Scepticism towards globalization, technological knowledge flows and the emergence of a new global system

Abstract

Research Summary

This paper examines the potential effect of anti-globalization on a key attribute of multinational enterprises (MNEs) – the ability to transfer efficiently complex firm specific technological knowledge internationally. Anti-globalization policies can supress the transfer of complex technological knowledge by limiting the international transfer of intellectual property, restricting the free movement of scientists and engineers or by dis-harmonizing regulations across nations. Such suppression is shown to significantly change the global system in terms of the location of value adding activities, their organizational firm boundaries and the origin of MNEs. The model predicts that after a "shock" of anti-globalization policies, which significantly increases international technological knowledge flow costs, a smaller number of firm- and MNE- location and control configurations emerges, and domestic firms become more dominant.

Managerial Summary

Anti-globalization policies threaten a key feature of multinational enterprises (MNEs) – the ability to transfer efficiently complex technological knowledge across political borders. They do so through limitations on the international transfer of intellectual property, restrictions on the free movement of scientists and engineers as well as through dis-harmonization of regulations across nations. We present a model that shows that such limitations are likely to change the global system making it much more similar to the one that existed pre- WW1 and WW2. The emerging global system is predicted to include a large proportion of domestic firms engaging in international trade and MNEs that locate only a small number of value chain activities abroad.

Introduction

The ability to transfer complex technological knowledge internationally has long been considered a major determinant of the existence of Multinational Enterprises (Buckley and Casson, 1976; Dunning, 1988; Rugman, 1986). The extant literature views this ability as a prime reason for the emergence of Multinational Enterprises (MNEs), claiming that MNEs are the most efficient mechanism for the transfer of complex firm specific technological knowledge (Kogut and Zander 1993, 1995; Martin and Salomon, 2003). It follows that restrictions on the cross-border transfer of such knowledge can be a real threat to MNEs.

The post 2008-2009 credit crunch era has been characterized by a sharp increase in sceptical anti-globalization. Anti-globalization has affected multiple aspects of international business, and has posed a real threat on the *free flow of complex technological knowledge* internationally. While the Internet and telecommunication advances generally smooth the flow of simple, codified and generally held technological knowledge, anti-globalization policies can increase the costs of transferring complex and tacit technological knowledge in several ways: First, by limiting the ability of MNEs to transfer specialized localized technological knowledge, residing in 'centres of excellence' (Cantwell, 1995; Santos, Doz and Williamson, 2004), across the world. This can be done through restrictions on the international mobility of intellectual property, intangible assets and innovations. Second, by restricting the free movement of skilled scientific, technological, and engineering labor between countries. Third, by dis-harmonization of regulations across nations, regions and economic blocks, that subsequently requires substantial and costly adaptation of internationally transferred technological knowledge to the specific location where it is used. In the current paper, we argue that, even when ignoring other effects of anti-globalization on MNEs (such as those restricting international trade or Foreign Direct Investments), the reduced capability to transfer complex technological knowledge internationally is likely to substantially make the current global system less globalized.

The core argument of this paper is that the backlash against globalization poses serious challenges to the flow of technological knowledge across political borders but within MNEs. Flows of technology are disrupted by security restrictions, flows of technology-carrying individuals by migration restrictions and the atmosphere of intellectual exchange of ideas is diminished by anti-globalization policies and rhetoric. Therefore, we contend that the efficient transfer of complex firm specific technological knowledge is compromised.

Specifically, the paper models the global system view (Casson, 2000; Buckley and Hashai, 2004) of the strategy of MNEs as they respond to anti-globalization policies. Our key treatment of anti-globalization policies is a significant increase in international technological knowledge transfer costs versus domestic (intra-national) technological knowledge transfer costs. On reasonable interpretations, our model shows that a significant increase in international technological knowledge transfer costs has profound effects on the global system when comparing it before and after a "shock" of anti-globalization occurs. Specifically, our model predicts that a smaller number of firm configurations – defined as different combination of location and control modes for value adding activities - emerge as many of the "pre-globalization era" configurations are rendered obsolete. Furthermore, domestic firms and MNEs that mostly concentrate their value chain activities in specific locations become more dominant in the anti-globalization era.

In the next section we explain the main mechanism through which anti-globalization can supress the international flow of complex technological knowledge and increase the cost of such technological knowledge flows. Then we model how a significant increase in the costs of international technological knowledge flows, relative to domestic ones, can affect the location of value chain activities, the organizational firm boundaries of such activities and the origin of MNEs. Finally, we discuss the implications of our model results for MNE strategy and public policy.

