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Thematic Overview: Charting the Evolution of Knowledge Flows

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Introduction: Trade in Knowledge Today

The Nexus: Knowledge Flows, Trade and Intellectual Property

Understanding cross-border flows of knowledge, often associated with transactions involving intellectual property (IP), is essential to analysing how modern economies grow and evolve, and how international trade can underpin technological development. How to stimulate knowledge flows and make more effective, systematic use of them is an immediate practical concern for contemporary policymakers and analysts seeking to frame and implement policies for economic and technological development, that strengthen innovation systems and tap into indigenous creative and innovative capacity. Trade is understood to serve as a major conduit for the knowledge dissemination and technology spillovers that are essential for sustainable development today. And the IP system has been crafted and implemented ostensibly to facilitate both innovation and the dissemination of the fruits of innovation. Trade in knowledge as such – transactions specifically over the licensing or transfer of IP rights, for instance – has become a practical reality and a major source of dynamism and disruption. The complex and dynamic interaction between the IP system and international trade is therefore critical to our understanding of knowledge flows and their contribution to development.

Yet technological change – digital disruption – is today itself increasingly a factor reshaping and diversifying the ways in which knowledge is developed, managed, transacted and disseminated. Accordingly, in the quarter-century since the WTO was established, and since its Agreement on Trade-Related Aspects of Intellectual Property Rights (‘TRIPS’) came into force, both the knowledge dimension of trade and the functioning of the IP system have been radically transformed. Many salient aspects of
these developments have been closely studied by scholars. Yet, when surveying available material to respond to WTO members’ increasing interest in understanding these complex phenomena, we found few resources that look at knowledge flows, trade patterns and the evolution of the IP system in an holistic way, while responding also to the development implications of technological change.

Hence the WTO Secretariat initiated a dialogue between policymakers and analysts, including a call for papers, several workshops and a peer review process, to fill this gap in available materials, an effort culminating in the present edited collection of readings and cutting-edge analysis. This volume forms a central part of the Secretariat’s efforts to build an up-to-date, inclusive and empirically well-founded information platform to support policy development by its members in this critical but challenging area.

Structure

The book is organized in four substantive parts, corresponding to four dimensions of the need for systematic understanding of cross-border knowledge flows or ‘trade in knowledge’:

(i) an overview of the conceptual framework for trade, IP and international knowledge flows
(ii) possibilities and challenges for measuring trade in knowledge
(iii) the impact of knowledge flows on trade and development
(iv) considerations for the governance frameworks that apply to these knowledge flows.

The present chapter provides a general introduction to the book, along with a thematic overview of the individual chapters contained in each of these parts. A concluding chapter then aims to draw together observations and insights from the substantive chapters and to offer ideas for future directions in research and policy dialogue.

Background

Knowledge flows, and their trade and development impacts, have come to the forefront of contemporary trade policy and trade relations. Governments seek to clarify and redefine their economic and development interests in the light of the disruptive effects of technological
change, the changing patterns of production and trade, and fundamental shifts in innovative and technological capacity.

The qualitatively more diverse and quantitatively higher cross-border knowledge flows since the 1990s have in part been associated with a process of diversification of production capacity, associated with the rapid development of emerging economies, notably in Asia. This evolution was, in turn, partly driven by the ICT revolution which so dramatically improved rapid and secure communications that it enabled the rise of global production chains or value chains – a transformation that Baldwin has termed ‘the second unbundling’, as physical steps in the production process (following the ‘first unbundling’, which had separated consumers from producers). As he has phrased it:

Globalization accelerated again from around 1990, when the information and communication technology (ICT) revolution radically lowered the cost of moving ideas. This launched globalization’s next phase—call it the ‘second unbundling’ since it involves the international separation of factories. Specifically, radically better communications made it possible to coordinate complex activities at distance. Once this sort of offshoring was feasible, the North–South wage gap that had arisen during the first unbundling made it profitable.

