parts in the Slovak Republic is different from cardboard manufacturing in Bangladesh or financial services in Mexico. What is lacking, though, is a more or less unified theoretical framework to capture all these changes and policy needs. Following recent work by Burlamaqui (in this volume) and others, this chapter denotes such theoretical framework as *knowledge governance* in order to capture both codified and tacit aspects of innovation, the impact of macroeconomic environment, international specialization, financing of demand and the role various governance structures (company level, public policies, international agreements) play in it. This chapter intends to widen and substantiate the concept of knowledge governance through a unified theoretical framework.[8] In other words, this chapter aims to show that global trade and financial environments play such a crucial role in the ways private sector organizational capabilities and routines (tacit knowledge) evolve, that in many ways companies in developing countries are very far removed from even starting to contemplate IPR and lobbying local politicians for enhanced IPR regimes or using WTO and TRIPS policy space for themselves (Reichman 2009). The chapter attempts to provide a theoretical framework to understand these challenges; most importantly, such a framework makes it possible to create a taxonomy of knowledge governance regimes, each a mix of trade, finance, IPR rules and forms of embedment of public- and private-sector actors. The taxonomy should illuminate what kind of policy space and tools are needed for successful catching-up strategies in the ICT-based paradigm with globalized trade and finance. In other words, while many development economists argue for widening the policy space under WTO and are particularly critical of TRIPS, few would argue for the return of the developmental state of East Asian blend. This article attempts to offer tools for delineating the developing-country agenda under the WTO global regime.

What follows is structured somewhat counterintuitively: instead of building theory first that is then followed by empirics, the chapter briefly summarizes key features and

7 East Asian experience being the most recent (see Wade 2004).

8 In this chapter, knowledge is understood in a very wide sense to also include technology and learning; the latter two are incorporated into tacit and intangible knowledge (for differentiation and discussion, see Primi in this volume).

challenges in global economy for developing countries, and only then does it proceed to construct theoretical premises that make it possible to understand the challenges in a single framework. While developing countries as a group differ greatly from Latin America to Africa to Eastern Europe – and also within these large regions, there are enormous differences (see Basheer and Primi 2009) – this chapter treats them as a group insofar as the challenges they face originate from the same sources. Precisely these sources are discussed next. This is done in order to understand what actually drives knowledge creation and dissemination in the catching-up context.

Part I: Global Drivers of Knowledge Creation and Dissemination in Developing Countries

The discussion that follows is not meant to be exhaustive in describing trends in global economy, nor is it based on solely original research; instead, it focuses on key features that influence innovation and technological change in developing countries and are global in nature. Following a broadly Neo-Schumpeterian approach, the chapter assumes that companies innovate in order to gain competitive advantages (see OECD and Eurostat 2005 for a classic definition). In doing so, companies rely on skills and routines they have developed, or as Alfred Chandler observed, companies rely on "learned organizational capabilities" that include technical know-how, management and marketing skills, established networks, and so on (Chandler 2005; Nelson and Winter 1982). In other words, in innovating, companies rely, use, create and reuse both codified and tacit knowledge and in doing so, they interact with the wider socioeconomic context or governance structures.[9] Hence, firms innovate at least in part in reaction to and in interplay with the knowledge governance structures surrounding them. Thus, the trends listed subsequently deal with governance structures in the global economy that impact innovation and knowledge creation and dissemination in firms in developing countries, in both *tacit and codified forms*.

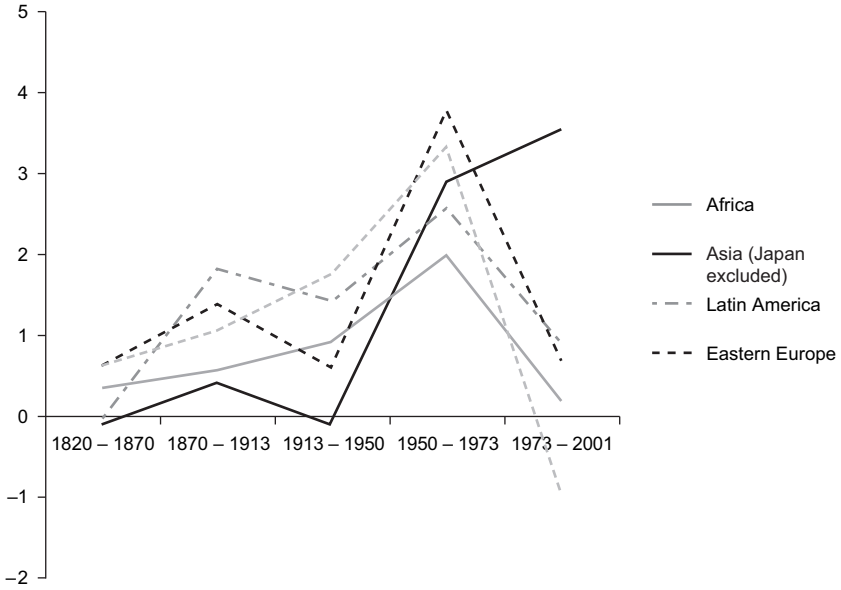
Canvassing the existing literature, the following key trends in innovation and knowledge creation in developing countries can be brought out first, by the impact of Foreign Direct Investment (FDI) and global financial flows; second, by the emergence of global production and innovation networks; and third, by the impact of global governance of trade and intellectual property rights. The first two features have a huge impact mostly (but not only) on tacit knowledge creation, the latter on the codified knowledge creation in developing countries.

Impact of FDI and global financial flows

Spurred by financial liberalization in most developing countries, the global financial flows (FDI, portfolio investments, etc.) have been increasing, particularly during the

9 The latter is typically denoted as national innovation system (see, in particular, Freeman 1974 and 1987).

Figure 3.1. Growth rate of GDP per capita of selected world regions; regional average in selected periods between 1820 and 2001; annual average compound growth rate



Source: Original data extracted from Maddison (2003); see also Kattel, Kregel and Reinert (2009b) and Wade (2005).

1990s, yet this seems to have little impact on development (with the exception of East Asia and China – countries heavily using various capital management techniques from capital account controls to sector specific FDI policies). On the contrary, as is shown on Figure 3.1.[10]

As foreseen by early development theorists, foreign-financing- and liberalization-led growth strategies tend to worsen the terms of trade for poorer countries (raising costs of imports and lowering costs of exports) and to lock these countries into lower value-added activities (undiversified economic structure). Moreover, typically negative externalities abound; for instance, in the form of price externalities with both capital inflows and outflows (via exchange rate appreciation and depreciation respectively); or in the form of quantity externalities (reduced credit availability following capital flight), or accumulation of large currency reserves as self-insurance against capital flight (Ocampo, Spiegel and Stiglitz 2008, 8–10). One can further add maturity mismatch problems (long-term investments are financed with short-term borrowing, engendering interest rate risk), dollarization/euroization of domestic borrowing, exposing borrowers to currency risks (on the latter, see, for instance, Becker and Weissenbacher 2007). In sum, "in international capital markets, developing countries bear the brunt of exchange

10 For discussion and various data, see Wade (2005); Ocampo, Kregel and Griffith-Jones (2007); Ocampo and Stiglitz (2008); Rodrik and Subramanian (2008).

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rate and interest rate risk even when the source of the fluctuations lies outside the country" (Ocampo, Spiegel and Stiglitz 2008, 14). While FDI tends to be more stable than portfolio investments,[11] both have strongly pro-cyclical character. This is often married in developing countries with a general macroeconomic policy environment that is already pro-cyclical (targeting inflation and fiscal balance, for instance). Thus, financial liberalization and macroeconomic liberalization tend to enforce each other (see also Epstein, Grabel and Jomo 2008).