Anti-globalization and MNE retrenchment

There are two extant accounts of the auto-destruction of the globalized economy (James, 2001). First, it is suggested that there are inherent faults in the global economic system itself, such as instability [boom and bust] exemplified by the volatility of capital flows. Second, scepticism towards globalization arises because of the social and political reactions that it provokes - i.e. fear and scepticism disrupt globalization. In line with the special issue theme in the current paper, we focus on the latter.

The drivers and consequences of anti-globalization to MNEs

The anti-globalization movement is composed of both rhetoric and policy changes. Anti-globalization rhetoric has been responsible (in part, at least) for the 'Brexit' vote and the election of President Trump in 2016 and to an overall emergence of populists as country leaders (Devinney and Hartwell, 2019). The perception that there have been significant losers from globalization – and the objective fact that a segment of the population has lost in real as well as relative terms from global changes, have been significant factors not only in the USA, but across Europe (Rodrik, 2007). This is conflated with opposition to "mass" immigration, further entwined with cultural arguments against 'alien' cultures, most notably Islamic immigrant groups, leading to the emergence of anti-globalization movements and the subsequent protectionist policies that are meant to satisfy such movements (Kobrin, 2017; Stiglitz, 2002, 2006; Rodrik, 2018).

This political and rhetorical movement has occurred at a time of retrenchment by significant and salient Western MNEs. Rationalisation by manufacturing MNEs, notably vehicle manufacturers in Europe (for instance, GM's sale of its Opel and Vauxhall facilities to Peugeot-Citroen in February 2017) is taken to signal the decline of MNEs as a leading phenomenon in the modern economy (The Economist, 2017).

The massive expansion of the 'market for market transactions' (Liesch, Buckley, Simonin, and Knight, 2012) has provided the scope for firms to outsource activities and to construct complex global supply chains using market transactions (contracts) rather than ownership as a means of sourcing key inputs. The expansion of the means of conducting business abroad has led to the rise of 'the global factory' (Buckley, 2011), a modern configuration of the MNE using knowledge links to control a constellation of interlinked firms, dominated by a focal unit, usually the brand holder, that orchestrates the strategy of the network.

Clearly, anti-globalization policies threaten not only ownership links, but also the less visible outsourcing and network ties that underpin globalization. The growth of free trade areas (such as NAFTA) and enhanced economic and political integration (the European Union) have shown an upward trend since the end of World War II as countries have sought economies of scale, protected 'home' region markets, using a common external tariff, and unity of regulations, all of which benefiting MNEs. The seemingly one-way trajectory of integration of national economies is now threatened by nationalistic rhetoric based on the single nation, abjuring previous integrationist and internationalist policies.

The splitting of monolithic blocs into separate groups (or nations, á la Brexit) creates new challenges for MNEs. An increase in tariff and non-tariff barriers again becomes a possibility faced by foreign subsidiaries, where before MNEs aimed for integration across the union or free trade area. Exit from a currency union (e.g. the Euro zone) would create even more fragmentation, adding currency differences to locational decisions. This is in addition to additional sources of risk – not just exchange rate risk, but real uncertainty as to the viability of the currencies, and indeed the stability of the economies that exit a currency union. Long run recovery may not, initially at least, compensate for the disruption of currency changes.

Anti-globalization therefore poses a challenge to the key tenets, predicted by international business theory, to promote the emergence of MNEs. In particular anti-globalization challenges the existence of tariff free and non-tariff free access to markets, the integration of markets for goods and services, liberalization in the flow of foreign capital (through exchange controls and other restrictions that can stem from security concerns, competition concerns, or from protection of key assets and innovations), liberalization in labor flows (by posing restrictions), and the harmonization of regulations across nations, regions and economic blocks.

Specifically, scepticism towards globalization and its resulting anti-globalization policies may become a dominant determinant of the free international flows of complex technological knowledge. This is a real threat to global companies because MNEs have predominantly been outsourcing operations but internalising knowledge (Buckley and Casson, 1976; Dunning, 1993; Martin and Salomon, 2003; Rugman, 1986). The possession of complex and unique firm specific technological knowledge has typically been considered the raison d'etre of the MNE – a basis for its ownership advantage (Dunning, 1988, 1993) that compensates for the liabilities of foreignness (Hymer, 1976). In parallel, the ability to transfer efficiently complex technological knowledge has been convincingly argued to be a key competitive advantage of the MNE (Kogut and Zander, 1993; Martin and Salomon, 2003; Salomon and Martin, 2008).