The offshoring of production stages to low-wage nations changed globalization, but not just because it shifted jobs overseas. To ensure that the offshored stages meshed seamlessly with those left onshore, rich-nation firms sent their marketing, managerial, and technical know-how along with the production stages that had been moved offshore. As a consequence, the second unbundling—sometimes called the ‘global value chain revolution’—redrew the international boundaries of knowledge. The contours of industrial competitiveness are now increasingly defined by the outlines of international production networks rather than the boundaries of nations.¹

Perhaps not entirely coincidentally, economists – notably Paul Romer – were at the same time recognizing that knowledge was a key and endogenous parameter in a country’s economic development, and could no longer be considered an external factor when modelling economic growth. As he observed at a 1992 World Bank conference on development:

All too often, economists concerned with the economy as a whole have been willing to treat the economics of ideas as a footnote to the rest of

economic analysis – important for understanding some of the details but not something that changes how we think about big policy questions. A neoclassical model with perfect competition and exogenous technological change continues to frame many, if not most, policy discussions of growth and development. Ideas are routinely ignored … ideas are extremely important economic goods, far more important than the objects emphasized in most economic models. In a world with physical limits, it is discoveries of big ideas (for example, how to make high-temperature superconductors), together with the discovery of millions of little ideas (better ways to sew a shirt), that make persistent economic growth possible. Ideas are the instructions that let us combine limited physical resources in arrangements that are ever more valuable.\(^2\)

He argued at that time that it is necessary to ‘take seriously the economic opportunities presented by the potential for producing new ideas and for diffusing existing ideas to the widest possible extent. In so doing, we must recognize that ideas are economic goods which are unlike conventional private goods and that markets are inherently less successful at producing and transmitting ideas than they are with private goods’.\(^3\)

Just at the time that such economic analysis was emphasising the necessity – and the significance for policymakers – of incorporating knowledge into models of growth and development, trade negotiators, led by the then industrialized countries, negotiated the TRIPS Agreement in order to increase legal certainty and predictability in the transfer of knowledge. Formally concluded in 1994 and entering into force the following year, its text had been essentially settled by 1992.\(^4\) The Agreement laid out minimum standards for the protection, use and enforcement of intellectual property rights that all WTO members would have to follow, while also incorporating provisions on technology transfer for least-developed countries and express scope for policymakers to craft laws to facilitate the flow of knowledge. The incorporation of the TRIPS Agreement into the package of international trade law that came into effect upon the formation of the WTO in 1995 meant that it

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\(^3\) Ibid., 89.

comprised a core element of the emerging legal and economic framework for what were to be the largest global transfers of knowledge in the period from the 1990s to the present day.

The period since 1995 has seen a fundamental transformation not only in the character and impact of digital technologies, but also in the geographical distribution of innovators and associated IP right owners, especially patents. Over this period, due specifically to the digital revolution, creative cultural content that used to be traded as physical goods are now sold on digital platforms online directly to markets across the globe – a burgeoning ‘trade in knowledge’ that frees valuable content from the physical carrier media once relied upon to transport it. Such ‘digital disruption’ offers new opportunities for development, as small traders and creative industries in the developing world can potentially overcome traditional obstacles to trade, although significant challenges remain, with concerns about the potential effects on beneficial competition of dominant online platforms and the difficulty of establishing alternative avenues for knowledge trade. Equally, the management of IP and IP licensing transactions constitute significant elements of dispersed global production chains and play a key role also in the knowledge spillovers resulting from IP-based transactions.

**Conceptual Framework**

Part I of this book sets out the conceptual framework about what we consider to be trade in knowledge in relation to trade in goods, services and intellectual property. We note the growing importance of trade in intangibles, distinguishing the delivery of knowledge-intensive services from the charges for the use of IP such as licence fees and royalties. We also note the rise in trade of digital products and services, and the IP dimension of such trade, in view of the fact that much of this trade is constituted as transactions in IP rights, whether through the purchase of licences or the transfer of ownership. Finally, this part looks at the existing IP framework for trade in knowledge, analysing both the TRIPS Agreement itself in its contemporary context, as well as provisions in subsequent trade agreements that have bearing both on IP in the digital environment and on trade in digital products; it then broadly points to the emerging policy issues and possible gaps in the regulatory framework thus far.

Antony Taubman’s introductory chapter sets the framework for the book. He charts the evolution and diversification of trade in knowledge
that has taken place in the quarter-century since the TRIPS Agreement came into force. Entirely new markets have come into being and, arguably, the very character of ‘trade’ is in need of reconsideration. For instance, the disruptive effect of digital technology has meant that much of the content formerly conceived of as ‘added value’ embedded in physical carrier media, traded and measured as ‘goods’, is now traded in the form of specific licences that use IP rights covering the content that is now increasingly accessed online in digital form. Taubman outlines how these new forms of exchange in valuable intangible content confront fundamental assumptions about the nature of trade and its interaction with the IP system, forcing a rethink of what constitutes the ‘trade-related aspects’ of intellectual property. The issues examined include the principle of territoriality of IP rights and the segmentation of markets according to national jurisdictions; the structuring of cross-border commercial exchanges into the two discrete categories of ‘goods’ and ‘services’; the emerging disparity in regional trade agreements between provisions on digital IP standards and on digital products and e-commerce; and the significance of IP rights being treated as assets in investment treaties. The chapter concludes that – whatever formal or legal overlay is applied to these new trading arrangements – it is essential to understand that this is now trade in IP licences as such, rather than trade in goods that have an IP component as an adjunct or ancillary element. Just as Romer and others demonstrated the need for economic growth theory to incorporate intangible knowledge as an endogenous factor, rather than maintaining it as exogenous to models of growth, trade policy must similarly work to incorporate an understanding of the trade in IP licences itself within cross-border commercial exchanges as an integral element of international trading relations. This means treating the exchange and licensing of IP rights systematically and effectively as ‘endogenous’ to trade. This is essential for an accurate empirical picture of trade relations today, given the economic significance both of dispersed global value chains and of trade in ‘pure’ IP content as such, particularly in the creative sectors.

