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International Technology Transfer Policies

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OECD TRADE POLICY PAPER

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INTERNATIONAL TECHNOLOGY TRANSFER POLICIES

Andrea Andrenelli, Julien Gourdon and Evdokia Moïsé (OECD)

Concerns are growing about policies and measures that restrict market access with the effect of "forcing" technology transfer. Efforts to target forced technology transfer are complicated by the sometimes blurred line between voluntary and mutually agreed upon technology transfers and that which is perceived to be, or is in fact, compelled. This study presents a discussion of the continuum of measures related to international technology transfer (ITT) and aims to identify those measures that pose the greatest concern over their potential to compel disclosure of commercially valuable and sensitive technology. It then briefly presents information on provisions in international trade and investment agreements that are relevant to ITT. The last section presents the perspective from the private sector in order to better understand how firms engage in technology transfers through research collaboration, licensing, joint ventures, and equity investments. The analysis in this report indicates that involuntary technology transfer is a complex issue, and it aims to provide a way for policy makers to think through the issues, to apply a systematic and analytical approach to assessing which policies are of the greatest concern.

Key words: International trade, FDI, competition, intellectual property, innovation

JEL codes: F1, F13, F15, F23, O3

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Executive Summary

Technology transfer by multinational enterprises (MNEs) is seen as one of the principal sources of knowledge and economic growth worldwide, as testified by the increasing focus on policies aimed at attracting and retaining international business. Market imperfections and externalities related to technology transfer and diffusion have been seen in many contexts as sufficiently important to justify government intervention. However, concerns are growing about policies and measures restricting market access, with the effect of "forcing" technology transfer.

Efforts to target forced technology transfer are complicated by the sometimes blurred line between voluntary and mutually agreed upon technology transfer and that which is perceived to be, or is in fact, compelled. It can also be difficult to gather information on practices which are generally hidden and that companies may be reluctant to report publicly, including for fear of losing access to valuable markets.

This report presents a discussion of the continuum of measures related to international technology transfer (ITT), ranging from policies aimed at creating an appropriate supporting environment for ITT, to policies that may have the effect of imposing ITT to varying degrees, to policies which clearly result in a forced transfer of technology. This "ITT continuum" maps policies according to the level of concern they raise for policy makers based on (1) the degree of compulsion the policies impose on foreign firms when they interact with local counterparts and (2) the effect they have on the extent of foreign firms' control of their proprietary technology.

Along the continuum, three main groups of policies can affect ITT.

The first, which normally does not raise concerns, includes *policies to enhance absorptive capacity*, which tend to be aimed at enabling and maximising the benefits of ITT, and *technology-related promotion of Foreign Direct Investment (FDI)* and *FDI facilitation measures*, which aim to attract and help to shape ITT effects.

The second encompasses policies sometimes regarded as potentially problematic. *Technology-related investment incentives* include ITT obligations for foreign firms attached to financial benefits, although this can be a grey area as firms are receiving something in return, even if their choice over the ITT is limited. Certain types of *ITT-related outbound investment* may be motivated by the acquisition of foreign technologies; this is of particular concern where these are directed by the state in support of state industrial plans.

The third covers policies often reported as problematic. Concerns have been raised about the use of *registration, certification and approval procedures* by government bodies to request, formally or informally, sensitive proprietary information which does not appear to be necessary, or indeed requirements to disclose source code. This group also includes *technology-related performance requirements* that impose local sourcing and local content requirements or data localisation, with the potential to compel involuntary technology transfer. Finally, it also includes measures related to *FDI restrictions* which can oblige foreign investors to have local partners, which can require transfer of, or have implications for, control of proprietary intellectual property (IP). FDI screening processes can also be of concern where there is a requirement to provide sensitive information.

The degree to which a given measure can be viewed as forcing foreign firms to transfer technology can be influenced by factors related both to the measure itself and the broader policy environment. Four factors are particularly relevant:

- The extent to which the measure sets up a *quid pro quo* between access to a given market and transfer of proprietary technology.
- Discrimination, not just in terms of the measure itself (non-discriminatory measures can still compel ITT), but in the broader environment (e.g. lack of equal access by foreign firms to the courts or to contract enforcement) can lead to increased vulnerability to involuntary ITT.
- Lack of transparency, both in terms of how measures are formulated and applied (e.g. where the criteria for receiving a license or certification are unclear or discretionary) and in the broader policy-making environment, can increase vulnerability to involuntary ITT.
- The role of the state in the economy. Where the state has a stake in companies competing or partnering with foreign firms, market-based transfer of technology under voluntary and mutually agreed terms can be compromised, and concerns can arise about protection of information provided to government bodies for approvals or licensing. Concerns may also arise when state-owned enterprises (SOEs) seek to obtain technologies through acquisitions of foreign firms or where the state otherwise directs or facilitates outbound investment in support of state policy.

Not all these factors are equally pertinent for all measures, and a combination, such as a lack of transparency coupled with discrimination, can compound the effects of a measure in terms of compulsion and control. Where such aggravating conditions apply, the measure can "leap" from the safe or the grey area of the ITT continuum into the area of concern.

Finally, intellectual property rights (IPR) are pivotal in preserving the technology owner's interests or, on the contrary, in resulting in unplanned transfers of technology when they are weak or discriminate against foreign firms. Relevant disciplines related to IPR protection, and ITT more broadly, can be found in the World Trade Organization (WTO) and in International Investment Agreements (IIAs), which include both Bilateral Investment Treaties (BITs) and relevant provisions in free trade agreements.

Lastly, the report looks at ITT from the perspective of the private sector. Drawing on data covering 93 multinational enterprises (MNEs) in eight high-technology sectors, the analysis shows that research collaborations and licensing agreements are the most common forms of direct technology transfer arrangement adopted by MNEs in the sample. In addition, the evidence is suggestive of an impact of technology transfer policies on the actual strategic decisions of businesses.

This initial exploration of ITT is intended to provide a framework to support government efforts to distinguish between policies that enable cross border diffusion of technology, with the resulting benefits for widespread innovation and growth, from policies that may compel the transfer of technology in order to benefit competing firms.

1. Introduction

Technology transfer by multinational enterprises (MNEs) is seen as one of the principal sources of knowledge and economic growth worldwide, as testified by the increasing focus on policies aimed at attracting and retaining international business. Market imperfections and externalities related to technology transfer and diffusion have been seen in many contexts as sufficiently important to justify government intervention. Such intervention typically takes the form of specific measures related to intellectual property rights (IPR), promotion of technology-related foreign direct investment (FDI), and policies to enhance absorptive capacity.

However, concerns are growing about policies and measures restricting market access with the effect of "forcing" technology transfer, or related to lax enforcement of IPRs resulting in involuntary disclosure of valuable IP. While certain measures are already subject to disciplines at the international level, others are not currently covered by international agreements.

Efforts to target forced technology transfer are complicated by the sometimes blurred line between voluntary and mutually agreed upon technology transfer that is normally associated with FDI unconstrained by government action, and technology transfer that is perceived to be, or is in fact, compelled. This adds to the existing difficulty in gathering information on practices which are generally hidden and that companies may be reluctant to report publicly, including for fear of losing access to valuable markets.

It is also important to distinguish between forced technology transfer that is the result of distortions to the normal processes of technology transfer, and technology transfer resulting from espionage or criminal activity. The focus of this study is on the perceived abuse of channels such as technology licensing, FDI (including joint ventures), and joint research projects, i.e. market channels within the control of the transferor of technology (see Maskus, 2004). Practices such as unauthorised reverse engineering, breach/leaks, and cyber-attacks – although of great concern– are beyond the scope of this study.

Against this background, this project has three parts. The first part presents a discussion of the continuum of measures related to international technology transfer (ITT), and aims to identify those measures that pose the greatest concerns over their potential to compel disclosure of commercially valuable and sensitive technology. The discussion also draws on business news for recent evidence of ITT policies perceived as forced and provides examples from the academic literature on instruments used by countries for ITT, along with evidence regarding whether mandatory technology transfer policies have achieved their objectives.

The second part briefly presents the relevant existing disciplines under the WTO, free trade agreements (FTAs) and bilateral investment treaties (BITs). The third part focuses on the private sector perspective, drawing upon firm data to present a picture of how firms engage in technology transfer through collaboration on research, licensing, joint ventures and equity investments and presenting some feedback from the private sector on involuntary technology transfer.

2. The ITT continuum

The OECD's recent stock-taking of official policies and regulations related to ITT (OECD, 2017) is a logical place to start but may not paint a full picture of technology transfer conditions imposed on technology holders. These conditions may be imposed in non-transparent negotiations of investment deals, through specific technical—but also potentially IPR-violating—requirements of various regulatory agencies, and through various specific forms of administrative guidance.

This paper develops a continuum that presents different groups of measures, ranging from policies aimed at creating an appropriate supporting environment for ITT, to policies that may have the effect of imposing ITT to varying degrees, to policies which clearly result in a forced transfer of technology.

This "ITT continuum" maps policies according to the level of concern they raise for policymakers. Central to developing the continuum is the understanding that 'forced' technology transfer is frequently the result of some form of compulsion imposed by government policies and practices, which affects the interactions of foreign firms with their local counterparts and prevents foreign firms from entering into agreements with local partners on market-based contractual terms that are voluntary and mutually agreed.

While there are clearly questions of degree, forced technology transfer can involve situations in which the owner of a technology (e.g. an investor or licensor) is required to transfer technology either to be permitted to operate under the same conditions as local firms or to access the market at all. Therefore, although the transferor of technology might choose to transfer technology to overcome serious obstacles, and a degree of consent might therefore be involved, the obstacles may still be viewed as *forcing* the owner's choice to give away proprietary technology[1].

The indicative ITT continuum (Figure 1) presents measures according to the level of concern they raise for policymakers, which means (1) the degree of compulsion the policies impose on foreign firms when they interact with local counterparts and (2) the effect they have on the extent of foreign firms' control of their proprietary technology. This continuum is designed to be a tool to assist policy makers in thinking through the universe of ITT measures, rather than a precise and static taxonomy. Views may differ regarding the level of concern raised by different ITT policies, and the placement of any given measure will depend on the detail of how it is structured, particularly for policies in the grey area.

Along the continuum, three main groups of policies can affect ITT. The first group, which normally does not raise concerns, includes *policies to enhance absorptive capacity*, which tend to be aimed at enabling and maximising the benefits of ITT, and *technology-related FDI promotion and facilitation measures*[2], which aim to attract and help to shape ITT effects, toward specific sectors for instance.

The second group encompasses policies sometimes regarded as potentially problematic by policy makers. *Technology-related investment incentives* include ITT obligations for foreign firms attached to financial benefits, although this can be a grey area as firms are receiving

[1] This is especially true for markets which are central to economic activity in given sectors.

[2] While there are important differences between investment facilitation (focused on providing a transparent and predictable environment and streamlining administrative procedures) and promotion (pro-active policies to attract investment), they are less significant for the purposes of this analysis and thus are grouped together.

something in return, even if their choice over the ITT is limited. Certain types of *ITT-related outbound investment* may be motivated by the acquisition of foreign technologies. While this is a standard practice, concerns have been raised about mergers and acquisitions that are directed or facilitated by the state, in support of state industrial plans, including through SOEs or SOE financing.

The third group covers policies that are often reported as problematic by firms. Concerns have been raised about the use of potentially any *registration, certification and approval procedure* by government bodies to request, formally or informally, sensitive proprietary information which does not appear to be necessary for (or related to) the relevant administrative process. In this sense, regular administrative procedures such as various forms or licensing or approval, can become, under some circumstances, instruments for compelling ITT. This group also includes *technology-related performance requirements* that impose on investors local sourcing and local content requirements (including in the context of government procurement) or specific operations (regarding data localisation or disclosure of source code), with the potential to compel involuntary technology transfer. In addition, within this group there are also measures related to *FDI restrictions* which, in certain circumstances, can oblige foreign investors to have local partners in order to gain market access, with implications in terms of control of proprietary IP and know-how. This can include the requirement, in the context of FDI screening processes, to provide sensitive information or technology as a specific determinant of approval of the FDI by the relevant regulatory body.