In the wake of anti-globalization political sentiments, there has been a recent and massive increase in concerns about national security and sovereignty. These concerns are particularly evident in infrastructure and communications. The reaction against the Chinese MNE Huawei and its role in fifth generation (5G) communications systems may well be the tip of an iceberg of security concerns (Financial Times, 2018). Importantly, the 'public good' nature of technological knowledge within MNEs – where all units of the firm, wherever located, have free access to a pool of common technological knowledge is violated if national or regional restrictions are placed upon it.

Anti-globalization mechanisms supressing the free international flow of technological knowledge

Restrictions of the transfer of MNE specific technological knowledge may take different forms. Below we highlight three major mechanisms through which anti-globalization policies can supress the transfer of complex technological knowledge: 1) by limiting the international transfer of intellectual property; 2) by restricting the free movement of technological labor; and 3) by dis-harmonizing regulations across nations.

Limiting the international transfer of intellectual property. Anti-globalization policies may be reflected in a reduced capability of MNEs to transfer specialized localized technological knowledge residing in 'centres of excellence' (Cantwell, 1995; Santos, Doz and Williamson, 2004) across the world, due to restrictions on the international mobility of intellectual property, intangible assets and innovations. Scepticism towards globalization may well make countries more sensitive towards the use of intellectual property created within their jurisdiction internationally, as doing so may lead to the relocation of productive activities outside their jurisdiction. As an example of this restriction, the U.S. Small Business Innovation Research (SBIR) grant program insists that "R&D work (financed with SBIR funds) must be performed in the United States". Similar provisions are imposed in countries including Israel, South Korea, Australia, and New Zealand (Conti, 2018). In the past, countries have been removing such restrictions, seeking to promote FDI. For instance, Israel removed this provision in 2005 (Conti, 2018) as part of its efforts to make its high technology industry more global. Yet, given scepticism towards globalization, policy makers are interested in promoting domestic R&D and production, especially when it comes to high technology firms. China, for instance, has been pushing foreign MNEs for greater "indigenous innovation" with the aim of tying greater shares of intellectual property and production to China (The Economist, 2017). To this end, stronger limits on the transfer of technological knowledge assets, such as intellectual property, may well prove more feasible to implement than the placement of other barriers, such as trade barriers that might be harder to implement as they are subject to bilateral and multilateral agreements (Fuller, Butzbach and Schnyder, 2019). [1] Hence it follows that restrictions to international technological knowledge flows may well be subject to "idiosyncrasies of individual actors using institutions for their own (and their supporters') ends" (Devinney and Hartwell, 2019).

Restrictions on the international transfer of intellectual property, intangible assets and innovations do not only limit the ability of MNEs to transfer technological knowledge to the most productive locations. They also hamper their ability to become 'meta-national' - that is, run a network of knowledgeable subsidiaries acting as 'listening posts' to sense, evaluate, absorb, and integrate geographically dispersed knowledge (Doz, Santos and Williamson, 2001). Hence, limits on international technological knowledge transfer may well result in duplicated innovative efforts as well as penalizing MNEs on a key determinant of their competitive advantage.

Restricting the free movement of technological labor. Restriction on international technological knowledge transfer can also take the form of limitations on the free movement of skilled scientific, technological, and engineering labor between countries. Indeed, one key method of transferring technology is through the transfer of people (as technology resides in individual brains). International migration has therefore become a key target of anti-globalization movements, and many countries have tightened and are tightening visa requirements.

For instance, the USA has recently announced severe limitations on granting H-1B visas, which are the only process utilized by MNEs today to obtain hirings of foreign developers and engineers in the USA. Such restrictions aim to encourage MNEs to enrol skilled domestic labor, rather than skilled foreign labor. The H-1B is capped at 85,000 applications with over 200,000 applications

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[1] See, for instance, the criticism towards President Trump's call for Apple to produce in the US after announcing the uplift of tariffs on goods coming from China (https://www.theguardian.com/us-news/2018/sep/09/donald-trump-apple-should-make-products-in-the-us-to-avoid-tariffs)

submitted each year.[2] H-1B happens once a year in April and is challenging for MNEs because it is not only expensive, but also adds another six months for applicants to get their work permits, which are usually given in October (six months after the H-1B lottery). Flows of key scientists are also a concern for governments fearing loss of technologies (and spying) so programmes such as China's 'Thousand Talents' are targeted to prevent outflows of technology (South China Morning Post, 2018). Given that employee mobility is a key mechanism for firms to generate and transfer new technological knowledge (Song, Almeida and Wu, 2003), such restrictions may well 'tax' the international technological knowledge transfer capability of MNEs and reduce technology flows in MNEs.