Lee Tuthill, Antonia Carzaniga and Martin Roy look at the ways digital technologies have stimulated the information component of services trade and consequently enhanced trade in both goods and services that embody knowledge. They illustrate the role that ICTs have taken on as conduits for digital and digitally-enabled trade. Their chapter briefly describes six important digital developments, namely the cloud, data analytics, (so-called ‘big data’), Internet of Things (IoT), artificial
intelligence, robotics and three-dimensional (3D) printing. These technologies are transforming the tradability of services, increasing the growth of cross-border services supplied electronically, across a wide range of sectors, from medical, to educational, financial, audiovisual or professional services. This chapter covers, in broad strokes, the landscape of policy challenges that governments confront as they seek to adapt, including policies that could potentially disrupt the growth of cross-border digital trade such as localization of data. Finally, the chapter provides illustrations of ways negotiators of trade rules have begun to shape new legal frameworks via regional trade agreements (RTAs) that elaborate upon and, in some respects, extend beyond existing multilateral trade rules. For example, in some cases, WTO members with no GATS commitments in basic telecommunication services made RTA commitments on the sector, with no limitations. However, trade disciplines allow countries to take measures to pursue legitimate policy objectives, provided that they are not applied in a manner that would constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on trade.

Wolf R. Meier-Ewert and Jorge Gutierrez explore how regulatory responses to emerging IP issues in digital trade may develop at the international level. In particular, the authors examine how existing mechanisms might influence the chances of developing internationally agreed rules in this regard. The authors note that the primacy of state sovereignty in intellectual property up to the late nineteenth century gave way to the important World Intellectual Property Organization (WIPO) treaties, which still retained some independence of member states and based international regulatory responses directly on national experience. While more regulatory sovereignty was ceded in TRIPS, the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty, the adoption of non-binding instruments (such as the WIPO Joint Recommendations in the area of trademarks) show the limits of decision-making by consensus. International non-state solutions such as the Uniform Domain-Name Dispute-Resolution Policy (UDRP) established by the Internet Corporation for Assigned Names and Numbers (ICANN) have introduced separate, technically determined solutions to specific IP issues. Proliferating free trade agreements (FTAs) have emerged as a new platform to agree to IP-related regulatory responses that can be used to project the national solutions of a few dominant FTA partners. However, these FTAs have also served to give legally binding status to internationally agreed non-binding recommendations.
The authors go on to highlight how these diverse approaches are apparent in recent IP-regulatory responses to emerging digital issues that are particularly relevant for digital business models, including inter alia Internet service provider (ISP) liability, ‘safe harbour’ provisions and the issue of orphan works, where there appears to be less agreement. Still further away from reaching any kind of agreement are the emerging issues of online exhaustion, data mining and IP-related questions of artificial intelligence.

**Measuring Trade in Knowledge**

Part II of this book discusses the possibilities and challenges for measuring trade in knowledge and what these measurements tell us about recent trends in cross-border knowledge flows. It benefits from chapters contributed by some of the leading researchers in the field. Their work measures both absolute and relative cross-border flows, and trends both in terms of dominant technologies as well as geographical distribution using different metrics. The two key sources of data explored are the balance-of-payments (BoP) statistics collected by the International Monetary Fund (IMF), and patent statistics.