Obviously, in this third group, some policies raise more concern than others. They are marked in red on the ITT continuum. *Requirements to disclose source code* in order to obtain market access, including in the context of administrative processes for licensing and certification or as part of investment screening, and *data localisation requirements* fall into the category of measures which have been the subject of widespread concern. These policies indeed set up a *quid pro quo* of market access for technology transfer, or alternatively can seriously jeopardise the firm's control over its proprietary technology. For these reasons, these measures are specifically highlighted on the ITT continuum, although they are a subset of previous categories. Additionally, while *mandatory joint-venture requirements* (JV requirements) are marked orange as they may or may not raise concerns depending upon their conditions, the subset of mandatory JV requirements which require transfer of technology, which are often reported as being of particular concern in relation to forced ITT, would classify as red.

Figure 1. The Initial ITT continuum

However, how these policies affect the technology owner's ability to decide whether to transfer proprietary technology and on what terms, will also depend on both the nature of the measures themselves and the wider policy environment. The importance of both these factors for the ITT decisions of foreign firms will be explored in the following section, following which the various policy measures specifically affecting ITT are indicatively positioned along the "ITT continuum", based on the degree of compulsion they are seen to exert on foreign firms interacting with local counterparts. Finally, the role of Intellectual Property

Rights (IPR) policies is discussed, as a necessary condition for technology transfer to occur on market-based, voluntary and mutually agreed, contractual terms.

2.1 The "leap" into forced technology transfer

Whether or not and the degree to which a given ITT-related measure (written or unwritten) can be viewed as forcing foreign firms to transfer technology can be influenced by a number of factors, related both to the nature of the measure itself and to the broader policy environment in which those measures are adopted and implemented. Four factors are particularly relevant.

In the context of technology transfer, a key issue is the extent to which the measure sets up a *quid pro quo* between access to a given market and transfer of proprietary technology. Measures become of greater concern when transfer of technology is a precondition to establish or operate in a foreign market. While firms still have the choice not to enter the market at all, should they wish to do so, there is a high degree of compulsion imposed on them to hand over their technology. These kind of conditions could thus be seen as impinging to a greater extent on the control over proprietary technology.

Similarly, lack of observance of non-discrimination is another factor that may exacerbate concerns about ITT. When measures apply only to foreign holders of technology, or are applied in such a way as to offer less favourable treatment than that offered to domestic owners of technology, ITT measures pose increased concern[3]. Equally, beyond measures specifically related to ITT, broader discrimination in the environment – such as lack of equal access by foreign firms to the courts or for contract enforcement – can lead to increased vulnerability to involuntary ITT. In this sense, the conditions in which domestic firms operate, both in relation to specific ITT measures and in the broader environment, are a good yardstick against which to assess whether policy measures contain a lesser or greater degree of compulsion for technology transfer from foreign firms.

A third factor which can apply both to the measure itself and to the broader policy environment and which can influence the extent to which technology transfer can be seen as forced is lack of transparency. This refers to the extent to which measures are transparent both in how they are formulated and applied. For example, where joint venture requirements lack clarity on the respective ITT- related obligations of the two partner firms, or where the criteria for receiving a license or certification are unclear or discretionary, or where the broader policy-making environment is non-transparent, there is a greater risk that policy measures may affect disproportionately the foreign firm's leeway in ITT decisions.

Finally, in terms of the broader policy environment, the role of the state in the economy may be relevant. Where the state is a player in the economy, with a significant stake in companies competing or collaborating with foreign firms, the conditions for the market-based transfer of technology under voluntary and mutually agreed terms can be compromised, including in the context of giving rise to concerns about the protection of information provided to government bodies for the purposes of approvals or licensing. Concerns may also arise when state-owned enterprises (SOEs) seek to obtain cutting-edge technologies and IP through mergers and acquisitions of foreign firms or where the state directs or facilitates outbound investment in support of state policy.

[3] That said, policies and measures can still have the effect of forcing technology transfer even if applied without discrimination.

These factors can mean that an otherwise neutral measure, particularly in the grey area of the ITT continuum, could be viewed as actually placing greater constraints on a foreign firm's choices in whether and how to transfer technology locally, or on its capacity to control proprietary technology in a non-transparent policy environment or where the involvement of the State in the economy and the ITT process is high. Not all of the above factors are equally pertinent for all measures, and a combination of conditions, such as a lack of transparency coupled with discrimination, can compound the effects of a measure in terms of compulsion and control. For example, if administrative requirements regarding the type information required for product certification are not transparent, and where the role of the state in the economy gives rise to doubts over the independence of the administrative or regulatory bodies and about the appropriate protection of information provided to them, a normal process of seeking administrative approval could become a potential channel for involuntary technology transfer. Where such aggravating conditions apply, the measure can 'leap' from the safe or the grey area of the ITT continuum into the area of concern.

2.2 The universe of ITT policies

Countries employ a wide variety of measures to attract foreign inward investment and to promote the transfer of foreign technology. This universe of ITT policy can be studied through the lens of the ITT continuum.

Absorptive capacities for ITT

The first group of policies, which are ITT measures that often do not raise concerns, are policies to enhance absorptive capacities, which are aimed at enabling and maximising the benefits from ITT. Absorptive capacity policies aim at attracting investment and maximising the capacity for positive spillovers to the domestic economy, and include *investments in education*, funding for *networks between universities and foreign firms*, and policies that *facilitate investor access to human capital in technology-intensive areas*, by, for example, encouraging the employment of foreigners alongside nationals or *investments in training for nationals*. Similarly, policies can also be aimed at creating the conditions for local companies to enter in partnerships with foreign firms, including through government projects to foster *collaboration on R&D activities among foreign and local firms* and to encourage *training by multinationals*.

It is clear from the literature (Box 1) that absorptive capacity is an indispensable ingredient in the successful attraction and diffusion of foreign technology. A number of studies illustrate that technology transfer policy alone may not work and should rather be complemented with such policies. There are good payoffs for governments that invest in upgrading local absorptive capacity.

Indeed, most empirical studies fail to find significant evidence of positive spillovers in the absence of significant absorptive capacity and stress that technology diffusion is not automatic and requires domestic investments (Box 1).

Box 1. Complementarity of measures: Absorptive capacity is required

Empirical studies, such as Aitken and Harrison (1999) Djankov and Hoekman (2000) Konings (2001), Javorcik (2004) and Newman et al. (2015) fail to find significant evidence of spillovers from FDI in developing countries and identify lack of absorptive capacity as a main factor in the relatively insignificant impact. Crespo and Fontoura (1998) provided empirical evidence that the absorptive capacity of domestic firms impacts the positive effect of technology transfer. In addition, Keller (2004) provided a comprehensive survey on the effect of technology transfer, concluding that technology diffusion is not automatic and requires domestic technology investments.

Local firms are more likely to benefit from technology transfer when governments in their countries take action to improve local firms' absorptive capacity and human capital. Additionally, action by firms themselves can be important. Blalock and Gertler (2009) used a panel data set of Indonesian manufacturing firms from 1988 to 1996 and determined that firms with increased R&D investment benefit from the presence of foreign multinationals. This result again indicates that technology transfer is conditional on the local firms' absorptive capacity in the host country.

Technology-related FDI promotion and facilitation

Technology transfer can also be influenced by general and specific policies and regulations in the area of FDI facilitation and promotion. Harding and Javorcik (2011), using data from 124 countries, show that sectors receiving investment promotion for FDI inflows receive more investment than other sectors, and this effect is still observed in the post-targeting period.

According to the OECD Policy Framework for Investment[4], investment promotion and facilitation include policies such as *streamlining of administrative procedures*, creation of *investment promotion agencies*, setting up of *information exchange networks* and *improvement of the business environment*. These measures are aimed at attracting foreign companies and facilitating the process of foreign investment, although there might be an effort aimed at directing foreign investment into high technology industries.

For example, in Chile, the FDI Promotion Agency InvestChile encourages investment in technologically advanced sectors such as energy. In this framework, the Chilean economic development agency (CORFO) promotes business linkages with SME suppliers, especially for solar energy (OECD, 2017).

Like *absorptive capacity policies*, *technology-related FDI promotion and facilitation* measures do not qualify as forcing technology transfer, even in a more unfavourable broader policy environment. Both types of measures are aimed at *attracting* investment, by creating the conditions for a supportive business climate. They do not impose constraints on the transferors of technology vis-à-vis their counterparts and, on the contrary, they help foreign investors to navigate new business conditions. In a similar vein, these measures are unlikely to pose risks to the control of proprietary technology. For these reasons they are marked in green in Figure 1.

Technology-related investment incentives

The third category includes *technology-related investment incentives*, which contain ITT obligations for foreign firms attached to fiscal, financial or other benefits. These include specific conditions which have to be met by the firm in order to obtain benefits. Investment incentives are among the most important policy instruments employed by governments to

[4] https://www.oecd.org/investment/toolkit/policyareas/investmentpromotionfacilitation.htm

influence the decisions of multinational firms. They affect the conditions of competition for investors, and must be designed with care to reduce local and global distortions.

This category includes policies such as *patent box systems*, *fiscal incentives* or *grant schemes dependant on R&D spending* by investing firms, or dependent on the *technology transfer characteristics* of investment. For example, patent box incentives are designed to attract and retain foreign technology, as preferential tax treatment is offered on income from royalties, licensing and R&D capital gains. A more specific example of technology-related investment incentive can be found in Costa Rica's Free Zone Regime (not yet implemented), where IP holders of technology would be fiscally encouraged to establish presence in the country and dedicate 0.5% of their local sales to local R&D activities (Kowalski, Rabaioli and Vallejo, 2017). This category also includes *incentives for building suppliers' capacity*, *using local facilities*, *employment of highly skilled local workforce* or *locating in the country*, although these are less sensitive in the context of forced technology transfer.

These measures are less likely to be of concern in terms of ITT. However, their impacts may be affected by the overall environment in which they operate. For instance, if receipt of an incentive is essential to being competitive in a given market, foreign firms may have little choice but to pursue it notwithstanding the risk that proprietary technology will have to be shared as a result. This could be the case, for example, where all domestic firms in the sector receive a benefit (such as low-cost energy) which a foreign firm would also need to receive in order to be cost-competitive in the market – highlighting also the importance of broader non-discriminatory treatment of foreign firms. Technology-related investment incentives also may give rise to concern if there is inadequate transparency with regard to both the declared purpose of the incentives system and to the measures themselves (i.e. who benefits from what).