Dis-harmonizing regulations across nations. Finally, scepticism towards globalization may also lead to dis-harmonization of regulations across nations, regions and economic blocks. The collapse of the Transpacific Trade partnership and the Transatlantic Trade and Investment partnerships, both aiming to provide strong protection to intellectual property (The Economist, 2017) and hence supporting the free flow of technological knowledge, is one example for such dis-harmonization.[3] In fact, if scepticism towards globalization leads to the breakup of economic integration agreements (e.g. the separation of the UK from the European Union) such regulation dis-harmonization may even intensify. In turn, this would require substantial adaptation of internationally transferred technological knowledge to the specific location where it is used. This means that MNEs need to invest a significant amount of time and resources to adapt internationally transferred technological knowledge on products and technologies to the specific requirements of different foreign locations (Bartlett and Ghoshal, 1989; Prahalad and Doz, 1999). The reduced capability to leverage knowledge internationally and the need to adapt technological knowledge to specific foreign locations, result in duplication of efforts, expose such knowledge to a greater risk of misinterpretation and hence increase the costs faced by MNEs transferring such knowledge (Buckley, Glaister, Klijn and Tan, 2009).

MNEs are, most probably, capable of responding to all other 'challenges' by reconfiguring their operations (in response to changing locational advantages and externalization/internalization

[2] See: http://money.cnn.com/2018/04/12/technology/h-1b-visa-applications-2018/index.html.
[3] See also, Bühl, Malarciuc and Völlmecke's (2016) analysis of the dispute between the European Union and the US on the regulation of genetically modified crops.

pressures) but restrictions on technological knowledge flows may well be an existential threat to international operations, especially for 'high technology' MNEs – i.e. those MNEs that are heavily engaged in the production and transfer of technological knowledge (Adler and Hashai, 2007; Martin and Salomon, 2003). The 'global system view' (Casson 2000, 2016; Buckley and Hashai 2004, 2014) based on internalization theory (Buckley and Casson 1976, 2009) utilises location factors and internalization versus outsourcing decisions to analyse the make-up of the global economy in terms of the location of economic activities and its ownership. One of the key distinguishing features of the global system view is the emphasis given to international technological knowledge flows and their costs. In the model below, we build on the insights of the global system view to demonstrate how the global system is likely to change in response to the increased constraints on technological knowledge flows, as discussed above.

Theoretical framework - global system evolution

The potential outcome and characteristics of a post anti-globalization global system are modelled by introducing a simple model relating to an economic system producing products that differ in their technological intensity and differentiation. The model predicts the evolving positions in the global system of MNEs originating from advanced and emerging countries, the global location of R&D, marketing and production activities and, importantly, the number of MNEs versus domestic firms operating in the global system. The model tests the effect of a single shock: a sharp increase in international technological knowledge flow costs, relative to domestic knowledge flow costs as a consequence of one or more of the anti-globalization policies discussed above. [4]

Our model consists of an economic system that produces four types of products. Type A products are technology intensive differentiated products (e.g. high technology gadgets), type B products are non-technology intensive and non-differentiated (e.g. simple low technology products), type C products are technology intensive and non-differentiated (e.g. non-branded high technology products) and type D products are non-technology intensive but differentiated products (e.g. simple

[4] Later in the paper we also add the effect of restrictions to international trade and FDI.

but branded products). Figure 1 below depicts the four types of products on a 2X2 matrix showing high vs. low levels of technology intensity and differentiation:

[Insert Figure 1 about here]

The system is comprised of similarly sized advanced country (AD) and emerging country (EM), where the domestic markets is sufficiently large to merit the attention of MNEs. This view is consistent with evidence suggesting that the last two decades have been characterized by the accelerated technological and industrial development of emerging countries relative to advanced ones leading to a significant increase in the income per capita of the former (Buckley and Hashai, 2014; Naughton, 2007). It therefore follows that about half of the output of an AD firm and an EM firm can be assumed to be directed to their domestic market and the other half to the international one. The transportation costs of AD and EM firms can therefore be ignored when comparing alternative configurations of the global system (as they are largely equal for both types of firms).

Following Buckley and Casson (1976, 1998), Buckley, and Hashai (2014) four types of value adding activity are involved: Headquarters (HQ), R&D (R), Production (P) and Marketing (M). AD is assumed to be comparatively intensive with skilled labor; hence according to the Hecksher-Ohlin-Samuelson (H-O-S) theory it is expected to have a comparative advantage and lower costs in high value adding activities such as R&D and marketing where technology intensive and differentiated products are respectively considered (Mudambi, 2008). EM is comparatively intensive with less skilled labor and hence has a comparative advantage and lower costs in production but also in R&D activities of non-technology intensive products and in marketing non-differentiated products. As we discuss later, given that our model offers products that vary in their technology intensity and differentiation levels, relaxation of these assumptions simply implies that our predictions for non-technology intensive and/or non-differentiated products also respectively apply for technology intensive and/or differentiated products.