Trade liberalization and increasing financial inflows have been accompanied by financial sector liberalization in terms of growing foreign ownership of the banking sector in developing countries (Chandrasekhar 2009, 36–9). Particularly, Latin American and Eastern European banking systems have seen transformative changes with, for instance, Mexico's banking sector having 82 percent of foreign ownership by 2002 (Chandrasekhar 2009). This figure is surpassed by Estonia, where virtually all of the banking sector is foreign-owned (Kattel 2010). However, this has not led to significantly increased investment and lending to the domestic productive sector. Rather, consumption, real estate and retail have seen growing lending during the last ten years. In essence, the domestic banking sector that used to be best equipped to assess local industry risk levels and that played a key role in intermediating domestic and foreign savings to productive investments, is now much less inclined and even less competent to do so.[12] On the contrary, the increased internationalization of the domestic banking sector has led to increasing financing of consumption-led booms in the real estate and retail sectors; a particularly drastic example is Eastern Europe and the Baltics, where the reversal of capital inflows in the aftermath of global crises has brought declines in GDP growth rates in double digits (with Lithuania topping the list in 2009 with a drop of almost 19 percent (see BIS 2009, 85). In addition, both in the history of the now developed countries and some of the catching-up countries, public development banks have played an important role in development via priority-sector lending and other forms of guarantees. This also has decreased dramatically. Indeed, it can be argued that financial liberalization has brought to many developing countries what can be called a monoculture banking that excels in consumption financing and securitization, but not at assessing risks of, and lending to, the domestic productive sector. This type of banking sector has little interest in cooperating with local productive and public sectors in working towards long-term development goals; it has a much stronger allegiance to its own shareholders.

The impact of such financialization of the economy and its increasing fragility on tacit innovation capabilities is enormous. Coupled with the change of the technoeconomic paradigm towards ICT-based production that enables an increasing modularity of

11 However, see the discussion by Kregel (1997) on how FDI is one of the most expensive forms of borrowing capital for financing growth. FDI risks are more difficult to hedge as such investments are less easily standardized and consequently, lenders' risk premiums tend to be high.

12 See, in particular, Kregel and Burlamaqui (2006); also Dore (2000) on German and Japanese relational banking.

products and tasks, the Washington Consensus policies emphasizing FDI- and export-led growth have created a truly toxic situation for many developing countries, especially in Latin America and Eastern Europe, where liability destruction was initially strong and quick in the 1990s, but was then followed by slow asset creation. This has left many developing countries with an almost completely changed economic and industrial structure that is deeply different from and much less skill- and technology-intensive than the previous structure. This explains the fast growth, but also why they do not catch up with the Asian economies in terms of productivity and income growth.

Specializing in lower-end production or services (also in sectors like ICT) virtually traps developing countries into low-wage jobs and, at the same time, lures the high-wage middle-class jobs away from the developed nations. Thus, while the global production grows, not all countries necessarily benefit from it. And, consequently, "firms maximize global output but do not necessarily maximize national income" (Palley 2006, 16). Perversely, this encourages "overspecialization" in developed countries towards high value-added activities and in developing countries towards industrialized production activities with low value added and linkages.

Emergence of global production and innovation networks

While global free trade and financial flows encourage the stickiness of knowledge creation in developed countries and the stickiness of production in developing countries – both are forms of geographic agglomerations or clustering that tends to be regional as well (Wade 2005 and 2008) – there is a trend towards global innovation networks (GIN), particularly so in ICT-intense production such as electronics. As Ernst (2009, viii) argues about the latter, "the offshoring of research and development through GIN creates handful of new – yet diverse and intensely competing – innovation offshoring hubs in Asia." The examples are Cisco, Intel and other multinationals that have research labs in Asia and, to a lesser degree, in other catching-up regions such Russia and Eastern Europe; but Asian companies can also create and manage such networks (see Table 3.1 for an example).

In fact, such global networks are also emerging on a much smaller scale; for example, Modesat, a small ICT company that sources R&D from Belarus, has headquarters in Estonia and sales in the United States. Similar to geographic dispersion of production, the major drivers of innovation offshoring and global networking are the seemingly endless possibilities to modularize tasks, particularly so in ICT-based or ICT-related industries (see Perez 2006 generally). The modularization of design enables the disintegration of value chains where standards become increasingly important for interoperability and compatibility. However, while intraindustry standards have become key for networking, patents and patent families are still highly important for electronics and ICT industry development. For instance, while for the second generation of GSM technology 140 key patents were claimed, "for the current third-generation mobile standards, the number of essential patents has substantially increased. For example, W-CDMA (one of the three competing 3G standards) is protected by more than 2,000 patent families comprising more than 6,000 individual patents from some 50 companies

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Table 3.1. Global innovation network: Handsets

Telecom service provider defines system architecture (China Mobile)
• Supplier of handsets and components (Taiwan, Korea, China)
• Suppliers of design platform (integrated device manufacturer: US, EU Korea; design houses: US, Taiwan, China)
• IP providers (UK, Taiwan)
• Software providers: OS/MMI/GUI* (India, Taiwan, US)
• Foundries (Taiwan, Singapore, China)
• Tool vendors for design automation and testing (US)
• Design support service providers (various Asian countries)

*OS = operating system; MMI = a special technique of printed circuit design; GUI = graphic designer interface

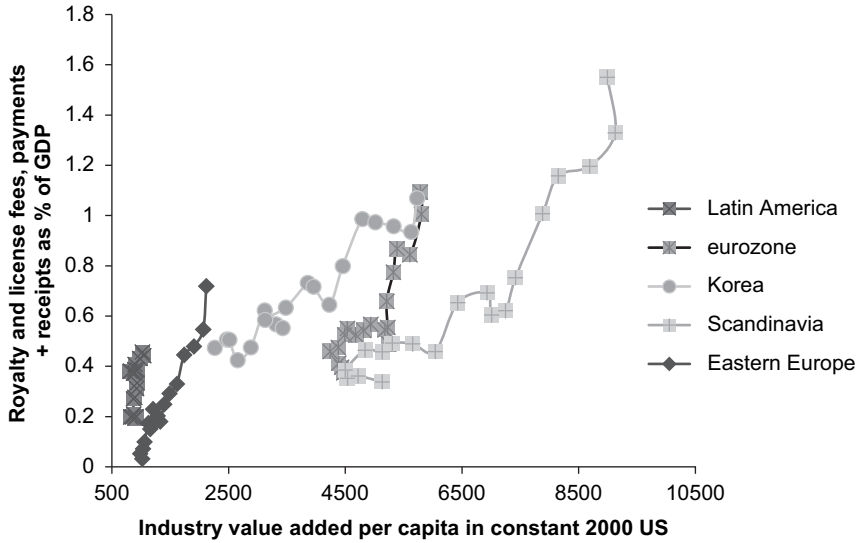
Source: Ernst (2009, 25).

and consortia" (Ernst 2009, 43). Such an enormous rise in networking makes, first, further networking both in R&D and production increasingly likely, but second, it also increases standardization within global networks. The standardization acts both as a barrier to entry for competitors and as a means to increase competition within the network. In effect, while knowledge sharing – opening up the innovation process to outside companies – becomes more and more the norm within global networks, this sharing is still highly asymmetric (multinational companies remain in the key role). Thus, developing-country hubs may experience diminishing returns to network integration: in electronics, for instance, "Asian labs remain focused primarily on repetitive detailed engineering and product development tasks" (Ernst 2009, 20; see Abrol 2004 on India's pharmaceutical industry). Developing-country innovation hubs may, in other words, experience a commodification of R&D similar to the commodification of production in the 1990s (see Ernst and Hart 2008, 28–9). This also means that statistics may easily not catch these trends (Krugman 2008). Indeed, developing countries might seem both to industrialize (measured by, e.g., the rising share of industry in GDP) and catch up technologically (measured by, e.g., the raising share of high technology exports), yet either trend is not necessarily indicating increased capacity for development, as domestic linkages remain weak and intense competition within global production and innovation networks keeps wages and profits low. On the contrary, there seems to be evidence of emerging high-tech enclaves around developing-country innovation hubs that form relatively low-intensity linkages and synergies with domestic actors within industry, research labs and the public sector.