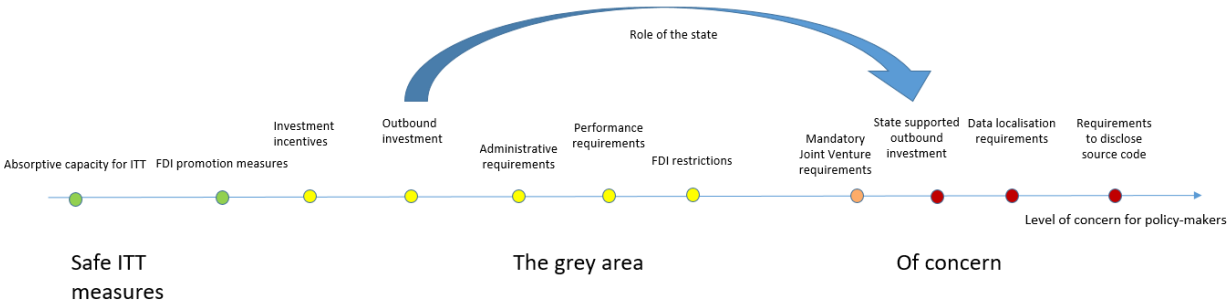
ITT-related outbound investment

The fourth category encompasses ITT-related outbound investment that can be motivated by the objective of acquiring new technologies. While outbound investment that is driven by technology acquisition has traditionally been a regular practice in the world of foreign investment and a core part of the strategy of many multinational companies, in recent times concerns have arisen over the *role of SOEs* or *private companies engaging in outward FDI in support of state industrial plans*. These concerns extend to *Mergers and Acquisitions (M&A) financed by state-owned banks* or *state-backed funds.*

Here the concern is less about the mechanism (foreign mergers and acquisitions in technology-rich sectors) than about the role that state actors can play in international mergers and acquisitions. State involvement would impact the competitive environment for other market participants when large SOEs are shielded from competition domestically and expand internationally, or when acquisitions are in support of state industrial plans. In these instances, the role played by the state in the acquisition of the foreign firm could make the outbound investment strategy 'leap' along the FTT continuum into the area of concern (Figure 2). These points were for example raised in the US Section 301 Investigation into the People's Republic of China's (hereafter "China") acts, policies and practices related to technology transfer, intellectual property and innovation.[5]

[5] According to that report (USTR, 2018a), the Chinese government directs and/or unfairly facilitates the systematic investment in, and/or acquisition of, US companies and assets by Chinese companies to obtain cutting-edge technologies and intellectual property and generate large-scale technology transfer

Figure 2. State involvement in outbound investment



Administrative requirements

Administrative requirements, such as for licensing or certification, or as part of conformity assessment procedures in relation to standards can also be potential channels for compelling ITT. In the course of these processes, firms can be *required to disclose sensitive information* explicitly and directly, as in the case of *requirements to disclose source code.* This can be regarded as a stringent requirement to provide very sensitive information, since source codes are often central to the business model of companies operating in high-technology sectors. For this reason, requirements to disclose source code is marked separately in red on the ITT continuum.

Other forms of involuntary ITT can take the form of the requirement to *disclose sensitive designs* (or other IP-related information) for product certification. These measures, insofar as they require the disclosure of information beyond that which is necessary to verify that products conform to legitimate objectives like public safety and security, can be considered as mandating technology transfer. The granting of administrative licenses, certification or approval can also be linked to unrelated concessions on the transfer of technology. Measures with the effect of requiring sensitive information to be disclosed in the course of administrative requirements would be of among those of greater concern along the ITT continuum. This is shown in Figure 3.

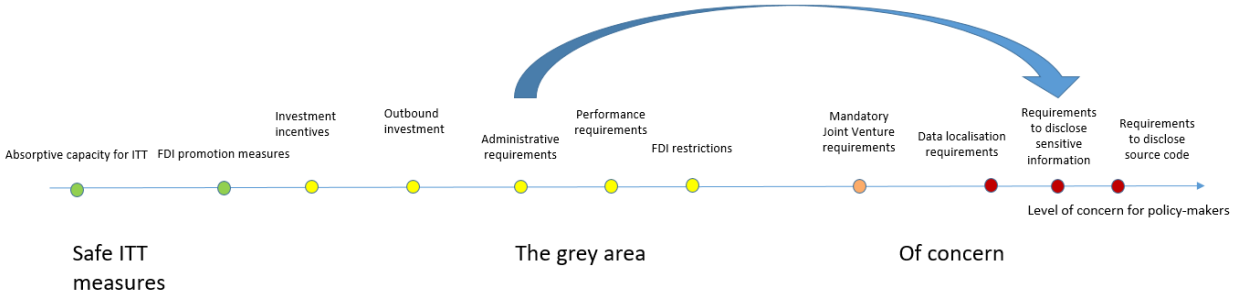
The external environment can also be particularly relevant in this context. That is, even where measures might not be automatically considered as forcing technology transfer per se, they might do so in policy environment where there is a lack of transparency regarding the use by the regulator of the acquired sensitive designs, or weak trade secrets protection. If the state is also a player in the economy, there may also be concerns about the transfer of this information to competitors in the market.

For example, the European Commission (2014) has identified as potentially trade restrictive the Circular 30 (2011) on certification and conformity of IT and telecommunications products of Viet Nam's Ministry of Information and Communications. The measure, requiring equipment to be tested by designated laboratories located in Viet Nam, could under the

in industries deemed important by Chinese government industrial plans. For example, the report cites the acquisition for approximately USD 1.9 billion of OmniVision Technologies, Inc. (OmniVision), a leading developer of advanced digital imaging solutions, which is reported to have occurred through significant state involvement. The acquisition of OmniVision was reportedly financed for two thirds by state-backed investment funds, and for one third by the state-owned Bank of China and China Merchants Bank.

analysis in this paper, also be of concern in the absence of sufficient safeguards and IPR protection in the broader policy environment.

Figure 3. The disclosure of sensitive information in the course of administrative requirements



Technology-related performance requirements

The fifth category encompasses technology-related performance requirements. Some require local sourcing or operations with a potential for technology transfer through positive externalities. In some cases, jurisdictions *require firms to invest in R&D locally*. In India, for example, the government requires foreign firms to build in-house R&D facilities to undertake R&D locally to increase local firms' R&D capacity (Ricken and Malcotsis, 2011).

Requirements to hire national employees, in particular at senior level, could in some circumstances increase the risk of unintentional transfer of technology, while *local sourcing (or local content) requirements* could force foreign companies to conduct sensitive operations in the host market. The positive externalities of foreign establishments on R&D, local employees or local sourcing could instead be targeted through FDI promotion or incentive policies. The compulsory nature of technology-related requirements can, however, give rise to greater concerns. For example, in Indonesia, the government mandates that smartphones and similar products within the 4G LTE spectrum need to have 30% local content - both in hardware as well as software – when sold on the Indonesian market (OECD, 2017).

These policies could be said to constrain the ability of foreign firms to enter in agreements with their partners on market-based, voluntary and mutually agreed, contractual terms (1), as foreign transferors of technology are forced to come to pre-established terms with local partners (e.g. workforce, companies). They may also have an adverse effect on the foreign firm's ability to control its proprietary technology (2), as they increase the risk of unintended transfer of technology. As these measures can vary in their impact on technology transfer, depending on how they are structured, they are marked in yellow.

Data localisation requirements are identified distinctively and marked in red in the diagram, because they are highly likely to set up a *quid pro quo* of market access for technology transfer. *Localisation of data storage* can have consequences for mandated transfer of technology, making it possible for proprietary information and trade secrets to be unintentionally transferred to or accessed by local firms, where relevant IPR and other laws do not ensure sufficient protection, for example. These requirements similarly affect the ability to control proprietary technology, especially if in combination with restrictions on cross-border data flows, because such policies might also force the choice of locating activities associated with the data.

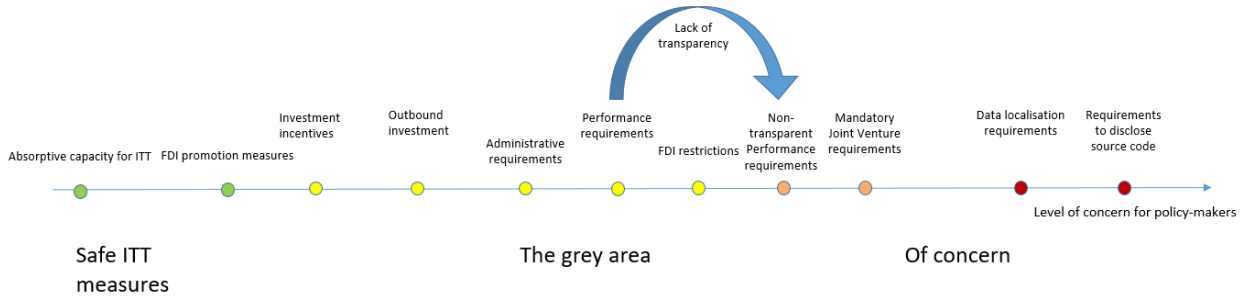
A number of studies point to the effectiveness of various performance requirements in resulting in the transfer of technology, or in promoting either more foreign R&D facilities within a host country and to greater parallel government investment in R&D or absorptive capacity.

For instance, Gallagher and Shafaeddin (2009) compared the policy for industrial learning in Mexico and China and argued that omitting performance requirements completely may lead to a reduction in government investment in R&D, education and human capital training. Sun et al. (2006) argue that the rapid increase of R&D facilities setup by multinationals in China between the 1990s and early 2000s was the response to the R&D requirements imposed by the government and to the complementary policies directed to foster the absorption capacity of local companies. Equally, Fosfuri, Motta and Ronde (2001) link performance requirements to hire national employees to technology transfer since human capital trained by FDI subsidiaries may promote technology transfer as they later work in other local firms.

That said, these findings are subject to some caveats. They assess the benefits of such measures, but these are not set against any related costs to the country or, indeed for the other economic actors affected by the transfer (the entities transferring their technology, or other countries in which those entities were previously operating). Over the longer term, there could be argued to be potential impacts on the incentives for innovation.

Measures in this group, while not in and of themselves of concern, could leap into the concerning segment of the ITT continuum depending on their design or under adverse factors pertaining to the policy environment. Factors such as lack of transparency (either in relation to the measure itself or in the overall environment) can give rise to considerable uncertainty about the conditions being applied by the government, which may impede normal business decisions relating to technology, and create circumstances in which local partners, employees, or governments can seek technology transfers that do not reflect market-based, voluntary and mutually agreed, considerations. This is shown in Figure 3 as the leap of performance requirements into an orange category.

Figure 4. The lack of transparency in performance requirements



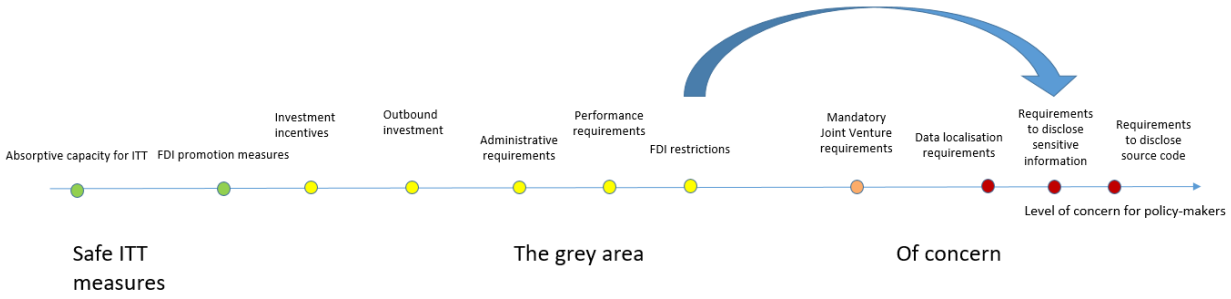
FDI restrictions

Limitations on the share of equity owned by foreigners apply in a number of countries and sectors. In certain circumstances, these limitations can oblige foreign investors to have local partners (e.g. *mandatory joint venture requirements*), which may have implications in terms of control of proprietary IPR and know-how. *Mandatory joint-venture requirements* are often reported as compelling transfer of technology in and of themselves, and they are therefore marked in orange on the ITT continuum. In addition, *screening procedures* may also have an impact on forced technology transfer. While these can be introduced in response to the need

to screen for the SOE involvement in acquisitions referred to above, they can also be disproportionately intrusive and require the disclosure of sensitive IP-related information in order to receive FDI approval. They can also be excessively restrictive and distort voluntary and mutually agreed technology transfer from local firms to foreign investors.

This type of restriction in screening and concessions is evident in the measure regarding the Examination, Approval and Registration of Foreign-invested Seeds Companies of the People's Republic of China. The measure indeed makes the establishment of a foreign-invested enterprise for crop seeds conditional upon the firm possessing "superior varieties (germplasm resources) from overseas, advanced seeds techniques and equipment" which can be introduced or adopted in China (Covington & Burling, 2014). Wehrle and Pohl (2016) explain that the Ministry of Commerce of China may require IPR-related documents to approve the transaction and such an approval is based on a substantial exchange of technology-related information. In addition, screening procedures might raise concerns not only when disclosure of information is a clear condition in the framework of investment screening– as in the instances presented above – but also in less transparent instances where the screening rules do not explicitly require disclosure of sensitive information, but such disclosure is implicitly encouraged or required. Therefore, FDI restrictions requiring disclosure of sensitive information – either as a result of their design or of the broader policy environment– would raise a higher level of concern for policymakers (Figure 5).