The value adding activities are linked to one another by flows of technological knowledge (denoted by K). Four main types of linkage are identified: $K_{HQ\text{-}R}$ – flow of technological knowledge between the firm's headquarters and R&D, reflecting the role of managerial discretion concerning technological advancement. $K_{R\text{–}P}$ - flow of technological knowledge between R&D and production,

K_{M-R} - flow of technological knowledge between marketing and R&D and K_{M-Cus}-flow of technological knowledge between marketing entities and customers (C_{AD}). All technological knowledge flows are two-way. This is because there is always feedback in technological knowledge flows between different value adding activities and between the firm and its customers. There is no flow of technological knowledge between production and marketing, as it is assumed that the transmission of technological knowledge between these two entities is entirely intermediated by R&D (Buckley and Hashai, 2004, 2014). Consistent with the extant global system view models (Buckley and Hashai, 2004, Casson, 2000, chapter 3), the flow of technological knowledge between headquarters, production and marketing is entirely intermediated by R&D.

The location of headquarters (either in AD or EM) represents the origin of the firm (Goldstein, 2007). Each value adding activity (R, P and M) can be located in either country (AD or EM) or in both. Thus, we assume that each value adding activity can be conducted in its entirety in a given country or be evenly split between AD and EM. This implies 54 ($2X3^3$) alternative location options, with two options for HQ and three for each value adding activity. Each location option represents a potentially optimal system 'configuration' that includes headquarters, R&D, production and marketing activities, connected via knowledge flows. Each location configuration may include a maximum of eight firms (the total number of combinations for four independent value-adding activities in the two countries) and a minimum of one firm (assuming one multinational internalizes all value chain activities).

Costs of operations

R&D Costs

The output of an R&D laboratory is a 'within firm' public good that can be transferred via K_{R-P} to production sites around the globe. R&D activities are assumed to incur only a fixed cost. As long as AD has a comparative advantage in technology intensive products then for a given level of technological output $C_{R,AD} < C_{R,EM}$ for the technology intensive products A and C (C_R= cost of R&D). On the other hand for non-technology intensive products (B and D): $C_{R,EM} < C_{R,AD}$.

Production costs

Production cost is made up of variable production cost, determined by the cost of producing and shipping one product unit to end customers (V_i, i= US, CH), and fixed production costs (F). More specifically, one can determine that: $C_{P,i}= F+V_i*x$; (C_P= cost of production, i= AD, EM, x=number of produced units). Since EM has a comparative advantage in production $C_{P,EM}< C_{P,AD}$.

Marketing Costs

The cost of marketing is specifically defined as the costs of distribution and marketing personnel required in providing pre-sale, sales, and post-sale services (including travelling costs and on-going market research cost). Like production costs, marketing costs are a function of fixed and variable costs, as: $C_{M,i} = F'_i+V'_i*x'$ (C_M= cost of marketing, F' – fixed costs, V' – variable costs, i=AD, EM, x'=number of units sold). As AD has a comparative advantage differentiated products, then $C_{M,AD}< C_{M,EM}$ for differentiated products (A and D). On the other hand for non-differentiated products (B and C): $C_{M,EM}< C_{M,AD}$.

Costs of technological knowledge flows

Technological knowledge transfer costs are expected to vary according to three major factors: technological knowledge complexity, geographic boundaries and organizational firm boundaries. Technological knowledge complexity typically reflects the extent to which knowledge is tacit and hard to teach (Kogut and Zander, 1993; Martin and Salomon, 2003). Typically, firms that engage in the production and transfer of complex technological knowledge are those whose products are technology intensive and those whose products are differentiated and require intensive interactions with their customers (Almor, Hashai and Hirsch, 2006; Martin and Salomon, 2003; Simonin, 1999). The more complex a firm's technological knowledge the higher technological knowledge transfer costs (Kim and Hwang, 1992; Kogut and Zander, 1993, 1995; Martin and Salomon, 2003; Salomon and Martin. 2008).