Thus, while China has become the world's second largest R&D investor after the United States and ahead of Japan, and while South Korea graduates nearly the same number of engineers as the United States (with only one-sixth of the population) (Ernst and Hart 2008), the patenting activity shows that

> [F]irms and organizations from the top ten developed countries account for more than ninety percent of all patents granted [in USPTO]… the US, Japan, and

Figure 3.2. The knowledge ladder: industry value added and trade in knowledge, 1990–2008



Source: World Bank WDI online database; calculations by the author.[13]

> Germany alone account for nearly eighty percent… the firms and organizations from the top ten developing and transition economies account for less than seven percent, with greater than five percent coming from Taiwan and South Korea. (Shadlen 2005, 4)

In 2005,

> developing countries paid net US$17 billion in royalty and licensing fees, mostly to IP rights holders in developed countries. Also, in 2005, the United States alone earned US$33 billion from developed and developing countries through the global IP system, more than its total development assistance budget of US$27 billion for that year. (Deere 2008, 10)

Combined with the above-mentioned impact of FDI and global financial flows, developing countries are decidedly behind the "knowledge curve" (Cimoli and Primi 2008; also Cimoli, Coriat and Primi 2009), as Figure 3.2 shows.

Thus, very few developing countries have the capacity and capability to rise to global innovation hubs, and even those that do face dangers of diminishing returns

13 Data for royalties and licenses includes both payments and receipts. Royalties and license fees includes international payments and receipts for the authorized use of intangible, nonproduced, nonfinancial assets and proprietary rights (such as patents, copyrights and industrial processes and designs). Hungary is excluded from Eastern European calculations, as it had a very high level of royalty and licensing fees in GDP in the late 2000s.

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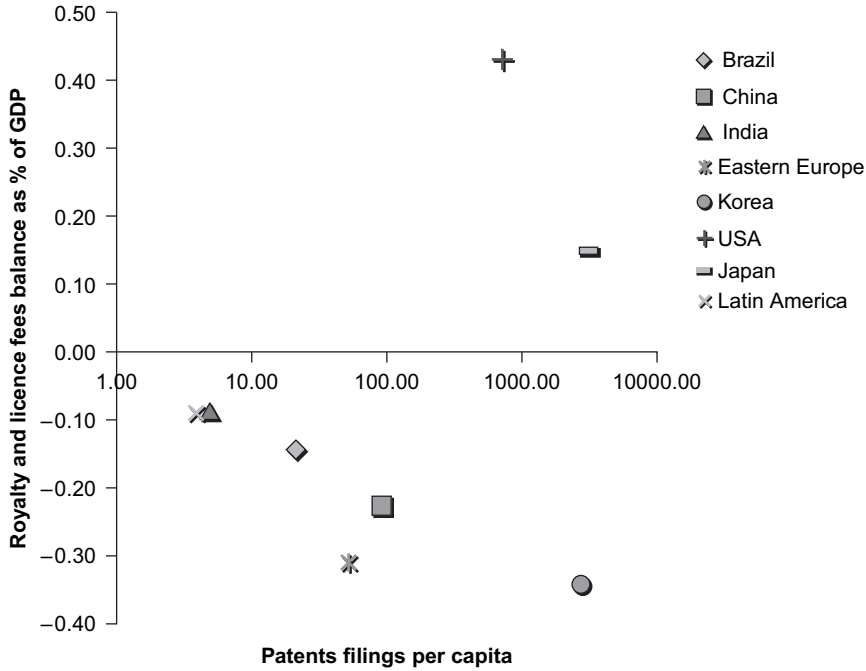
Figure 3.3. Knowledge creation and trade balance in knowledge



Source: WIPO, World Bank WDI Online database; calculations by the author.[14]

from network integration. While in terms of patents, South Korea is able to keep up with the United States and Japan, its trade in knowledge has a decidedly negative balance as shown in Figure 3.3.

This does not bode very well for the rest of the developing countries. Indeed, if we compare Latin America and Central and Eastern Europe to East Asian economies,[15] we can see clear differences emerging during the last two decades. The former can be said to lag further behind the developed countries, not to catch up (Figure 3.4).

This is also clearly visible in the generation of codified knowledge. Figures 3.5–3.7 show trends in patent applications, scientific and technical articles and in the number of researchers in the last two decades in three catching-up regions.[16] Eastern Europe,

14 Data for patents is for 2006 and includes all filings around the world; data for royalties and licenses is for 2008 and includes both payments and receipts. Royalties and license fees includes international payments and receipts for the authorized use of intangible, nonproduced, nonfinancial assets and proprietary rights (such as patents, copyrights and industrial processes and designs). Hungary is excluded from Eastern European calculations as it has a very high level of royalty and licensing fees in GDP (1.99 percent).

15 For an overview of East Asian innovation clusters, see Chaminade and Vang (2006).

16 In order to simplify, one country from each region is shown as a "proxy" for regional trends; in addition, all three countries have relatively strong similarities in terms of high rates of FDI inflow and growth of exports, including high-tech exports; choosing other countries from the respective regions does not change the trends significantly.