Figure 5. The requirement to disclose sensitive information related to FDI restrictions



Findings from literature can shed light on the motivations of host countries that have sought to require foreign investors to enter into joint ventures. Kokko (1994) studies Mexican manufacturing data and shows that when there is both a high technological gap and high foreign share ownership, spillovers are less likely, but that the large technological gap alone does not pose as much of a challenge. Javorcik (2004), using firm level survey data from Lithuania, shows that there are positive productivity spillovers from FDI to local suppliers and that these are significant in the case of shared ownership, but not in the case of fully owned foreign investments. Ghebrihiwet (2017) shows that there is more technology transfer under acquisition than under direct entry.

Proton, the joint venture between Mitsubishi (a Japanese multinational firm) and HICOM (a Malaysian state-owned enterprise) illustrates the effect of mandatory joint ventures. In the early 1980s, the Malaysian corporate auto sector, including assembling, spare parts production, marketing and distribution, was controlled by foreign firms. The setup of Proton, initiated and mandated by the government, led to the development of the first Malaysian-designed car and the capacity building of local suppliers and manufacturers of key components (Wad, 2011; Ricken and Malcotsis, 2011). However, this policy may not be ultimately successful because the technology from these mandatory joint ventures tends to be out of date.

Indeed, a body of research shows that forced technology transfer policies often fail to achieve their goals, resulting only in transfer of dated or marginal technology (Box 2). The blueprints of a technology are also not always easy to operationalise into an actual industrial or business process when the know-how on how to run the process is lacking.

Box 2. Empirical findings of counterproductive technology transfer policies

Unsuccessful performance requirements. Urata and Kawai (2000) find that performance requirements were not a determinant for intra-firm transfer of technology technologies by Japanese manufacturing firms. Blomstrom et al. (2000), studying technology flows from the United States by American companies operating in 33 different countries, find that performance requirements in the host countries have on the contrary a negative effect.

R&D investment requirements can fail. Howell (2018), using a set of novel data on China's automobile sector, show that R&D investment requirements fail to trigger transfer of up-to-date technology or lead domestic firms to improve manufacturing quality.

So can technology transfer related tax incentives. Tavares-Lehmann et al. (2016) explained that design and implementation of technology transfer-related tax or fiscal incentives are complicated. If not well tailored, they become fiscal burdens on governments.

Mandatory joint ventures are not always successful. Jiang et al. (2018), studying the international joint ventures in China's manufacturing industry from 1998 to 2007, which accounted for approximately a quarter of all international joint ventures in the world, determined the absence of spillover effects of FDI in the prohibited industry (i.e. with foreign equity limitation). Cosbey and Mann (2014), studying mandatory joint ventures in developing countries such as India and Nigeria, argue that mandatory joint ventures are more likely to fail, because of missing key characteristics such as shared objectives, trust and complementary capabilities. Baoteng and Glaister (2003) documented that only 10 out of 50 agricultural joint ventures set up in Ghana survived in the 1990s.

Moreover, most of the technologies transferred into these ventures are out of date. Moran (2002) finds that technology employed in mandatory joint ventures in Mexico tends to be 3 to 10 years behind the most updated technology, and that the technical training in these mandatory joint ventures is only a part of that provided in wholly-owned counterpart subsidiaries. Chang (2013) determines that technologies that are transferred into a joint venture in technology-intensive industries in China tend to be out of date rather than cutting edge ones. Chang et al. (2013) argue that wholly owned subsidiaries outperform joint ventures in terms of technology.

And can discourage FDI. Holmes, McGrattan and Prescott (2015), study quid pro quo policies in developing countries and in particular China, which require multinational firms to transfer technology in return for market access. They equal those policies to a tax for the right to sell domestically, imposing a higher burden the more advanced the technology targeted for transfer. Such burden discourages the FDI inflow from countries with advanced technology. Lu et al. (2017) determined that inflows of FDI in China substantially increased only in industries which became open to FDI and in which an increasing number of products are referred to as (FDI)-encouraged products. Moran (2002) explained that one of the reasons IBM withdrew from the Indian market was that it was forced to form a mandatory joint venture with a local partner.

IPR policies underpin the ITT continuum

Policies to acknowledge and protect IPRs play a central role in the ITT conditions prevailing in a country. They indeed underpin the ITT continuum and can be considered as pivotal in preserving the technology owner's interests or, on the contrary, in resulting in involuntary transfers of technology when weak. As for the other types of measures analysed so far, the broad concept of "IPR policies" encompasses many different disciplines.

The *patent system* aims at providing the necessary legal protection for technology holders to preserve control over inventive technology for a limited term (20 years under the TRIPS agreement) while disclosing how to make and use the inventions, thereby improving knowledge dissemination and facilitating the transfer of technology. *Licensing agreements,*

regulated in the context of the patent system, are actually one of the major channels for promoting technology transfer. Licensing plays a crucial role in creating income for the patentee, and promoting dissemination and further development of technologies by a wider group of licensees, thereby facilitating the commercialisation of innovative products. *Adequate protection of trade secrets* is also of great importance. It concerns proprietary information developed by businesses that provides a competitive advantage in their commercial activities because it is unknown to others. The owner takes reasonable measures to keep this information secret; unlike patents, this protection is not time limited, and is becoming more important in the context of digitalisation. Beyond regulation on the books, *enforcement* is an important element of the IPR system. Elements of effective *enforcement* include transparent, fair and equitable procedures that permit effective action against infringement of IPRs, including remedies to prevent and deter infringement, as well as the opportunity for review of final administrative decisions by a judicial authority.

For given legitimate purposes and under established conditions, countries can have recourse to compulsory licensing – allowing a third party to produce a patented product or process without the consent of the patent owner, or to use the patent-protected invention itself. Several countries use compulsory licensing[6] – to compel dissemination of certain types of technology domestically, particularly for pharmaceuticals. For example, in Thailand the government issued a compulsory license in 2007 for Kaletra, the patent of which was originally owned by Abbot Laboratories. India issued its first compulsory license in 2012 to Natco, a local generic pharmaceutical company, to produce a patented drug made by Bayer. Certain OECD Member States have raised concerns about these actions.[7]

Implementation of IPR policies may also discriminate against foreign interests in order to facilitate technology flow from foreign investors to local firms (Maskus, 2000). Liegsalz and Wagner (2013) provide an overview of the institutional background of patent examination at the State Intellectual Property Office (SIPO) in China. Conducting a duration analysis of the population of 443 533 patent applications in China from 1990 to 2002, they determined that domestic applicants were granted patents faster than foreign applicants, especially in technology-intensive sectors.

Rassenfossea and Raiteria (2000) also analysed whether discrimination existed against foreign applicants in the grant of patents at SIPO. The authors did not determine an overall anti-foreign application bias at SIPO. However, foreign patent applications in high technology areas were 'about four to seven percentage points less likely to receive a patent grant than similar domestic applications'.

Certain countries have weak and discriminatory IPR protection and enforcement, which enables firms to imitate or reverse engineer technology products from other countries, notwithstanding the fact that they are under patent protection. Implicit arrangements may also lead to weaker protection of property rights owned by foreign investors.

Cao (2014) highlighted how China's relatively well developed IP regulatory framework fails to provide appropriate protection because of weak patent law enforcement by legal, economic, political, social and cultural institutions, thereby impeding FDI inflows and

[6] https://www.wto.org/english/tratop_e/trips_e/public_health_faq_e.htm.

[7] See, e.g., US Trade Representative, Special 301 Report (2013), at 39, and Special 301 Report (2008), at 37 (available at https://ustr.gov/issue-areas/intellectual-property/special-301/2013-special-301-review).

regular technology transfer. However in a more recent hearing before the US-China Economic and Security Review Commission, Mark Cohen (2018) acknowledged progress with the creation by China of specialised IP courts which have undertaken a number of new measures[8] which have led to fairer treatment of foreign firms[9] and increased transparency[10].

Adequate IPR protection as a prerequisite for ITT

Adequate IPR protection can play an important role in attracting FDI and encouraging technology transfer and knowledge spillovers. In pioneering work, Mansfields (1994) provided convincing evidence that technology intensive firms are reluctant to transfer new technologies to countries with weak intellectual property laws. In light of this, developing countries could potentially increase their attractiveness to potential investors owning advanced technology by strengthening their protection of intellectual property (UNCTAD, 2005).

However, there is intense public debate on the impact of strong IPR protection. Advocates argue that the impact is positive, as in the absence of appropriate IPR legislation in host countries, foreign companies may attempt to limit technology transfer by refusing to license advanced technology, charging excessive prices for technology transferred, or incorporating anti-competitive restrictions into technology transfer agreements (Jeffries, 2001). They also argue strong IPR protection could bring higher economic growth through inducement to more innovation. But there is another stream in the literature which argues that the net effect of strengthened IPR protection is not always conducive to transfer of technology, and it depends on country and industry characteristics. Opponents posit that the spillover effect could be stronger where there is no effective IPR protection, as local firms in the host country can reverse engineer and imitate a multinational firms' product at a lower costs (as long as the host country has appropriately competent human capital).

Box 3 reviews the literature on the impact of IPR protection on FDI and technology transfer and shows extensive empirical evidence in favour of a positive net effect of strengthened IPR on technology transfer. This is particularly the case when composition of FDI matters, i.e. if the country aims to attract FDI in technology intensive sectors with high potential for technology transfer. However, for this positive effect to materialise, there is a need for sufficient technological endowment in the host country, which can be missing in developing economies which require assistance to build absorptive capacity.

[8] "*in such areas as citation to cases and use of case law; drafting of shorter and more to the point judicial opinions; the introduction of dissenting opinions and en banc decisions by judges; experimentation with amicus briefs; and diminished role of behind the scenes adjudication committees."* See Mark Cohen Testimony. https://uscc.gov/sites/default/files/Mark%20Cohen%20uscc%20testimony.pdf.

[9] In 2015, foreigners reportedly won 100% of their infringement cases in this court, see M. Goldberg, "Enclave of Ingenuity: The Plan and Promise of the Beijing Intellectual Property Court" (19 May 2017), https://elischolar.library.yale.edu/ceas_student_work/4.

[10] The Beijing IP Court is publishing 95% of its cases. See J. Schindler, "The Beijing IP Court Gave Foreign IP Plaintiffs a Perfect 65-0 Win Rate in 2015, Reports One of its Judges" (4 July 2016), http://www.iam-media.com/blog/Detail.aspx?g=8dc59dc8-6405-4b86-b241-27e89afc6089.

Box 3. Impact of IPR protection on technology transfer

Studies in favour of a positive effect

Nunnenkamp and Spatz (2004), using data on US FDI stocks in 166 countries, determine that a positive relationship exists between IPR protection and FDI and that IPR protection affects both the quantity and quality[1] of FDI. Yueh (2006) focused on the generation of domestic patents in China and confirmed that strengthened protection and local R&D appear complementary in inducing innovation. Park and Lippoldt (2008) determine that improved IPR protection stimulates technology transfer and local innovation, particularly in the BRIC countries, as evidenced by their case studies. Branstetter et al. (2006), analysing affiliate-level data of US multinational firms, found a positive association between strengthened protection on the one hand and royalty payments for transferred technology, R&D expenditure and total levels of foreign patent applications on the other hand. Branstetter et al. (2011) shows evidence that US multinationals shift production of more technologically intensive goods to affiliates by increasing the affiliates' assets, net property, plant and equipment, employment compensation, transfer of technology from other countries and R&D expenditures when the host countries' IPR protection strengthens.

The impact is also felt on the composition of FDI. Javorcik (2004), using firm-level data from Eastern Europe, determined that strong IPR protection has a positive and statistically significant effect on the composition of FDI inflows. Weak protection deters foreign investors from investing in high-technology sectors, including pharmaceuticals, cosmetics and health care products, chemicals, machinery and equipment and electrical equipment. It also discourages foreign investors from engaging in local production and prompts them to invest in distribution facilities in all sectors.