Technological knowledge transfer cost is also expected to vary between different geographic locations. It is expected to be positively related to distance[5], especially when cross-border transfer is

[5]Distance is a composite variable comprised of geographic, cultural and factors.

required (Galbraith, 1990; Teece, 1977). This expectation is based on the fact the co-location of value adding activities as well as proximity to the firm's customers is more likely to facilitate technological knowledge transfer (Jaffe, Trajtenberg and Henderson, 1993). The separation of value adding activities is more likely to result from the need to conduct extensive travelling, involve intensive inter-site communications, incur higher control costs and become exposed to misinterpretations and mistakes (Casson, 1994, 2000; Galbraith, 1990; Martin and Salomon, 2003; Teece, 1977; Van den Bulte and Moenaert, 1998). This is particularly relevant to international technological knowledge transfer where additional costs associated with distance are incurred due to the need to communicate in two or more languages and accommodate different legal systems as well as different tax and regulatory regimes (Hirsch 1976; Hymer, 1976; Kogut and Singh, 1988; Rangan and Adner, 2001). Moreover, our earlier observation that the costs of complex, tacit and firm specific technological knowledge transfer exceed that of simpler codified and generally held knowledge, implies that complex technological knowledge transfer is more sensitive to cross border knowledge transfer.

Finally, a large body of literature supports the notion that, when complex technological knowledge is concerned, inter-firm knowledge flow costs exceed intra-firm flows (e.g. Buckley and Casson, 1976; Buckley and Hashai, 2005; Kogut and Zander, 1992, 1993; Martin and Salomon, 2003; Salomon and Martin, 2008). In general, intra-firm organisational bonds are expected to reduce the cost of complex technological knowledge transfer. Externalization of technological knowledge is likely to result in knowledge dissipation costs associated with the misappropriation of transferred knowledge and higher control and monitoring costs to protect firms' technological knowledge as well as higher negotiation and litigation costs (Martin and Salomon, 2003). While simple technological knowledge can be relatively efficiently transferred across organizational boundaries, paving way for firms to specialize in specific domains (Buckley and Hashai, 2014), the transfer of complex technological knowledge across organizational boundaries is typically inefficient and costly (Kogut and Zander, 1993; Martin and Salomon, 2003). Following the discussion above, our model makes two key assumptions concerning the effect of geographic and organizational boundaries on technological knowledge transfer costs:

Geographic boundaries. When complex technological knowledge is involved its cost of transfer across borders becomes much higher than transferring such knowledge locally (Casson, 2000: 67-70; Teece, 1977). Such cost differences result from cultural differences between countries (Contractor, 1990; Hofstede, 1980; Kogut and Singh, 1988), geographic distance (Jaffe, Trajtenberg and Henderson, 1993; Krugman, 1991) and the greater complexity of control in an imperfect world (Buckley and Casson, 1976; Martin and Salomon, 2003). Hence, if we let α denote within country technological knowledge flow cost and β denote across country technological knowledge flow cost, we assume that $\alpha<\beta$. This assumption relates to K_{HQ-R}, K_{R-P} and K_{M-R}. When any of these flows relates to a value adding activity that is concurrently operated in two countries (one in AD and one in EM) these technological knowledge flow costs equal $(\alpha+\beta)/2$. In the case of $K_{M-C_{AD}}$ (knowledge flow between marketing and customers), as the markets in AD and EM are assumed to be equal in size, each firm faces a cost of $(\alpha+\beta)/2$. Hence, similar to transportation costs when comparing alternative configurations of the global system these costs cancel one another out and thus can be ignored.

It is noteworthy that technological knowledge flow cost differences become less significant, for non-complex and explicit knowledge. In our model, knowledge flows concerning either technology intensive or differentiated products can be thought of as being flows involving more tacit and complex technological knowledge relative to knowledge flows accompanying non-technology intensive and non-differentiated products. We return to this point when solving the model.

Firm boundaries. Where firm boundaries are concerned we follow Kogut and Zander (1993), Martin and Salomon (2003) and many others to assume that the more complex are products, the greater the wedge between intra-firm and inter-firm technological knowledge transfer costs. Transaction costs are further likely to increase inter-firm technological knowledge transfer costs when technology intensive and/or differentiated products are involved, due to frequency and asset specificity effects (Williamson, 1985). Specialization of firms in specific value adding activities as well as the reduction of agency costs reduces inter-firm technological knowledge transfer costs for non-technology intensive and non-differentiated products (Buckley and Casson, 1976, 1998; Casson, 1994, 2000; Williamson, 1985). Letting γ denote intra-firm technological knowledge flow cost and δ denote inter-firm technological knowledge flow cost, it therefore follows that $\gamma<\delta$ for all technological knowledge flows (K_{HQ-R}, K_{R-P}

and K_{M-R}) related to technology intensive and/or differentiated products (which typically involve complex knowledge). In contrast, $\gamma>\delta$ for all technological knowledge flow costs related to non-technology intensive and/or non-differentiated products that typically involve simpler knowledge.