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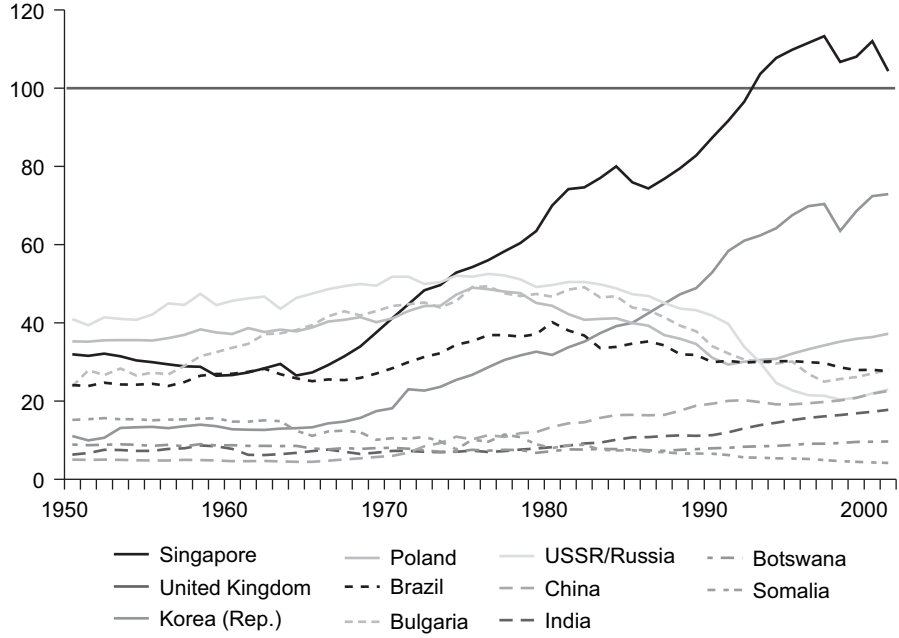
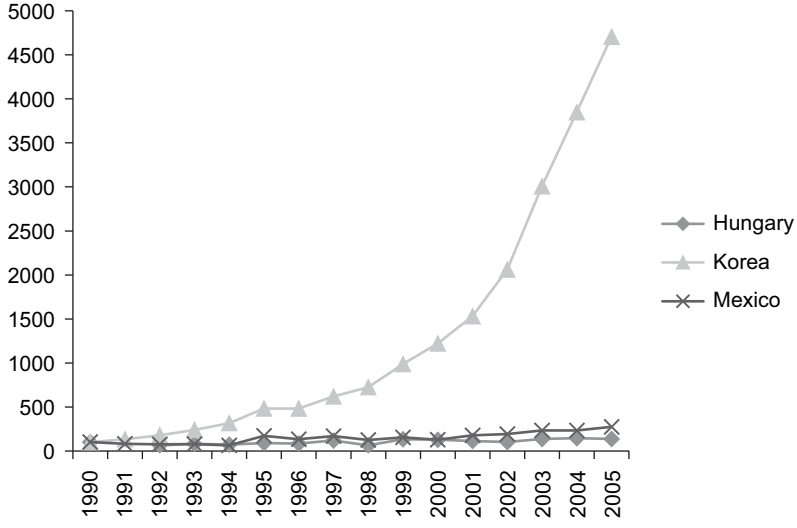
Figure 3.4. GDP per capita in selected developing countries, 1950–2001 (in 1990 international Geary-Khamis dollars); UK = 100



Source: Original data extracted from Maddison (2003). Countries listed in the key in descending order of GDP (2001).

Figure 3.5. Patent applications at European, US and Japanese patent offices, 1990–2005; 1990 = 100



Source: OECD database.

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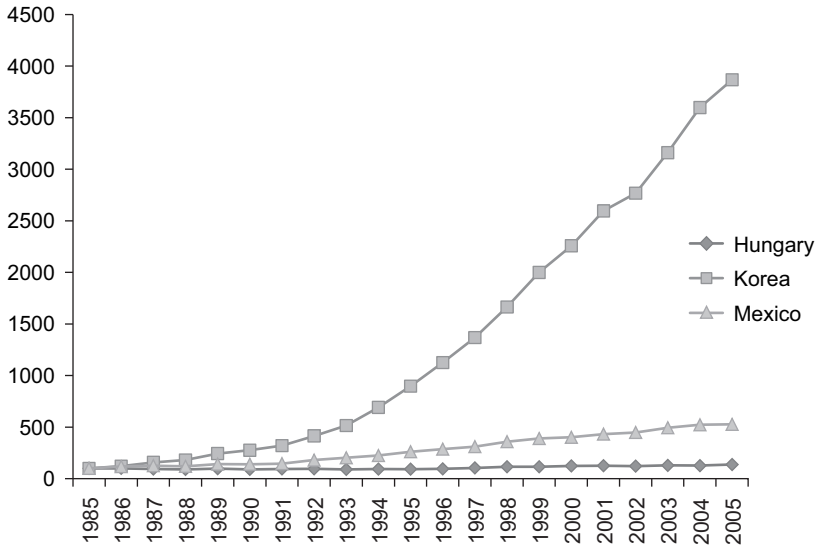
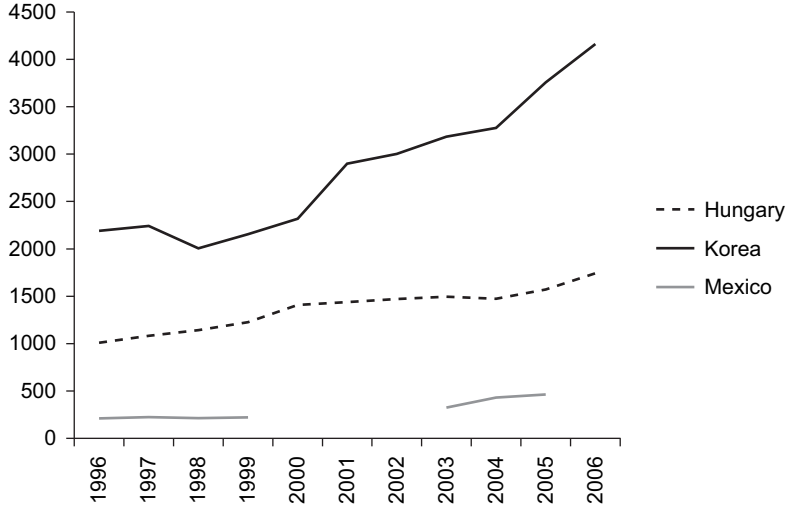
Figure 3.6. Scientific and technical articles, 1985–2005; 1985 = 100



Source: World Bank WDI Online database.

Figure 3.7. Researchers per million inhabitants



Source: World Bank WDI Online database.

positioned by many to become one of the key areas for global innovation networks from electronics to automobile manufacturing to biotechnology, does not exhibit dynamics similar to East Asia.

In other words, while both Eastern Europe and Latin America pay increasing attention to innovation and innovation policy, and are indeed creating a myriad of

policies and in fact investing more and more into these and related fields, these two regions seem unable to match East Asia's dynamics.

And while it is noticeable that in many areas, the starting points of South Korea and East Asia, respectively, were very low, the dynamics of its trends are simply breathtaking: for instance, according to World Bank data, in 1981 South Korea had only 168 hits in scientific and technical publications compared to Hungary's 2,107; but by 2005, South Korea had 16,396 hits compared to Hungary's 2,614 (same data is used in Figure 3.6).

It is more than telling that even on the back of such dynamic changes, East Asian companies face serious challenges in reaping the economies of network integration (notably in electronics), as argued above.

The best explanation is probably the enormous agglomeration effect that the developed countries enjoy despite the growth of East Asian innovation hubs. In fact, as argued above, a liberalized trade environment only enforces agglomeration effects in a sense predicted by Ricardian comparative advantage theory.

If it is more or less true that agglomeration effects only get stronger towards the developed countries with global markets and finance, then one has to draw two conclusions. First, open innovation, peer production and other similar ideas showing the benefits from non-IPR-based R&D can only have a limited positive impact in developing countries (notwithstanding all the positive externalities in the rich countries).

Indeed, heavy patenting and standardization in R&D and production bear witness to almost opposite trends in many industries. Second, the emergence of global IPR governance is very much in the interest of developed countries; the stronger the governance system and the more stringent the rules are, the better it should be for the developed countries. In essence, globalized and liberalized free trade necessitates the rise of global IPR regulation (see next section).

To sum up, without engendering diversified domestic demand and linkages, developing countries may end up having a comparative advantage in simple low-value-added production and R&D activities and in low-cost, low-impact innovation (see Chaminade and Vang 2008; Rodrik 2007). Standardization of production and R&D activities has an enormous impact on the tacit organizational capabilities of developing-country companies as this essentially creates "rules of the game," and thus, domestic linkages may be significantly less important for many companies. As Evans (1995, 16) has already argued, "The new alliance of local entrepreneurs and transnational corporations make it harder to sustain the old alliance between local capital and the state."