Andreas Maurer and Joscelyn Magdeleine focus on an analysis of the statistics on IP-related transactions recorded as goods and services in international balance-of-payments data – in effect, an incomplete measurement of trade in IP as such, although a measure with its shortcomings. Their chapter opens this part of the book because this has been the standard means of measuring cross-border knowledge flows through trade: according, it provides the baseline for improved – more accurate and comprehensive – measurements of cross-border payments for charges for the use of IP, and the authors helpfully identify how statistics could be made more complete and accurate. They chart how licence fees for the use of IP have increased more than four-fold since 1995, twice as fast as exports of high-tech goods and 1.5 times faster than the overall increase of trade in commercial services. This trade, which is driven in part by global production arrangements, remains highly concentrated geographically, with the US and the EU (28) accounting for more than 76 per cent of the receipts in 2016. However, they note how the data suffer from serious lacunae in that only a very small number of mainly

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5 See https://data.worldbank.org/indicator/BM.GSR.ROYL.CD.
OECD countries report complete information, and there are several definitional problems that prevent a full understanding of the dimension, direction and other details of trade in IP-related products. The authors conclude by making several recommendations to consider in order to improve the statistical basis, including the creation of a new international dataset covering international IP-related flows.

Throwing some doubts over the conclusions that can be drawn from an uncritical view of the BoP statistics described in the previous chapter, Thomas Neubig and Sacha Wunsch-Vincent show how tax planning by multinational enterprises has seriously distorted the measurement of cross-border IP flows and affected national measurements of imports, exports, GDP and productivity. The main data sources assessing these flows are described and the main distortions to these flows are assessed. Focusing on the implications of differing taxation regimes, the chapter describes the tax effects on cross-border IP measures in more detail and measures the magnitude of and trends in the tax distortions. The authors estimate that overall tax-induced mis-measurement could be more than 35 per cent of the Charges for Use of Intellectual Property (CUIP), being more for individual countries, particularly those with high tax rates. The authors suggest some initial possible approaches to reducing mis-measurement distortions.

Elucidating general patterns of the more valuable technical knowledge flow across borders from patent citations and patents network data, Andrew W. Torrance, Jevin D. West and Lisa C. Friedman test three specific hypotheses designed to shed light on such flows. The first is general, and is inspired by a growing interest in technology transfer between the developed and developing world: the net flow of more valuable technical knowledge tends to be from more developed to less developed countries. It transpires that the importance of citing developed world patents is much greater on average than citing developing world patents throughout the entire time period from 1985 to 2018. From 2010 onwards, the disparity narrows somewhat, in large part due to China. The second hypothesis concerns the trajectory of pharmaceutical knowledge flow between developed and developing countries. Developing world pharmaceutical patents cited by developed world patents also exhibited a general rising trend. However, the average importance of cited developing world patents remained consistently far above that of the developed world level, again in no small measure due to China. This may mean that while smaller numbers of pharmaceutical patents are filed by developing countries, these tend to be more important inventions.
Overall, pharmaceutical patent trends in citations, aggregate importance and mean importance do not appear to diverge meaningfully from those for patents across all technological fields. The third hypothesis concerns the trajectory of climate change mitigation knowledge flow (especially from developed to developing countries) after the 1997 Kyoto Protocol and the 2015 Paris Agreement on climate change. Looking only at wind-power patents, the authors reject conclusions from earlier more general studies and tell us that there is no clear evidence that the Kyoto Protocol influenced any of the metrics used to characterize wind technology patent knowledge flows but there are some positive trends after the Paris Agreement, which, given how recent these data are, should be treated with great caution. One striking observation apparent from the analyses in this chapter is that US patents make up a huge proportion of patent citations, patent importance and technical knowledge flows within the developed world. Similarly, China has recently come to dominate patent citations, patent importance and technical knowledge flow within the developing world.

Laurie Ciaramella, Gaétan de Rassenfosse and Florian Seliger provide a long-term view on the sources of knowledge flow between developed and developing nations. The authors rely on patent data to explore three potential sources of cross-border knowledge flows: R&D collaboration, technology sourcing and technology transfer. R&D collaboration is measured by looking at patents that are co-invented or co-applied for by parties in two different countries. Technology sourcing is measured by patents that are applied for by a party in one country but invented in another country. Technology or knowledge transfer is measured using information on the transfers of ownership (i.e. sales) of patents. All three sources provide very consistent conclusions. First, knowledge flows with East Asia, particularly China, are occurring more frequently. Second, knowledge flows are increasingly concentrated in information and communication technologies. Third, while the United States and Canada traditionally have greater patenting activity with Asia than with Europe, the share of activity between Europe and Asia has been increasing in recent years. Fourth, greater patenting activity between the United States and Canada and Asia implies that the US/Canada region is more likely to benefit from reverse knowledge flows as China progresses towards becoming a technological leader.

Jacob Dubbert, Alexander V. Giczy, Nicholas A. Pairolero and Andrew A. Toole provide a valuable survey of empirical studies on cross-border trade in knowledge that use IPRs data. This review finds that most studies