Optimal location and control configurations

An optimal global system minimizes the cost of operations and flows within it to determine the location of value adding activities (hereinafter – location configuration) and whether to internalize or externalize them (hereinafter – control configuration). This view follows a long tradition in International Business research where patterns of investment in foreign markets are explained by rational economic analysis, according to which firms choose their optimal structure by evaluating the cost of economic transactions (e.g. Buckley and Casson, 1976; Dunning, 1977, 1988, 1993; Hirsch, 1976; Martin and Salomon, 2003; Morck and Yeung, 1992; Rugman, 1986), but extends it to a global system (Casson, 2000: 62-63, Buckley and Hashai, 2004, 2014).

According to the above assumptions, the global system is now comprised of 54 alternative location configurations, with different costs. Appendix Table 1 details the costs of these 54 location configurations. For instance, one such configuration (configuration 1) is when HQ are located in the AD (indicating an AD based MNE), R&D is conducted in AD (with a cost of $C_{R,AD}$), production is also conducted in AD (with a cost of $C_{P,AD}$) and so are marketing and sales ($C_{M,AD}$). In this setup, there is the cost of technological knowledge flow from HQ to R&D, from R&D to production and from R&D to marketing. Since all value adding activities are domestic, each of these costs will be α, summing up the technological knowledge flow costs of this firm to 3α. The total costs of each configurations are the total costs of operations (the three value adding activities) plus technological knowledge transfer costs.

The configuration(s) with the lowest operation and flow costs represents the solution of the global system in terms of location optimality. Once the location configuration is determined, the appropriate firm boundaries (or control configuration) may also be determined according to the difference between intra- and inter-firm technological knowledge flow costs for technology intensive/non-technology intensive as well as differentiated/non-differentiated products.

We assume that in each control configuration where HQ is included, its location identifies the home origin identity of the firm (AD or EM). In control configurations where HQ is not included, the home origin of the firm remains obscure, but if there are no contradictory origins (i.e. one activity with EM location and the other with AD location), liability of foreignness considerations (Hymer, 1976) are likely to dictate that the location of these activities also determines their origin[6]. The easiest way to understand the general properties of the solution is to eliminate the configurations that are dominated by others for each product type given our above assumptions on operation and technological knowledge flow costs.

A key feature of this model is testing the effect of a significant increase in international relative to domestic technological knowledge transfer costs, given the effects of anti-globalization policies. In terms of our model, this change implies that, in all cases where we assume that $\alpha < \beta$, the difference between α and β becomes extremely high (or at the extreme case $\beta - \alpha \rightarrow \infty$). Clearly in this extreme case only two location configurations will emerge - our two domestic location configurations – configuration 1 (comprising of a single or several AD domestic firms, depending on the product type) and configuration 38 (comprising of a single or several EM domestic firms, depending on the product type).

However, a more interesting interpretation of the increase in the wedge between α and β would be to consider a somewhat more subtle difference between the two parameters. For the sake of simplicity we distinguish between two cases: all location configurations in which $\beta \geq 1$ in the aggregate technological knowledge flow costs between the different value adding activities[7] will become unsustainable, whereas all location configurations where $\beta < 1$ will remain sustainable. This allows us to distinguish between location configurations involving substantial international technological knowledge flows (and hence when such costs increase these locations will need to bear them) and configurations that do not involve substantial technological knowledge flows. Next, we identify the

[6] For instance, a firm with production and marketing activities only, both located in EM, is likely to originate from an emerging country.
[7] See the last column in Appendix Table 1.

dominating location and control configurations for each of the four product groups presented in Figure 1, pre- and post anti-globalization policies.

Technology intensive and differentiated products. Based on the assumptions made earlier on operation and technological knowledge flow costs, pre anti-globalization four configurations dominate all others for type A products: 1, 7, 13 and 38 (see Appendix Table 1). The dominance of these four location configurations relative to one another (in terms of costs) depends the magnitude of the various cost variables and cannot be determined without further assumptions on these costs.