Studies stressing the need for absorptive capacities

Maskus (2004) in a survey of IPR policies and regimes explains that the *positive impact of IPR protection on ITT is heterogeneous* and depends on the development level of the host country. A positive relationship between IPR protection and inward flows of ITT is only evidenced in middle-income and large developing countries, while evidence is limited on the impact of IPR protection in least developed countries.

Bascavusoglu and Zuniga (2002) reviewing knowledge flows from French firms to 19 country destinations and 29 sectors determined that the *effect of IPR protection depends on the market size and technology endowment of the host countries*. Better IPR protection can increase such flows if the destination markets have strong technological capacities and commercial potential in terms of size, while strong IPR protection in low-income countries has a non-significant effect and may deter technology flows in low-technology sectors.

Hsu and Tiao (2015), investigating the relationship between IPR protection and inward FDI in 11 Asian countries from 1985 to 2010, determine that *the positive causality between strengthened IPR protection and FDI inflows depends on the characteristics of the country*. The difference between home and host country characteristics would cause a negative effect in attracting FDI for the host country.

Allred and Park (2007), using a sample of 2 446 companies from 35 developing and developed countries, determine that strengthened *IPR protection only has a positive effect in developed countries.* For developing economies, patent strength negatively affects domestic patent filings and insignificantly affects R&D and foreign patent filings.

1. As measured by the technology content of FDI as determined by the local R&D expenditure of US affiliates, value added by US affiliates in the host country, and exports of the US affiliates in the host country.

3. International Framework

This section briefly presents information on provisions in international trade and investment agreements that are relevant to ITT[11]. Certain disciplines, such as WTO TRIPS provisions on national treatment, patents and protection of undisclosed information, have drawn the attention of WTO Members as possible grounds for challenging ITT policies of concern. Recent free trade agreements (FTAs) also provide more extensive guidance as regards the protection of undisclosed information. Beyond IP related disciplines, provisions governing the wider investment policy environment can be found among WTO TRIMS provisions on national treatment, the WTO General Agreement on Trade in Services (GATS), notably in relation to scheduled commitments relating to market access (Article XVI) and national treatment (Article XVII) for mode 3, as well as in investment chapters in FTAs and bilateral investment treaties (BITs).

3.1 WTO TRIPS

The TRIPS Agreement's objective provides that the protection and enforcement of IPR "*should contribute to the promotion of technological innovation and to the transfer and dissemination of technology… in a manner conducive to social and economic welfare, and to a balance of rights and obligations*" (TRIPS Article 7).

Provisions of the TRIPS Agreement that may be particularly relevant to the issue of involuntary ITT include the following[12]:

- National treatment: Article 3 requires WTO members to "*accord to the nationals of other Members treatment no less favourable than that it accords to its own nationals with regard to the protection of intellectual property*", subject to certain exceptions provided in other agreements;
- Patent non-discrimination: Subject to certain qualifications, Article 27 establishes that patents must be "*available for any inventions, whether products or processes, in all fields of technology*" and reiterates the principle that patent rights should be "*enjoyable without discrimination as to the place of invention (…) and whether products are imported or locally produced*."
- Patent exclusive right: Article 28 provides that a patent "*shall confer on its owner the following exclusive rights : (a) where the subject matter of a patent is a product, to prevent third parties not having the owner's consent from the acts of making, using, offering for sale, selling, or importing for these purposes that product; (b) where the subject matter of a patent is a process, to prevent third parties not having the owner's consent from the act of using the process, and from the acts of using, offering for sale, selling or importing for these purposes at least the product obtained directly by that process.*" Likewise, patent owners must "*have the right to assign, or transfer by succession, the patent and to conclude licensing contracts*."

[11] There are many other international agreements and instruments that refer to ITT including, for example, environmental agreements and the UN SDGs. However, the focus of this paper is on provisions in selected trade and investment instruments.

[12] Related disciplines in FTAs seek to reinforce or build upon TRIPS commitments or to address IP issues outside the scope of the TRIPS agreement. Among the 100 FTAs that have entered in force since 2010, 61 reaffirm TRIPS. Some FTAs, especially in the Americas or Asia, also include specific mention of IPRs as one of the forms that an investment may take.

- Term of protection: Article 33 stipulates that for patents "*the term of protection available shall not end before the expiration of a period of twenty years counted from the filing date*."
- Trade secret protection: Article 39 imposes an array of obligations on WTO Members with respect to trade secrets ("undisclosed information") and data submitted to governments or governmental agencies. For instance, natural and legal persons must "*have the possibility of preventing information lawfully within their control from being disclosed to, acquired by, or used by others without their consent in a manner contrary to honest commercial practices*", where the information meets certain requirements. In addition, "*Members, when requiring as a condition of approving the marketing of pharmaceutical or of agricultural chemical products which utilize new chemical entities, the submission of undisclosed test or other data, the origination of which involves a considerable effort, shall protect such data against unfair commercial use*." Members also "*shall protect such data against disclosure, except where necessary to protect the public, or unless steps are taken to ensure that the data are protected against unfair commercial use.*"
- IPR enforcement: Articles 41 through 61 set out several provisions relating to IPR enforcement, which can be valuable tools in challenging involuntary ITT. Active enforcement and the possibility of effective action against infringements can contribute to a favourable environment and prevent ITT measures from moving to areas of concern in the ITT continuum.

Article 31 of the TRIPS Agreement addresses WTO Members' laws allowing for other use of the subject matter of a patent without the authorisation of the right holder including "*by the government or third parties authorised by the* government", commonly referred to as compulsory licensing. Article 31 establishes an extensive framework of conditions with respect to compulsory licensing.

Other TRIPS provisions specifically address the situation of least-developed countries. For instance, Article 66 provides that least-developed country Members "*shall not be required to apply the provisions of TRIPS, other than Articles 3, 4, and 5, for a period of 10 years from the date of application*". Upon a duly motivated request by a least-developed country Member, the TRIPS Council shall accord extensions of this period.

Likewise, Article 66.2 provides that developed country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members to enable them to create a sound and viable technological base. The TRIPS Council requires developed country Members to submit full reports on activities undertaken to meet this obligation every three years, with annual updates submitted between reports. Since 2003, the WTO Secretariat has received reports about such incentives regularly from eight jurisdictions: Australia (from 2005), Canada, Japan, New Zealand, Norway, Switzerland, United States, and the European Union.

IPR chapters in FTAs build on TRIPS disciplines in the areas of relevance to ITT, and more robust provisions can be found in some of the most recent FTAs. For example, some trade agreements provide a more detailed framework for the protection and enforcement of trade secrets.

3.2 WTO GATS

Provisions in the GATS Agreement aim to establish a "*framework of principles and rules for trade in services with a view to the expansion of such trade under conditions of transparency and progressive liberalization…".* In addition to the agreement's transparency provisions (Art.III) and the call for ensuring that measures of general application in sectors where specific commitments are undertaken "*are administered in a reasonable, objective and impartial manner"* (Art.VI), other provisions that may be particularly relevant to the issue of involuntary ITT include:

- Market access commitments: Art.XVI requires each Member to "*accord services and service suppliers of any other Member treatment no less favourable than that provided for under the terms, limitations and conditions agreed and specified in its Schedule."* Unless otherwise specified in their Schedule, Members are not allowed to maintain or adopt "*limitations on the number of service suppliers …; on the total value of service transactions or assets …; on the total number of service operations or on the total quantity of service output …; measures which restrict or require specific types of legal entity or joint venture through which a service supplier may supply a service; and limitations on the participation of foreign capital in terms of maximum percentage limit on foreign shareholding or the total value of individual or aggregate foreign investment."*
- National treatment provisions : Art.XVII requires Members to "*accord to services and service suppliers of any other Member, in respect of all measures affecting the supply of services, treatment no less favourable than that it accords to its own like services and service suppliers,"* in the sectors inscribed in their Schedule.

3.3 WTO TRIMS and International Investment Agreements (IIAs)

Remedies against certain types of involuntary ITT policies could also be sought under the WTO TRIMS Agreement. The agreement recognises that certain investment measures can restrict and distort trade and requires Members to refrain from any trade-related investment measure inconsistent with GATT Articles III and XI, by discriminating against foreign products or imposing quantitative restrictions. The illustrative list of inconsistent measures contained in the TRIMS includes those that require "*the purchase or use by an enterprise of products of domestic origin or from any domestic source, whether specified in terms of particular products, in terms of volume or value of products , or in terms of a proportion of volume or value of its local production."*

In connection with its commitments under the TRIMs Agreement, the Protocol of Accession of the People's Republic of China specifies that "*China shall eliminate and cease to enforce … performance requirements made effective through laws, regulations or other measures (*or*) enforce(*ment*) of contracts imposing such requirements (*and*) ensure that … any other means of approval for … investment by national and sub-national authorities, is not conditioned on … performance requirements of any kind, such as local content, offsets, the transfer of technology, export performance or the conduct of research and development in China*."

International Investment Agreements (IIAs): FTAs and BITs

Provisions relevant for international technology transfer are increasingly included in international investment agreements (see Annex Table A1). The bearing of each IIA on technology transfer policies is determined primarily by a) whether the agreement applies to the conditions imposed on potential investors prior to, and as a condition for, the establishment in the recipient country, as opposed to only regulating the operation of investments once they have been established; and b) the extent to which the agreement imposes limitations on the parties' ability to subject the establishment and operation of an investment to technology transfer requirements or other requirements that may constrain the choices of potential investors in transferring technology.

Some of the earliest IIAs to include provisions requiring non-discrimination and the prohibition of certain performance requirements with respect to the pre-establishment phase of potential investments are BITs, mainly those concluded by Canada, Japan and the United States. Similar provisions can increasingly be found in the investment chapters of FTAs: two thirds of all FTAs containing detailed investment provisions concluded since 2010 require the recipient country not to discriminate between foreign and domestic investors, not only with respect to their operations in the country once the investment has been established, but also as regards the conditions for establishing such investment.

In most of these FTAs and BITs, the list of conditions that are prohibited in connection with the establishment or operation of an investment explicitly includes requirements imposing the transfer of technology and requirements to supply a specific region or the world market exclusively from the recipient country's territory. On the other hand, those IIAs frequently specify that the recipient country maintains the possibility to subject the receipt or continued receipt by the investor of an advantage, to (among other conditions) the conduct of research and development in its territory[13]. Some of the most recent IIAs, such as the EU-Japan Economic Partnership Agreement, the CPTPP, the FTA between Korea and Costa Rica, El Salvador, Honduras, Nicaragua and Panama – all three signed in 2018 but not yet in force – or Japan's 2013 BIT with Mozambique, also explicitly prohibit the requirement to transfer a production process or other proprietary knowledge to a natural or juridical person in the recipient country's territory. These prohibitions may be subject to various exceptions – such as where a requirement is imposed or enforced by a court, administrative tribunal or competition authority to remedy a practice determined after judicial or administrative process to be anticompetitive.

Several of the IIAs that explicitly prohibit technology transfer as a requirement in relation to the approval and operation of foreign investment also clarify that such transfer may nevertheless be imposed or enforced by a court, administrative tribunal or competition authority to remedy a practice determined after judicial or administrative process to be anticompetitive. These IIAs generally also include reference to TRIPS Articles 31 on compulsory licensing and Article 39 on undisclosed information and note that the prohibition does not apply where unauthorised use of intellectual property rights falls within the scope and is consistent with one of these articles.

[13] Under the EU-Japan Economic Partnership Agreement, while the parties can condition the receipt of advantages on the conduct of research and development in their territory, they are explicitly barred from subjecting the approval or operation of the investment on the achievement of a given level or value of research and development in their territory.