In terms of codified knowledge creation, the rich countries still have an enormous advantage, with many developing regions actually falling behind. As codified knowledge (patents, copyrights, scientific publications, etc.) paves the way for standardization and is highly helpful in defining technology trajectories, increasing IPR is fundamental to the emerging business models of many companies (see Cimoli and Primi 2008). While there are highly publicized cases of companies such as IBM giving some of their patents to the public domain, there is also increasing evidence of a growing IPR (over)importance in many industries (see, e.g., Jaffe and Lerner 2004;

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Heller 2008).[17] Similarly, as with increased trade and production, such tendencies increase global codified knowledge without necessarily helping global wealth and growth.

Impact of global governance of trade and intellectual property rights

For much of the twentieth century, countries discussed how to regulate international trade. However, while these debates were strongly colored by the developmental agenda from the Havana Charter of 1948 to attempts in UNCTAD during the late 1970s and early 1980s to establish a code of conduct for technology transfer (Roffe 1985; UNCTAD 2001),[18] during the 1980s and 1990s, both the United States and the European countries successfully managed to turn the agenda upside down (Deere 2008). Moreover, the earlier developmental agenda relied on what Reinert (2009) calls emulation: successful cases of development during the 500 years of capitalism have mostly been based on unrestrained copying from other successful countries, past and present. In essence, successful development has been historically based on policy creation using history as a toolbox. While the latter includes basic principles such as infant-industry protection, policy bias towards increasing returns activities, and so forth, the application of these principles has been based on context-specific amendments – that is emulation, not simply copying. It can be argued that international development debate sought to agree more or less on the rules for emulation up to the 1980s and that the Uruguay Round initiated the exact opposite. The WTO and its descendants (e.g., bilateral agreements) assume universal rules and institutions that should be more or less precisely copied by developing countries in order to widen markets and allow access for technological and market leaders whose activity should then lead to various spillovers and positive externalities. Thus, while emulation assumed high levels of capacity to choose from a heterogeneous set of policy options, the WTO policy

17 However, pooling of patents between different companies to form networks or new companies to reap the benefits from networking is not, strictly speaking, a novel approach or specific only to our times. Thus, for instance, the US radio and electronics industry was created via pooling patents into RCA in the post–World War I era (Chandler 2005). Further, the role of industry associations and similar forms of knowledge sharing and standardization is widely known to have been highly conducive to development, at least since Colbert's reign in France in the seventeenth century (Cole 1964). Indeed, the idea of embedded autonomy developed by Evans (1995) and others is based on the assumption of both tacit and codified knowledge "traveling" along local linkages between various actors, both public and private (see Hirschman 1958). Such successful processes are not tied to high-tech sectors, where knowledge is so important. McDermott's (2005) study of Mendoza and San Juan wine regions in Argentina shows how and why such embedded linkages are successful in terms of knowledge generation and innovation also in traditional sectors.

18 This was partly inspired by the Japanese success at technology transfer, partly by the so-called Andean Code of 1970 that attempted to regulate foreign investment, technology transfer and trade for the six Andean economies (Abbott 1975).

space assumes decontextualization of policymaking (e.g., in what field and for how long to grant patents and to whom vs. patents being granted in all fields anywhere in the world for 20 years). The former assumes an institutional framework for policy learning, the latter in turn assumes the capacity to implement agreed policies. Policy learning is usually associated with high levels of policy competence, strong bureaucratic autonomy and coordination, high levels of embeddedness between economic actors and the state, exemplified by the Weberian state described by Evans and others. Policy implementation and copying in the 1990s, in turn, became associated with decentralization and market-like discipline within the public sector, exemplified by new public management reforms (see Drechsler 2005). Consequently, the WTO is based not only on a very different set of economic ideas and ideals, but also on a substantially different view on policy capacity and governance.

Accordingly, the establishment of the WTO in 1994 and its accompanying treaties such as GATS, TRIPS, TRIMS and a host of other multilateral and bilateral agreements regulating trade, IPRs and investment is seen by many heterodox economists as severely limiting the policy space available for developing countries.[19]

Particularly, TRIPS have come to epitomize the significantly changed international landscape of trade and IPR governance. In general,

> [T]he changes in intellectual property regimes concern two different, although related, domains: (1) the modification of prevailing norm and the generation of a new set of incentives deriving from jurisprudential rulings within the US system, and (2) the increasing relevance of intellectual property in multilateral and bilateral trade negotiations and in international disputes between countries. (Cimoli, Coriat and Primi 2009, 508; see also 509–13)

Yet, as Wade (2003, 622) succinctly argues, these international regulations "are not about limiting *companies'* options, as 'regulation' normally connotes; rather, they are about limiting the options of developing country governments to constrain the options of companies operating or hoping to operate within their borders." This is consistent with the assumption shared by most Washington institutions in the last decades that government failures are usually worse than market failures and thus disciplining governments should bring more return in terms of developmental intervention. Further, this view is hardened by the perceived lack of policy capacity in developing countries, but "ironically, the world is proceeding on the assumption, in the TRIPS agreement, that developing countries do have a considerable capacity to enforce patents and copyrights" (Wade 2003, 634).

While up to the 1990s, much IPR regulation and governance was national and based on late nineteenth-century conventions, TRIPS "places significantly greater limitations on how countries configure their patent regimes" (Shadlen 2003). TRIPS

19 Wade (2003), Gallagher (2005), Shadlen (2003 and 2005), Correa (2000), Li and Correa (2009) and Thrasher and Gallagher (2008) offer summaries and discussions of such arguments.

makes it easier to establish private rights over knowledge, these rights are more absolute and tend to last longer (20 years):

> Whereas countries could previously deny patents to certain types of inventions so as to encourage reverse-engineering and lower the barriers to entry in technologically-intensive sectors, now countries must offer patents in virtually all fields… Whereas countries could make the enjoyment of the monopoly rights conferred by patents conditional upon local production or licensing and transferring technology to local users, TRIPS limits how governments regulate patent-holders.[20] (Shadlen 2005; also Wade 2003, 625–7)

Similarly, TRIMS (Trade-Related Investment Measures), "bans performance requirements related to local content, trade balancing, export requirements, and it also bans requirements on public agencies to procure goods from local suppliers" (Wade 2003, 627; Kattel and Lember 2010 on procurement and the WTO). GATS (General Agreement on Trade in Services), another result of the Uruguay Round, has a similar objective to liberalize and deregulate trade in services. In addition, GATS also includes Financial Services Agreement (FSA; second and fifth protocols to GATS) that came into force in 1999 and that is bound to make the above-described tendencies in financial liberalization only more pronounced (Raghavan 2009). Perhaps ironically, the liberalization of financial services, undertaken under US leadership, also led to the repeal of the Glass-Steagall act (segmentation of investment and commercial banking) in the United States that is seen by many as one of the main culprits in the financial meltdown of 2008/2009 (see, e.g., Kregel 2008a). The situation is probably even more ironic given that it is not by any means certain whether under FSA, the reintroduction of Glass-Steagall would be even legitimate (Raghavan 2009, 11).

However, there is particularly strong agreement among researchers that in many cases, bilateral trade agreements (BTA) apply much more stringent IPR regulations, trade liberalization measures and investment requirements than various WTO agreements proper. While some researchers argue that WTO agreements are asymmetrical ("developing countries' rights and developed countries' obligations are unenforceable" (see Wade 2003, 624), others go on to argue that developing countries should in fact cooperate in the WTO to try to enforce the agreements on the developed countries also (and not dismantle TRIPS; see Shadlen 2003).[21] The agreement on BTAs is much more equivocal: they should be avoided by developing countries.[22]

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20 In particular, the pharmaceuticals were outside of patent coverage in many countries prior to TRIPS (Shadlen 2003).