Finally, it is worth noting innovative provisions in some of the recent IIAs involving Japan[14], such as the EU-Japan EPA, the CPTPP, the Japan-Mongolia EPA and the Japan-Israel BIT, which prohibit requirements for the potential investor "*to adopt a given rate or amount of royalty*" when entering into a licence contract, or "*a given duration of the term of a license contract … enforced in a manner that constitutes direct interference with that licence contract by an exercise of non-judicial governmental authority*".

4. The private sector and technology transfer

While technology transfer might raise concerns in its involuntary forms, it is important to underscore that the transfer of technology underpins business in today's knowledge economy[15]. Companies interact, cooperate and compete through a number of different means, including by collaborating in research, setting up joint ventures and investing in other firms to acquire knowledge and capabilities. This section presents the wider picture of companies' technology transfer arrangements, drawing on the FactSet database. This serves the purpose of providing a tentative "heatmap" of sectors and relationships which would be sensitive to ITT policies, in order to inform the debate on technology transfer policies. Additionally, some feedback from the private sector on involuntary technology transfer is presented in Box 4.

The FactSet Supply Chain Relationships database, covering more than 16 100 publicly traded companies, classified into 148 different industries and 20 broad economic sectors, provides a useful wider picture of companies' technology transfer arrangements. Building on recent OECD analysis,[16] it is possible to provide a general mapping of direct technology transfer arrangements between major multinational companies and their business partners.

As noted earlier, analysis of ITT can require fine judgments on what constitutes voluntary, as opposed to involuntary, technology transfer. Similarly, differentiating between business relationships directly involving transfer of technology and linkages which produce technological spillovers is arguably a difficult task (Maskus, 2004). In this regard, Factset data offers information on thirteen possible channels through which parent companies interact with other companies – referred to as 'linkages' or 'relationships' in this report. The types of linkages/relationships are summarised in table A2 in Annex[17]. Six of these linkages are defined as direct technology transfer arrangements: equity investment, investor relationships, joint ventures, out-licensing, in-licensing, and research collaboration (see

[14] The USMCA (signed on 30 November 2018) also includes such provisions.

[15] This section draws on and expands the database on MNEs and their cross-border business partnerships developed under the auspices of the Investment Committee and the Working Party of the Trade Committee in the context of joint work on trade and investment inter-dependencies in GVCs. For more information, see the report "Micro-evidence on corporate relationships in Global Value Chains: Role of trade, FDI and strategic partnerships", forthcoming OECD Trade Policy Paper.

[16] "Micro-evidence on corporate relationships in global value chains: Role of trade, FDI and strategic partnerships", forthcoming OECD Trade Policy Paper.

[17] While the Factset Supply Chain Relationships displays a number of limitations, including lack of information on the value of the relationships between parent and partner companies, its uniqueness lies in the granular information on the type of relationships existing between firms.

Table A2 in Annex for definitions)[18]. These six direct technology transfer arrangements cover the key categories of measures included in the ITT continuum.

While most business interactions indeed involve an element of knowledge sharing or technological spillover, the linkages identified above often require a direct transfer of technology as a prerequisite to establish business relationships. Equity investment and investor relationships are included in the category of direct technology transfer arrangements due to the strategic role investment flows can play in the acquisition of new technologies, as well as the effect equity investment can have on the strategic decisions of independent companies.

Based on this categorisation, it is possible to look at the sectors where direct technology transfer arrangements are prevalent, based on a sample of 160 Multinational Enterprises (MNEs) in 14 different economic sectors, across both manufacturing and services[19]. Of those sectors available in the sample, six manufacturing and two services sectors stand out for the use of direct technology transfer arrangements and involvement in research collaboration. These are Chemicals, Electronics, IT Services, Internet/software services, Motor Vehicles, Pharmaceuticals, Semiconductors and Telecommunications Equipment.

At the aggregate level, research collaboration with foreign partners is the main form of direct ITT arrangement, occurring 1 453 times in the sample. This is followed by international licensing – appearing 781 times as the sum of in-licensing (474) and out-licensing (307) relationships – and by international Joint Ventures, with 304 reported linkages. International Equity investment amounts to 205 linkages, comprising international Equity Investment (114) and international Investor relationships (91)[20].

[18] Transfer of technology with fully or majority owned subsidiaries (intra-company transfer of technology) falls outside the scope of analysis. Similarly, arms' length trade in goods and services, as well as marketing activities, manufacturing services, distribution, and integrated product offerings, are not considered as direct channels of technology transfer for the purpose of this study.

[19] This sample extends the coverage of firms and sectors analysed in "Micro-evidence on corporate relationships in Global Value Chains: Role of trade, FDI and strategic partnerships" (forthcoming OECD Trade Policy Paper) with the addition of 13 MNEs operating in the Semiconductors industry. As the focus of this report is ITT, the number of technology transfer linkages reported below excludes relationships between parent MNEs and partners in their own economy. Only linkages with foreign parties are therefore taken into account. All reported relationships occur with independent firms.

[20] While this information is instructive of the main technology transfer arrangements recorded in the Factset sample, important caveats remain. It is not possible to determine whether transfer of technology is the primary target of some types of relationship. For example, International Joint Ventures could be formed as a result of market access considerations, to share financial risks or to divide the costs of research and development. Information on the economic value of these linkages is missing, and it is even less possible to tell whether these technology transfer arrangements were established under pressure or under voluntary and mutually agreed terms. Furthermore, 38 research collaborations, 12 joint ventures and 3 licensing relationships are double-counted in the paragraph above, i.e. they are linkages reported by two different MNEs in the sample, although they actually represent the same arrangement (e.g. a joint venture binding two companies in the sample). These observations are not dropped because this would require an arbitrary decision on their sector and geographical location, i.e. whether they would belong to one partner MNE or the other. Lastly, the data was extracted from the Factset database from July 2017 to June 2018, and again in November 2018 for the Semiconductors industry. Marginal changes in MNEs' strategies occurring during this period might therefore not be recorded in the data.

Preferences for channels of technology transfer, however, vary significantly across sectors (Figure 6). While research collaboration is most commonly observed in IT services, Semiconductors and Telecommunication Equipment, firms in Electronics and Pharmaceuticals tend to use licensing as a form of direct ITT arrangement.

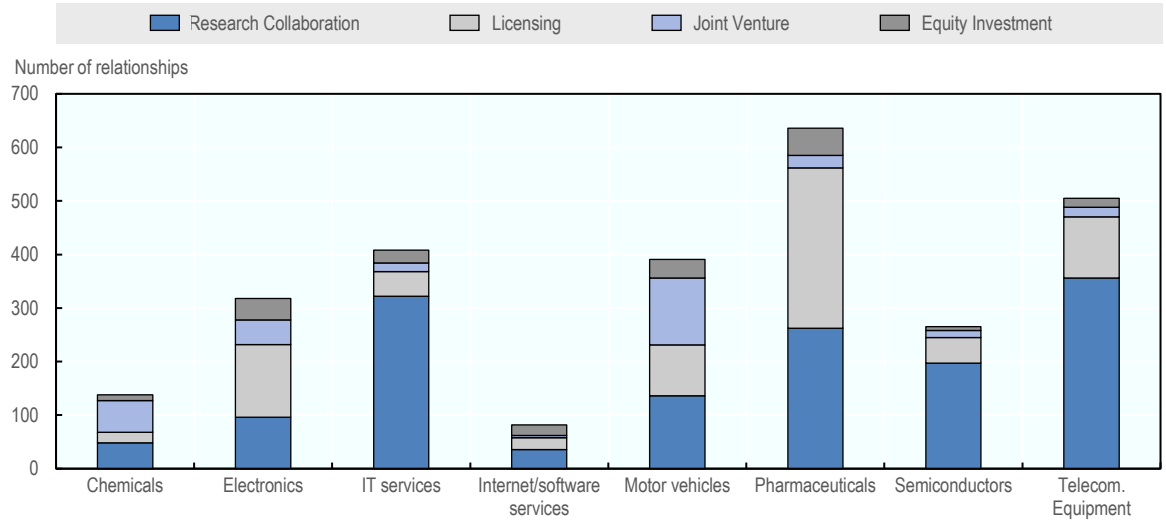
The volume and possible internal diversity of international research collaborations are instructive in two key respects. First, these underscore the collaborative nature of technological innovation in today's knowledge-intensive GVCs, where companies cooperate and compete simultaneously to build competitive advantage. Second, the sizeable share of research collaborations poses complex questions for regulators related to patenting and respective contractual rights regarding innovation born of the collaboration between independent firms, or alternatively to the respective IP rights and obligations of partner firms collaborating in research.

International Licensing remains the second most important technology transfer arrangement. This underscores the centrality of IPR protection in underpinning the ITT continuum. For both research collaborations and licensing agreements, a broader supportive policy environment remains critical in allowing independent firms to collaborate towards innovation. Moreover, in the absence of an appropriate policy environment for licensing, firms are likely to internalise technology transfer through FDI, in order to avoid the pitfalls of dealing with independent companies. In this regard, it is important to note that Figure 4 exclusively reports licensing between parent companies and independent firms; that is, while licensing combined with equity investment (<50% share of equity) is included in the figure, intra-firm licensing – with fully or majority owned subsidiaries – is not.

International Equity investment, while an important channel, raises difficulties for analysis. It is not possible to identify – on the basis of the data in the sample – whether the investment was carried out for technology acquisition purposes. Similarly, it is difficult to tell whether Equity Investment includes a majority of portfolio investment or a majority of FDI. That said, this distinction may be less important than previously thought: portfolio and venture capital investment can also serve as a channel for technology and intellectual property acquisition[21]. Moreover, it is likely that – although more limited in number – these investment linkages are generally of greater economic significance compared to research collaboration and licensing linkages.

[21] See, for example, Updated Section 301 report (USTR, 2018b) which argues that small investments for minority stakes by state-backed venture capital (VC) firms can enable those governments to access to cutting-edge US technology and private technology-related information. The report states that available evidence indicates that a foreign government has created and supported a web of entities that have established a presence in Silicon Valley and other US technology centres to invest in high-technology US start-ups and engage in a variety of VC investment related activities.

Figure 6. Direct technology transfer arrangements by industry



Note: Direct technology transfer arrangements are not mutually exclusive: research collaborations sometimes occurs along with licensing agreements between two companies, and the same is true for other direct ITT arrangements. In addition, the sample size for each sector varies, and this is likely to have an impact on results. See table A3 in the Annex for the full sample.
Source: OECD, based on FactSet Supply Chain Relationships.

Finally, international Joint Ventures (IJV) also emerge as an important channel of technology transfer. This is particularly the case for two sectors in the sample: Chemicals and Motor Vehicles. Due to the relative richness of information on international joint ventures in the Motor vehicles sector, the analysis below focuses on this industry.

As for all other direct technology transfer linkages analysed in this report, the data for Joint Ventures reported below refers exclusively to international arrangements, meaning that it excludes joint ventures of parent companies with domestic partners. In this instance, the focus on international partners reduces – while not fully eliminating – the impact of sample selection bias on the distribution of IJVs[22]. In addition, as for equity investment, the economic significance of international Joint Venture projects is very likely to be higher than that of licensing and research collaborations.

The main locations of international Joint Ventures partners in the sample (Figure 7[23]) are China and Hong Kong, China, where 23 relationships are reported between the parent companies in the sample and companies registered in China and Hong Kong, China. Beyond this, the United States and Japan are the second and third most important IJV markets in the sample, with EU countries and India following suit with significant shares of overall IJVs. Many factors might explain this geographical distribution, including

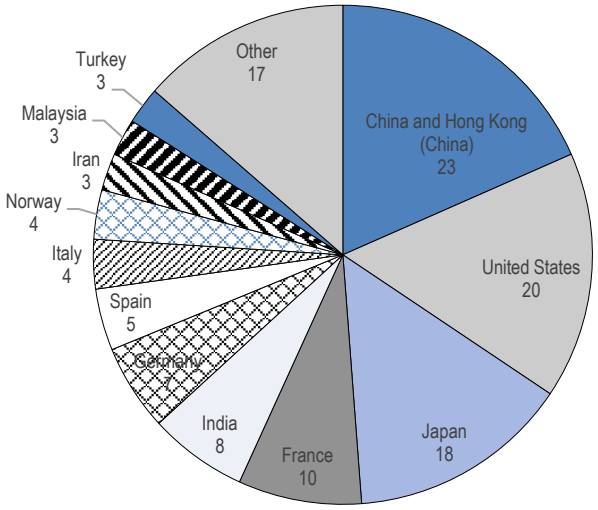
[22] By not looking at domestic partners, the distribution of IJV is likely not to reflect the geographical distribution of parent companies – which are expected to have significant numbers of joint ventures with partners in their own economy – but rather other factors such as market size, access to resources, regulatory framework, etc.

[23] "Other" includes: Brazil (2), Russian Federation (2), South Africa (2), Korea (2), Chinese Taipei (2), Austria (1), Belgium (1), Egypt (1), Indonesia (1), Netherlands (1), Sweden (1), and the United Kingdom (1).

demand factors (i.e. access to large markets), supply factors (e.g. access to resources or skills), the search for technological assets or the wider regulatory framework, among others.

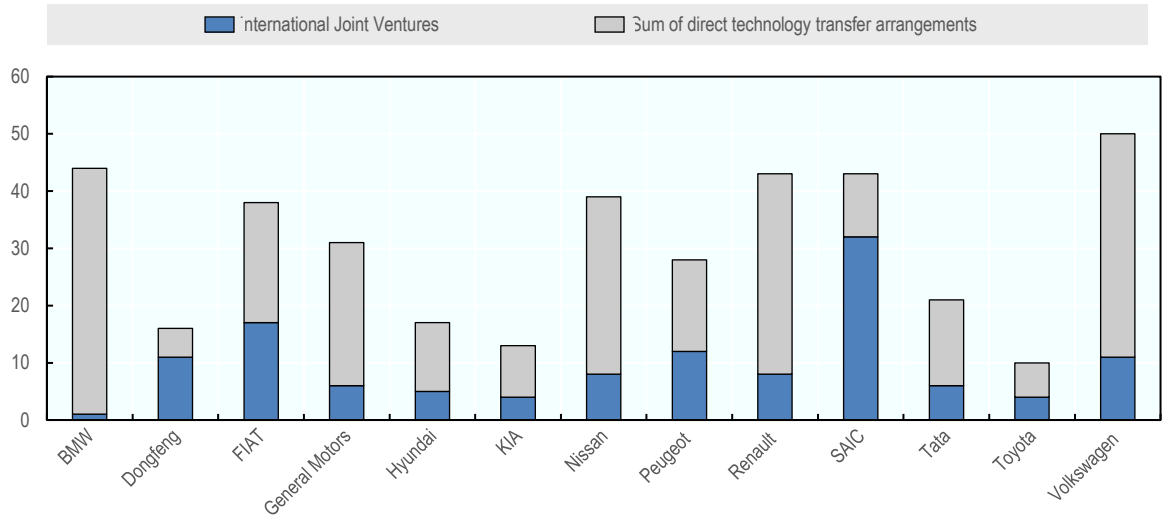
An additional possible explanation for the concentration of IJVs in China and Hong Kong, China, might rest in China's equity restrictions for the automotive sector listed in its *Foreign Investment Catalogue*. The measures – although replaced in 2018 by the *Special Administrative Measures for Access of Foreign Investment (2018)* – establish joint venture requirements in car manufacturing, mandating that Chinese investors shall hold at least 50% of equity shares. This requirement might have resulted in IJV serving as a key mode of direct technology transfer arrangement between foreign and domestic companies. This seems to be confirmed by analysis of the use of IJV as a form of direct ITT channel at the company level (Figure 8). Parent companies located in China – i.e. Dongfeng Motor and SAIC Motor – are indeed the only companies to rely on IJVs for more than half of their total direct ITT arrangements, while the other companies in the sample tend to rely on research collaboration and/or licensing as preferred modes of ITT. This evidence – although not conclusive– is suggestive of an impact of such technology transfer policies on firms' business decisions.

Figure 7. International joint ventures in motor vehicles, by country



Source: OECD, based on FactSet Supply Chain Relationships.

Figure 8. International joint ventures as a share of total direct technology transfer arrangements in Motor Vehicles, by company



Source: OECD, based on FactSet Supply Chain Relationships.

Finally, Factset micro-data also sheds light on direct technology transfer arrangements occurring between Multinational Enterprises and governments, both in the country of parent MNEs and abroad. For ITT- intensive sectors, it is, for example, possible to observe that companies in Telecommunications equipment reported research collaborations with the governments of Brazil, China, Rwanda, Turkey and the United Arab Emirates, as well as a joint venture with a province in China. In Pharmaceuticals, research collaborations are reported between MNEs and the governments of Iran, Saudi Arabia, and the United States, as well as with national research centres in France and Japan. In IT services, the government of Singapore was reported as an equity investor in an important multinational enterprise, while research collaborations are reported between MNEs and a Japanese city, the government of India and Sweden.

This small body of evidence underscores that interactions between MNEs and governments – at the federal, provincial or local level – are not unusual in Global Value Chains. They can indeed serve a wide variety of policy purposes, including information exchange, capacity building and improvement in absorptive capacities. This underscores the importance of transparency on the terms of collaboration between companies and governments, as well as clarity regarding the nature of collaborating MNEs (such as in the case of State-owned or State-backed enterprises) and regarding the objectives governments are seeking to attain through such collaborations. In sum, the wider policy environment constitutes a key element distinguishing voluntary technology transfer from its more constraining variants.

Box 4. Feedback from the private sector: China

Drawing on a survey of 106 respondents foreign firms in China and interviews with 38 foreign firms, Prudhomme et al. (2018) identified three categories of ITT policies of concern: market access (administrative licencing, FDI conditions or JV requirement), IPR enforcement (including unfair court rulings in IP civil litigation), and strong performance requirements (including in relation to certain licensing requirements found in the Technology Import and Export Regulations and certain policies related to IP and technical standards). They found that these ITT policies are likely more of concern for firms when accompanied by specific conditions, in particular, strong state support for industrial growth, and lack of competition.

The American Chamber of Commerce of Shanghai (2018) conducted a 2018 survey of over 434 respondent members in China. Pressure to transfer technology was most often faced in industries China considered strategically important, including: aerospace (44%) and chemicals (41%). Overall, 21% of surveyed companies faced such pressure; those in service sectors were less likely to indicate problems. 60% of respondents also said that the regulatory environment lacked transparency, with lack of IPR protection (61.6%) and obtaining licenses (59.5%) the top two regulatory challenges. China's Cybersecurity Law also featured: 31% said they had been required to establish a local data centre and cloud presence, and 28% said this made them less willing to bring data into China.

A 2016 survey by the European Chamber of Commerce in China (2017) of over 190 respondent European firms found that in five industries - aerospace and aviation, machinery, automotive and auto equipment, environment technology and utilities of primary energy - at least 20% of respondents reported having to transfer technology in exchange for market access. According to the report, in many cases companies simply refused to bring their best technologies and products to the market. In high tech sectors these figures were even higher and between 30-40%, such as in aerospace (36%), aviation (36%), civil engineering and construction (33%), and still above the average in autos (27%) and chemicals (23%).

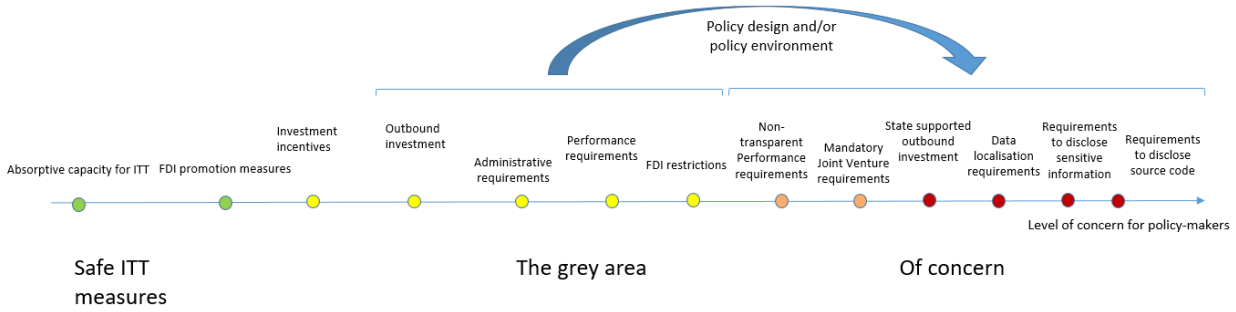
Recent targeted interviews with selected companies conducted by the OECD secretariat confirms the picture of measures of concern on the ITT continuum. Companies expressed concerns in relation to China about: (i) explicit requirements, or pressure, to include ITT requirements in JVs; (ii) local content requirements (e.g., to use Chinese encryption technology in the absence of access to certification processes for foreign technologies); (iii) the new cybersecurity law, including the potentially broad scope in the absence of clear definitions of key terms; (iv) in the context of both data localisation and certification and licensing procedures, requirements to disclose sensitive information to government bodies where, in the absence of transparency and given the role of the state in the economy, there were questions over the protection of, and possible access by competitors to, this information. There was also recognition by companies that firms knowingly engaged in investment if they felt the rewards were sufficient even if they did not like the fact that technology transfer was required for market access.

5. Conclusion

The analysis in this report indicates that involuntary technology transfer is a complex issue, but one about which there are clear and growing concerns. This report aims to provide a way for policy makers to think through the issues, to apply a systematic and analytical approach to assessing which policies are of the greatest concern.

The report uses a continuum of ITT measures to present different groups of measures, ranging from policies aimed at creating an appropriate supporting environment for ITT, to policies that may have the effect of imposing ITT to varying degrees, to policies which clearly create risk of involuntary transfer of technology. It considers policies in terms of (i) the degree of compulsion they impose on foreign firms and affecting the bargaining power between foreign and local firms; and (ii) the effect they have on foreign firms' control of their technology.

Figure 9. ITT policies and the leap into areas of concern



The report also highlights the importance of broader factors in shaping the impact of policies, such as the extent to which they impact the ability to access or compete in a given market; the transparency not only of the policy itself, but also in the broader governance environment; the extent to which the policy is non-discriminatory, but also the extent of discrimination against foreign firms in the wider business environment; and finally, the role of the state in the economy (including in terms of the implications for the confidence of business in the independence of regulatory bodies). Figure 9 summarises the broad types of ITT policies described in this report, indicating how these can "leap" along the continuum into the area of concern, either as a result of the specific policy design or of the broader policy environment.

It is hoped that this analysis will be useful to policy makers in their efforts to address these issues.