21 See also Dreyfuss (2009); further also Cimoli, Coriat and Primi (2009, 514–18) on flexibilities within TRIPS; an even wider discussion is provided by Rodrik (2007, 123–47), and by Thrasher and Gallagher (2008); the latter also discuss South-South agreements.

22 In addition to global IPR and trade regulations, there are over 200 regional free-trade agreements that again focus on IPRs, investments, services and similar issues.

In addition to IPR and trade regulations, BTAs tend to also preclude usage of capital management techniques and in many cases force changes in the banking system as well (Thrasher and Gallagher 2008).

All these agreements – GATS, TRIPS, TRIMS and BTAs – internationally regulate areas that were previously typically left to countries themselves to govern and, moreover, in many ways, the agreements preclude or at any rate make classical industrial policy tools difficult to use.

There is also one more problem, particularly with TRIPS: it has failed to deliver growth and innovation: "contrary to the argument championed by the TRIPS' advocates, stronger and homogenous patent regimes have not accelerated the pace of innovation in developing countries" (Cimoli, Coriat and Primi 2009, 521; see also Hu and Jaffe 2007; Laforgia, Montobbio and Orsenigo 2009).

Summary of global trends

Summarizing the above-mentioned three drivers (nature of global innovation and production networks, impact of foreign owned banking on domestic producers, and changed in international governance), it can be argued that financial liberalization has brought not only increasing investment into developing countries, but also increasing fragility both in the form of vulnerability through openness and in the form of underdiversified domestic economies. Simply put, increased FDI and financial flows, transformation of domestic banking and increasing integration into global production and innovation networks crowd out diversification. For firms in the catching-up context, this means that they are often trapped in activities where barriers to acquire new knowledge or imitate and use the existing products and processes are relatively high. At the same time, knowledge, particularly in its codified form, is still and even increasingly so, being produced in developed countries in the North. This makes for a peculiar world where rich countries are increasing their share in knowledge and innovation while poorer countries are increasing their share in producing rapidly commodifying industrial goods. Such a world motivates and justifies both the neomercantilistic behavior of rich countries (increasing patenting) as well as the beggar-thy-neighbor policies of developing countries (increasing production through, e.g., exchange rate depreciation; see also Wade 2003, 633). The problem is that such a behavior neither induces global growth nor is it available to most countries caught in the middle that fall under international governance institutions. For these countries, most governance tools remain out of reach as they lack the policy capacities to maneuver with the space allowed by the WTO, and they are forced to operate in a world where international governance essentially means a nongovernable economic sphere that precludes these countries from developing the required policy capacities. In essence, for most developing countries, infant-industry protection and reaping economies of network integration via upgrading is increasingly difficult due to global forces of trade and specialization as well as the tightened policy space available for policy selection. It is, however, relatively clear, first, that to change international governance of IPR and trade makes sense only when done in unison with changes in the financing of growth; second, different countries and

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different sectors within countries need to have different policy regimes. This is, of course, what the traditional industry policy used to be about: sectoral (vertical) policies. Yet, it seems relatively safe to assume that both global trade and finance, and global production and innovation networks are here to stay. The question is how to find policy regimes and tools that fit the needs and context of developing countries under these circumstances.

While the East Asian developmental state relied on what can be called bilateral embeddedness with policymakers and industry leaders, today we arguably need something that can be termed multilateral embeddedness with various knowledge poles and actors (see Evans 2009, and Jayasuriya 2005 from the public-policy side). For instance, the capacity and institutional learning required for negotiating with international financial institutions and local R&D labs tends to be increasingly different and separated from each other as well. As Evans argues,

> In the twentieth-century developmental state, embeddedness was important both as a source of information and because implementation of shared projects depended on private actors. Insofar as embeddedness aimed at industrialization, the logic of constructing it was comparatively straightforward. The key information involved figuring out which industrial projects were feasible and what kind of incentives would be required to engage the energy of the relevant firms. The "culture" of leading firms had to be reshaped so that competition was seen more in terms of innovation and risk taking. The primary cast of partners was a small set of industrial elites with relatively well-defined interests. Building ties on the basis of personal networks and administrative structure was a feasible project. (Evans 2009)

As argued earlier, global trends and in particular the changing technoeconomic paradigm make it necessary to significantly upgrade this; now "the need for information and engagement from societal partners is even greater, but the interlocutors and the character of the networks are more complicated. Information must be gathered from constituencies that are more numerous and less organized" (Evans 2009). For this, we need a theoretical framework that enables us to unify key aspects in global economy – innovation, trade and financial aspects – into one systematic setting.

Part II: Towards a Taxonomy of Knowledge Governance Regimes

What follows is a simple exercise that should enable us to create taxonomies of knowledge-governance regimes that, in turn, should clarify why catching up has become relatively rare and why developing countries need to rethink most of all their policymaking structures.

The framework

As argued in the introduction, in a Schumpeterian framework, companies innovate in order to gain competitive advantages. Or, to express it in financial terms, we can

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understand innovations as ways that companies use to hedge their balance sheets. Thus, innovations are the connection between macroeconomic financial stability and microeconomic firm behavior.[23] However, as shown by Arthur (1994) and others working in the Schumpeterian tradition, innovations and technological change often follow self-enforcing mechanisms that are highly path dependent and act as natural barriers of entry for competitors. Path dependency follows what is called a life cycle of a technology or a product (Abernathy and Utterback 1978): most innovations develop through three main phases from undefined and experimental, through rapid growth and transformational, to maturity. The first phase is characterized by high market risks and research and development costs for an entrepreneur. This is usually a highly experimental period, often involving customers in testing innovative solutions. Once the technology enters the transitional phase, the entrepreneur benefits from economies of scale/scope and possible exports to other regions and countries, increases in companies' employment levels and real wages, and so forth. In a final phase, the sales volume declines or stabilizes, prices as well as profitability diminish and entrepreneurs often seek either to retain market positions by patents and other forms of protection (or rent-seeking) or innovating again.

However, to understand knowledge creation and dissemination dynamics involved along the technology/product life cycle where firms try to hedge their balance sheets via innovation, it is useful to look at the transaction-cost dynamics involved in knowledge creation along the life cycle. We can make three observations: First, the nature of knowledge changes along the life cycle: while in its early experimental phases, codified knowledge in the form of scientific findings, inventions, and so on, plays a crucial role, in the transformational growth phase, as shown by Arthur (1994), increasing returns generate powerful learning effects via feedback from the market and accordingly, tacit knowledge is more fundamental here. In the maturity phase, in turn, the role of codified knowledge generally declines as process innovations to lower costs are prominent. In sum, along the life cycle, the balance between tacit and codified knowledge changes and this in turn impacts other market participants via competition.

Second, the lowering of transaction costs involved in knowledge creation can be done, as the original Coasean idea suggests (Coase 1988), in two ways: either via the market or within the firm. In the Coase framework, markets are bundles of rules and regulations (either enforced by private agreements or by governments) and accordingly,

23 This is loosely based on Hyman Minsky's work. In Minsky's (1982, 22–9) terms, there are three distinct financing positions for business units (and households and governments) in a free-market system: hedge, speculative and Ponzi finance. All positions are defined according to the ability of a business unit to meet its financial commitments. At any given point in time, any economy consists of businesses, households and eventually, government finances that are a mix of all three positions. Innovation in industry (coupled with competition) can create all of the above-described financing positions (e.g., failed product development can engender speculative or Ponzi positions; the same results from successful innovations by competitors). Equally, these financing positions can impact business units' incentives to innovate in order to create a hedged financing position.