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Annex A. Tables

Table A.1. INVT provisions related to technology transfer in recent FTAs[1]

Short title	Date of signature	Pre-establishment national treatment provisions[2]	Prohibition of certain performance requirements (PR)	Technology transfer included in PR prohibition	Exclusive supplier requirement included in the PR prohibition	R&D location requirement authorized for access to FDI incentive
EU-Japan Economic Partnership Agreement	17-07-2018	Yes	Yes	Yes	Yes	Yes
Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)	08-03-2018	Yes	Yes	Yes	Yes	Yes
Korea - Republics of Central America FTA	21-02-2018	Yes	Yes	Yes	Yes	Yes
Australia-Peru FTA	12-02-2018	Yes	Yes	Yes	Yes	Yes
ASEAN - Hong Kong, China SAR Investment Agreement (2017)	12-11-2017	No	No	No	No	No
Argentina - Chile FTA (2017)	02-11-2017	Yes	No	No	No	No
China - Hong Kong CEPA Investment Agreement (2017)	28-06-2017	Yes	Yes	Yes	Yes	Yes
PACER Plus (2017)	14-06-2017	Yes	No	No	No	No
Intra-MERCOSUR Investment Facilitation Protocol (2017)	07-04-2017	No	No	No	No	No
Canada - EU CETA (2016)	30-10-2016	Yes	Yes	Yes	Yes	Yes
Brazil - Peru ETEA (2016)	29-04-2016	No	No	No	No	No
EFTA-Philippines FTA	28-04-2016	No	No	No	No	No
Singapore - Turkey FTA (2015)	14-11-2015	Yes	Yes	Yes	Yes	Yes
Australia - China FTA (2015)	17-06-2015	Yes, for AUS only	No	No	No	No
China - Korea FTA (2015)	01-06-2015	No	Yes (TRIMS)	No	No	No
Eurasian Economic Union - Viet Nam FTA (2015)	29-05-2015	Yes	Yes	Yes	Yes	Yes
Honduras - Peru FTA (2015)	29-05-2015	Yes	Yes	Yes	Yes	Yes
Korea - Viet Nam FTA (2015)	05-05-2015	Yes	Yes	Yes appr.only,	Yes	Yes
Korea - New Zealand FTA (2015)	23-03-2015	Yes	Yes	Yes	Yes	Yes
Korea - Turkey Investment Agreement (2015)	26-02-2015	Yes	Yes	Yes	Yes	No
Japan - Mongolia EPA (2015)	10-02-2015	No	Yes	No	Yes	Yes
ASEAN - India Investment Agreement (2014)	12-11-2014	Yes	No	No	No	No
Canada - Korea of FTA (2014)	22-09-2014	Yes	Yes	Yes	Yes	Yes

Australia - Japan EPA (2014)	08-07-2014	No	Yes	Yes	Yes	Yes
EU - Georgia Association Agreement (2014)	27-06-2014	Yes		Limited,		
EU - Moldova Association Agreement (2014)	27-06-2014	Yes		Limited		
EU - Ukraine Association Agreement (2014)	27-06-2014	Yes		Limited		
Treaty on Eurasian Economic Union (2014)	29-05-2014	Yes				
Australia - Korea, Republic of FTA (2014)	08-04-2014	Yes	Yes	Yes	Yes	Yes
Mexico - Panama FTA (2014)	03-04-2014	Yes	Yes	Yes	Yes	Yes
Pacific Alliance Additional Protocol (2014)	10-02-2014	Yes	Yes	Yes	Yes	Yes
Singapore – Chinese Taipei EPA (2013)	07-11-2013	Yes	Yes	Yes	Yes	Yes
Canada - Honduras FTA (2013)	05-11-2013	Yes	Yes	Yes	Yes	Yes
Colombia - Israel FTA (2013)	30-09-2013	No	No	No	No	No
Colombia - Panama FTA (2013)	20-09-2013	Yes	Yes	Yes	Yes	Yes
New Zealand – Chinese Taipei ECA (2013)	10-07-2013	Yes	Yes	Yes	Yes	Yes
EFTA - Costa Rica - Panama FTA (2013)	24-06-2013	No	No	No	No	No
Colombia - Costa Rica FTA (2013)	22-05-2013	Yes	Yes	Yes	Yes	Yes
Colombia - Korea, Republic of FTA (2013)	21-02-2013	Yes	Yes	Yes	Yes	Yes
CACM - EU Association Agreement (2012)	29-06-2012	No	No	No	No	No
Australia - Malaysia FTA (2012)	22-05-2012	Yes	Yes	No	No	No
China - Japan - Korea Trilateral Investment Agreement (2012)	13-05-2012	No	Yes (TRIMS)	Yes (no unreas/discrim)	No	No
Guatemala-Peru FTA	06-12-2011	Yes	Yes	Yes	Yes	Yes
Central America - Mexico FTA	22-11-2011	Yes	Yes	Yes	Yes	Yes
Panama-Peru FTA	25-05-2011	Yes	Yes	Yes	Yes	Yes
Costa Rica-Peru FTA	21-05-2011	Yes	Yes	Yes	Yes	Yes
Mexico-Peru FTA	06-04-2011	Yes	Yes	Yes	Yes	Yes
India - Malaysia FTA (2011)	18-02-2011	Yes	No	No	No	No
India - Japan EPA (2011)	16-02-2011	No	Yes	Yes (est.only)	Yes (est.only)	No
Australia-New Zealand Investment Protocol	16-02-2011	Yes	Yes	Yes	Yes	Yes
Korea-Peru FTA	14-11-2010	Yes	Yes	Yes	Yes	Yes
EFTA-Peru FTA	14-07-2010	No	No	No	No	No

EFTA-Ukraine FTA	24-06-2010	No	Yes (TRIMS)	No	No	No
Canada-Panama FTA	14-05-2010	Yes	Yes	Yes	Yes	Yes
Costa Rica-Singapore FTA	06-04-2010	Yes	Yes	Yes	Yes	Yes

*Note*s:
1. Among over 100 FTAs signed since January 2010, the table only lists those FTAs that contain certain types of provisions relevant for ITT.
2. Post-establishment national treatment provisions are also particularly relevant for ITT. All FTAs listed in this table also contain explicit provisions requiring national treatment of investments once they have been established.

Table A.2. Types of supply chain relationships covered by FactSet

Investment	
Subsidiaries	An investment enterprise that is fully (100%) or majority owned (>50%) by its parent company.
Equity investment	An investment of up to 50% of an enterprise's voting power.
Investors	Entities which own equity stake in the parent company
Strategic partnerships:	
Joint Venture	The parent company jointly owns a separate company with one or more companies.
Out-licensing	An owner (licensor) of intellectual property (patents, trademarks, copyrights, trade secrets) (IP) authorizes a licensee to make, use, or sell, the specified IP of the licensor, under voluntary and mutually agreeable terms.
In-licensing	A licensee receives authorization from an owner (licensor) of intellectual property (patents, trademarks, copyrights, trade secrets) (IP) for the licensee to make, use, or sell, the specified IP of the licensor under voluntary and mutually agreeable terms.
Research collaboration	Companies collaborating with the parent company for research and development, generally for new product development, common between science companies and between technology companies. This designation is applicable for products in development, not marketed.
Integrated product offering	Companies with whom the parent company agrees to bundle standalone products/services of each company, which are marketed together as one offering. No money is exchanged upfront, and costs, risks, and profits are shared.
Arm's length trade	
Suppliers	Companies from which the parent company purchases goods or services.
Manufacturing	Entities which provide paid manufacturing services to the parent company.
Distribution	Entities which the parent company pays to distribute this company's products/services.
Marketing	Entities which provide paid marketing and/or branding/advertising services to the parent company.
Customers	Entities to which the parent company sells products/services; the "opposite" of Supplier relationship.

Table A.3. MNEs included for the analysis

FactSet sector	FactSet industry	Companies
Electronic technology	Telecommunications equipment	Apple (United States), Samsung (Korea), Ericsson (Sweden), Nokia (Finland), Qualcomm (United States), HTC Corporation (Chinese Taipei), ZTE (China), Tcl Corporation (China), LG UplUnited States Corp (Korea), ARRIS International Plc (United States), Garmin Ltd. (Switzerland), EchoStar (United States)
Consumer durables	Electronics/appliances	oshiba (Japan), Sony (Japan), Panasonic (Japan), LG Electronics (Korea), Haier (China), Midea (China), Whirlpool (United States), FUJIFILM Holdings Corp (Japan), Electrolux (Sweden), Sharp (Japan), Qingdao Haier (China), SEB SA (France)
Consumer durables	Motor vehicles	BMW (Germany), Fiat-Chrysler (Italy), General Motors (United States), Renault (France), Toyota (Japan), Volkswagen (Germany), Tata Motors (India), Dongfeng Motor (China), Peugeot SA (France), Hyundai Motor (Korea) , SAIC Motor (China), Nissan (Japan), KIA Motor (Korea)
Consumer non-durables	Apparel/footwear	Adidas (Germany), Dior (France), Hermes (France), Kering (France), Levis (United States), Nike (United States), PVH (United States), Pou-Chen (Chinese Taipei/China), VF (United States), Yue-Yuen (Hong Kong/China), IndUnited Statestria de Diseno Textil (Spain), Asics (Japan), Burberry Group (United Kingdom), Prada (Italy) and Hugo Boss (Germany), Gap (United States)
Consumer non-durables	Beverages: non-alcoholic	PepsiCo (United States), Coca-Cola (United States), Suntory Holdings (Japan), Fomento Economico Mexicano SAB de CV (Mexico), Red Bull GmbH (AUnited Statestria), Dr Pepper Snapple Group (United States), Arca Continental SAB de CV (Mexico), ITO EN (Japan), Embotelladora Andina (Chile), Refresco Group (Netherlands), Lotte Chilsung Beverage (Korea), Britvic (United Kingdom).
Consumer non-durables	Food: Major diversified	Nestle (Switzerland), Kraft Heinz Company (United States), Danone (France), Kellogg Company (United States), CJ Corporation (Korea), Associated British Foods (United Kingdom), UniPresident Enterprises Corp (Chinese Taipei), Barilla (Italy), General Mills (United States) , Bonduelle (France).
Health technology	Pharmaceuticals: Major	GlaxoSmithKline (United Kingdom), C.H. Boehringer (Germany), Merck & Co. (United States), Les Laboratoires Serviers (France), Johnson & Johnson (United States), Sun Pharmaceutical IndUnited Statestries (India), Pfizer (United States), Sanofi (France), Roche Holding (Switzerland), Novo Nordisk (Denmark) and Takeda Pharmaceutical Co. (Japan)
Process industries	Chemicals: Major diversified	DowDuPont Inc. (United States), Mitsubishi Chemical Holdings Corporation (Japan), Johnson Matthey Plc (United Kingdom), Formosa Chemicals & Fibre Corporation (Chinese Taipei), Arkema SA (France), Hanwha Chemical Corporation (Korea), Kemira Oyj (Finland), Godrej IndUnited Statestries Limited (India), Hanwha Corp.(Korea),I AECI (South Africa).
Process industries	Agricultural commodities/milling	Cargill (United States), Archer-Daniels-Midland (United States), Wilmar International Limited (Singapore), Charoen Pokphand Foods Public (Thailand), Dansk Landbrugs Grovvareselskab (Denmark), Inner Mongolia Yili IndUnited Statestrial Group Co. (China), Bunge (United States), Golden Agri-Resources (Singapore, China).
Electronic technology	Semiconductors	Intel Corporation (United States), Taiwan Semiconductor Manufacturing Co. (Taiwan), SK hynix Inc.(Korea), Micron Technology (United States), NVIDIA Corporation (United States), ASE IndUnited Statestrial Holding Co. (Chinese Taipei), STMicroelectronics (Switzerland), MediaTek Inc. (Chinese Taipei) Infineon Technologies (Germany), Renesas Electronics Corporation (Japan), Semiconductor Manufacturing International Corp. (China), Tianjin Zhonghuan Semiconductor Co (China), Hua Hong Semiconductors Ltd. (China).
Finance	Bank: Major	Bank of China (Hong Kong/China), Bank of Communications (Hong Kong/China), Deutsche Bank (Germany), HSBC (United Kingdom), Lloyds (United Kingdom), Mizuho (Japan), Societe Generale (France), BNP Paribas SA (France), Banco Santander (Spain), Unicredit (Italy), UBS Group (Switzerland), Barclays (UNITED KINGDOM).
Technology services	Internet software/services	Criteo (France), Expedia (United States), Facebook (United States), Tencent Holdings (China), Recruit Holdings (Japan), NAVER (Korea), United Internet (Germany), MercadoLibre (Argentina), Twitter (United States), Freenet (Germany), Yandex (Netherlands).
Technology services	Information technology services	SoftBank Group (Japan), IBM (United States), Fujitsu (Japan), Accenture (Ireland), Tata Consultancy Services (India), Capgemini (France), CDW (United States), Atos (France), Infosys (India), Wipro (India).
Commercial Services	Advertising/Marketing Services	WPP (United Kingdom), Omnicom Group (United States), Hakuhodo Dy Holdings Incorporated (Japan), Publicis Groupe (France), Interpublic Group of Companies (United States), Cheil Worldwide (Korea), GfK (Germany), Jcdecaux (France), Groupon (United States), Havas (France).