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firms exist as reactions to these. And as firms seek to hedge their financing positions via innovations, the latter are in turn made possible by applying knowledge that is available on the market or has to be developed in-house, or both, depending on the phase of the particular product life in which the company happens to be.

Third, it is relatively obvious that tacit knowledge such as routines, company culture, and the like, cannot be acquired or licensed in the same way that patents or other forms of codified knowledge can be. The former are, in essence, nonmarket ways of knowledge generation that then, if successful, hugely influence competitors via enforcing the latter away from hedged financing positions which forces a new cycle of innovations or at least attempts at innovating and acquiring or generating knowledge for innovation.

In such a framework, it becomes clear that knowledge creation and dissemination is an arena inherently structured by both technological dynamics and company behavior in reaction to existing diverse governance structures, both within the company and created by the public sector (either domestically or internationally). Or, to put it differently, transaction costs are in large part influenced by governance structures that in turn influence the way companies *can* innovate in order to hedge their positions – or fail to do so. Such a framework offers a relatively simple matrix to differentiate knowledge governance regimes.

Taxonomy of knowledge governance regimes

There are highly interesting attempts to categorize knowledge markets. In addition to Burlamaqui's (2006) market features approach, Cimoli and Primi (2008) have created a taxonomy of how companies can capitalize on intellectual property. However, both the market features approach and the knowledge markets taxonomy concentrate more on codified knowledge and leave out tacit capabilities influenced by macroeconomic environment, financial structure and other knowledge governance features. In addition, the knowledge markets taxonomy reflects knowledge markets viewed from the developed-country perspective and their impact in the developing world.

To simplify the above-described framework further, one can think of it in two dimensions. First, knowledge governance structures have formed various policies, institutions and their impact in terms of levels of diversification of domestic economy, banking sector activities, origins of financing, knowledge rules (IPR and competition policies), macroeconomic variables (interests, exchange rates, trade treaties) and the like. This dimension reaches from domestic to international. Second, innovation and technological change can be captured in a dynamic sense through technological and product maturity and life cycles described above. This dimension covers the typical life-cycle range from the undefined product/technology to maturity. It is important to note that the latter assume the existence of increasing returns during the life cycle.

However, both dimensions need to be understood context-specifically: while biotechnology is in many ways in early stages in rich countries, car production would be in a similar position in the poorest economies where the lack of skills and other

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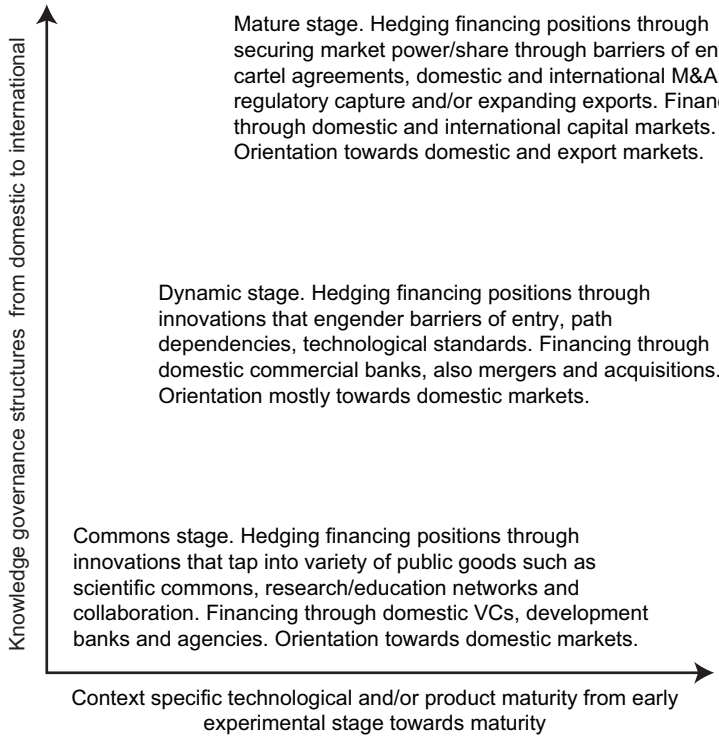
Figure 3.8. Knowledge markets and ideal types of strategies to hedge financing positions through innovations[24]



framework conditions make car production an early-stage activity, albeit with a very short life cycle, as internationally, car markets are well developed.

Such a categorization into two dimensions makes it possible to come up with a taxonomy that consists of three ideal-typical stages. For simplicity's sake, these can be called commons, dynamic and mature stages. As depicted in Figure 3.8, each stage represents an ideal-typical scenario for entrepreneurs to hedge their financing positions through innovations where regulatory and policy bundles influence transaction costs in knowledge acquisition, usage and generation. Thus, these stages represent types of knowledge markets in the sense that each stage offers distinctly different opportunities for innovation and profit-making and is characterized by different types of competition and financing and regulatory environment in terms of trade agreements, safety standards, and so on. In sum, each stage offers a relatively unique nature of demand that in turn is structured by national and international institutions, rules and agreements.

While the stages in Figure 3.8 refer to theoretical and ideal-typical private-sector strategies at hedging innovation in various knowledge markets, these can be

24 See also Primi's taxonomy in this volume; instead of technology life cycle, she uses the knowledge-technology-learning continuum.

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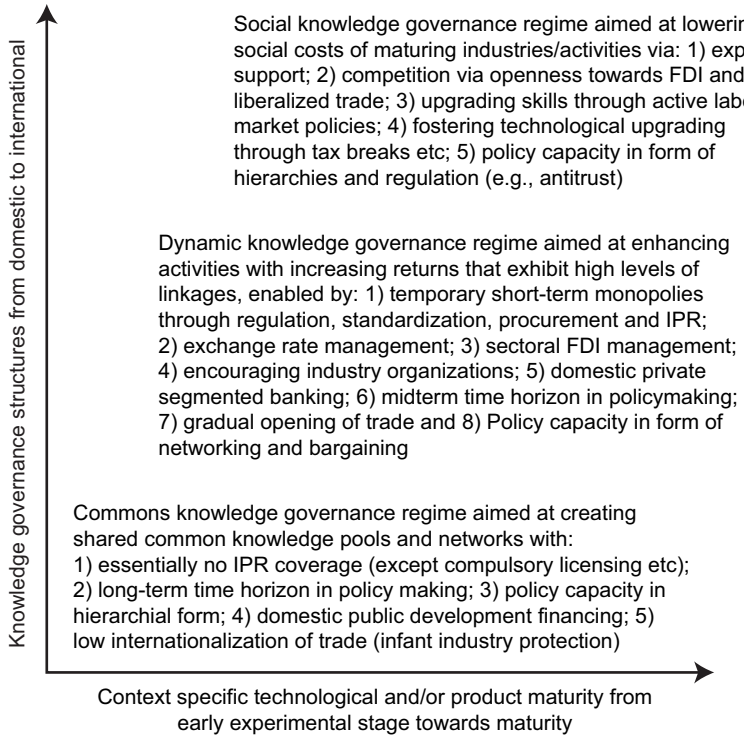
supplemented with historically successful development strategies and policies described briefly above. Figure 3.9 structures the historically successful development experiences into ideal-typical successive policy cycles that in real economies took place not only in succession (as technologies/products mature), but also in parallel in different sectors.

Now each stage from Figure 3.8 represents its own variety of knowledge governance regime that enables hedging through respective innovations that in turn are influenced by knowledge governance structures that enable or disable innovations. The idea of a regime is directed towards the question which kind of organizational capabilities and knowledge dynamics the policy regime should induce in private-sector actors, that is what kind of transactions costs should be lowered by public interventions, and, on the other hand, what kind of public-sector capacities (institutions and policies) are needed for this, whether more hierarchical (e.g., creating state-owned companies, dealing with the companies directly from a ministry) or network-based (e.g., developing industry association, cooperation between various actors). In other words, each stage reflects a different type of embeddedness that is a combination of organizational capabilities (private), including tacit and codified knowledge, and capacities (public). The framework developed above makes it possible, essentially, to map the need for different regimes and to catalogue them, and thus to overcome the limits of traditional sector-specific industrial policies, as sectors themselves are often sliced in different value chains, different sectors utilize university research, and so on. Figure 3.9 lists all three stages and regimes with exemplary keywords in innovation, finance, trade and policies, based on historical experience with industrial, technology and innovation policies and development financing. The regimes are ideal-typical in nature and essentially represent normative lessons from the development history within the theoretical framework developed above.[25]

Each regime thus represents a combination of activities and actors that have institutionalized interaction and learning mechanisms. The key lesson from Part I, however, was that global challenges make it difficult to generate relatively straightforward institutional responses typical of twentieth-century developmental states with clear apex or nodal agencies at the top of development-guiding companies, universities and indeed, politicians through various stages and industries during the development processes. Indeed, global networks and trade make it highly likely that once developing countries embark on enhancing scientific commons, they may easily end up subsidizing international innovation and R&D networks and reap very low benefits of their own. Equally significantly, developing-country policymakers have decreasing bargaining power with multinational corporations as the latter can be footloose and, moreover, can rely on WTO rules and lobby their own governments for WTO-plus type of bilateral agreements. Indeed, this is what both the United States and the European Union are increasingly doing (see Deere 2008). Further, actors from different regimes may easily

25 In many ways, such regimes could be found in Japan during its development decades after World War II, when it deployed a mix of competition, industrial and investment policies reminiscent of the dynamic regime described here (see Singh 2002).

Figure 3.9. Knowledge governance regimes in the historical perspective[26]



have strongly conflicting needs and values (think, for instance, of needs and values of scientific communities and those of large production or agricultural companies). In addition, as said earlier, these stages are different in different contexts. Indeed, it is important to keep in mind that developing countries also exhibit high levels of differences between themselves in terms of technological capabilities (Basheer and Primi 2009).

However, the taxonomy of regimes also helps to analyze developing-country problems with knowledge creation and innovation. As argued in Part I, many developed countries are squeezed into the mature stage in various activities without significant policy capacities to manage the exit or upgrading of these activities. At the same time, many catching-up economies emphasize innovation policies aimed at collaboration between universities and industry, hoping to engender a higher rate of commercialization activities, thus, in terms of knowledge governance regimes, these countries attempt to facilitate the move from

26 Kumar and Gallagher (2007) and Thrasher and Gallagher (2008) build policy regimes around market failures and also connect the respective domestic regimes with international treaties that cover these (see, in particular, Kumar and Gallagher 2007, 8). Thus, for instance, for alleviating market failures in scale economies and technological dynamisms, the policy regime includes tariff sequencing, technology-transfer requirements, joint ventures, public research and development, compulsory licensing, selective permission for patents, government procurement.

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commons to a dynamic regime (Kattel and Primi 2009). Yet, most catching-up economies lack both dynamic private-sector actors (as they are squeezed to maturing activities and hence send "wrong" signals to policymakers in the form of keeping wages and safety standards low, etc.) and, as we saw earlier, their policy capacity has been hollowed by an increased application of universalistic rules emanating form WTO regimes and new public management reforms that make coordination exceedingly difficult. Shadlen's analysis of Brazil's difficulties in trying to differentiate between incremental and radical innovations through a law that enforced cooperation between the intellectual property agency and health authorities is a good example of how management issues have become pivotal in using the policy space available under the WTO as well as pushing innovation as a development-policy tool (Shadlen in this volume). Indeed, the impact of increasing decentralization (e.g., in the form of developmental agencies and regional innovation initiatives) of innovation management in developing countries seems largely underresearched and yet, in light of the above, it seems fair to argue that understanding deficiencies in policy management holds the key to developing countries' chances in using available policy spaces to develop context-specific knowledge governance regimes. Developing countries thus face not only complex policy choices (e.g., to support strong basic research or more applied research) but these are necessarily accompanied by choices of governance and management structures (e.g., centralized versus decentralized policy arenas). And, on top of it, as already argued, conflicts are bound to be strong between different knowledge markets/stages/regimes compounding governance and prioritization even further. The idea of knowledge governance regimes thus suggests that developing countries should work toward being able to coordinate different regimes. Consequently, the move from creative emulation towards international harmonization of universal rules is not simply a decisive "tightening" of policy space often discussed in heterodox literature, but moreover, a process towards complexity and, even more importantly, of weakened policy capacity by developing countries. The latter is mainly due to a blockage of learning processes that is generated through, first, complexity and conflicts between various knowledge markets and, second, because of harmonization pressures to global WTO regimes that motivate direct and quick coping instead of slow experimentation and resulting learning.

Thus, the idea of a variety of knowledge governance regimes strongly implies that developing countries should build their policy capacity with three rather large policy arenas in mind with often differing and even conflicting needs and actors. This speaks for increased efforts both in capacity building and, as importantly, in policy coordination. These efforts should pay attention not only to technical knowledge, domestic institution building and networks, but also to the public-sector structure and the nature of public service, and to international coalition building among like-minded countries.

It is, however, a somewhat one-sided argument to say that developing countries should build strategic policy capacities and alliances to utilize the existing policy space.[27] The logic

27 See, however, Reichman (2009) for an excellent discussion how this is possible, especially for large dynamic economies such as India and China; also see Jones, Deere-Birbeck and Woods (2010) on how small states can collaborate within WTO rules.

of global economy also says that much of the responsibility rests with the rich countries: BTAs are key to narrowing the policy space available to poorer countries. In many ways, the development agenda has to be turned upside down: financial flows need to be curbed and managed, and knowledge flows need to be reversed. Yet, both seem highly unlikely within the current international governance and global trade liberalization.

Conclusion

This chapter argues that, simply put, increased FDI and international financial flows, transformation of domestic banking and increasing integration into global production and innovation networks crowds out diversification of domestic economy in many developing countries. At the same time, knowledge, particularly in its codified form, is still, and even increasingly, being produced in developed countries in the North. In essence, for most developing countries, infant-industry protection and the reaping economies of network integration via upgrading is increasingly difficult due to global forces of trade and specialization as well as the tightened policy space available for policy selection.

The chapter then develops a simple theoretical framework for knowledge markets and knowledge governance regimes. These allow it to show what are three ideal-typical knowledge governance regimes. For simplicity's sake, these can be called commons, dynamic and mature stages. Each stage has its own variety of knowledge governance regime. The aim of regimes is to show that instead of traditional sector-specific industrial policy, globalized markets and international governance require various types of policy capacity (institutions and policies), that is, different types of organizational capabilities (in the private sector) and capacities (in the public sector). It is possible to use some of the aspects of knowledge governance regimes under current global rules (as shown by East Asia, China, India and increasingly, also by Brazil), yet for most countries the policy space and domestic capacities remain very limited.

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