When firm boundaries are also considered, because type A products are both technologically intensive and differentiated, inter- vs. intra-firm technological knowledge flow costs considerations imply that for all four configurations single firms will emerge. If { } denotes internal firm boundaries, the optimal boundaries we get span: $\{HQ_{AD}, R_{AD}, P_{AD}, M_{AD}\}$ for configuration 1, $\{HQ_{AD}, R_{AD}, P_{EM}, M_{AD}\}$ for configuration 7,$\{HQ_{AD}, R_{AD}, P_{AD}+P_{EM}, M_{AD}\}$ for configuration 13, and $\{HQ_{EM}, R_{EM}, P_{EM}, M_{EM}\}$ for configuration 38. These boundaries indicate three AD based firms and one EM based firm, where the first AD firm and the EM firm are purely domestic and the other two AD firms are MNEs obtaining production facilities in EM. The upper part of Figure 2a below depicts this solution. Figure 2a (as well as Figures 2b-2d) depict the location of each value adding activity (AD location to the left of the separating line and EM location to the right of the separating line) and its firm boundaries are reflected by an ellipse, collapsing all same firm value adding activities under a single ellipse. Straight-line ellipses represent AD based firms, whereas broken-line ellipses represent EM based firms.[8] Each ellipse includes a number that represents the relevant configuration number to which the ellipse belongs.

For type A firms the 'shock' in international technological knowledge flow costs implies that configurations 1, 13 and 38 will now dominate the global system. This implies that two AD based firms and one EM based firms will remain sustainable after the anti-globalization policy shock with, respectively, the following firm boundaries: $\{HQ_{AD}, R_{AD}, P_{AD}, M_{AD}\}$, $\{HQ_{AD}, R_{AD}, P_{AD}+P_{EM}, M_{AD}\}$ and $\{HQ_{EM}, R_{EM}, P_{EM}, M_{EM}\}$. Largely this global system matches the divide between Western digital

[8] In some Figures there are also dotted line ellipses representing undetermined origin.

giants (Amazon, Google, Facebook) and their Far Eastern counterparts (Baidu, Alibaba, Tencent). It also resembles that of highly reputed defence technology producers that, due to governmental restrictions on the transfer of classified military technology, concentrate the vast majority of their value adding activities at home. This new global system is shown in lower part of Figure 2a.

[Insert Figure 2a about here]

Non-technology intensive and non-differentiated products. The location solution for type B products pre anti-globalization is straightforward. Because R&D, production and marketing are cheaper in EM for this type of product and since only domestic technological knowledge flow costs between HQ, R&D and marketing are involved, configuration 38 dominates any other configuration. Because type B products are both non-technologically intensive and non-differentiated inter- vs. intra-firm technological knowledge flow costs considerations imply the emergence of four EM based firms with the following boundaries: $\{HQ_{EM}\}$, $\{R_{EM}\}$, $\{P_{EM}\}$ and $\{M_{EM}\}$. In essence, this configuration implies that entrepreneurs (represented by HQ) can outsource the whole value chain to independent firms specializing in conducting either R&D, production or marketing and sales. Post anti-globalization there will be no change in the dominating location and control configurations for type B products, with the same four EM based firms emerging as the optimal solution. Figure 2b below depicts this solution.

[Insert Figure 2b about here]

Technology intensive and non-differentiated products. Pre anti-globalization the following configurations dominate all others for type C products: configuration 1, 4, 7, 12, 13, 16, 19, 22, 25, 38 and 39. The dominance of these location configurations relative to one another (in terms of costs) depends on the magnitude of the various cost variables and cannot be determined without further assumptions on these costs. In terms of control configuration, because type C products are technologically intensive inter- vs. intra-firm technological knowledge flow costs considerations imply that the following AD based firms emerge in this systems: for configuration 1-$\{HQ_{AD}, R_{AD}, P_{AD}, M_{AD}\}$, for configuration 4- $\{HQ_{AD}, R_{AD}, P_{AD}, M_{EM}\}$, for configuration 7- $\{HQ_{AD}, R_{AD}, P_{EM}, M_{AD}\}$, for configuration 12- $\{HQ_{AD}, R_{AD}+R_{EM}, P_{AD}, M_{AD}\}$, for configuration 13- $\{HQ_{AD}, R_{AD}, P_{AD}+P_{EM}, M_{AD}\}$, for configuration 16- $\{HQ_{AD}, R_{AD}, P_{AD}+P_{EM}, M_{EM}\}$, for configuration 19- $\{HQ_{AD}, R_{AD}, P_{AD}+P_{EM},$

M_{AD}+M_{EM}}, for configuration 22- {HQ_{AD}, R_{AD}, P_{AD}, M_{AD}+M_{EM}}, and for configuration 25- {HQ_{AD}, R_{AD}, P_{EM}, M_{AD}+M_{EM}}. Two additional EM based firms also emerge as optimal solutions of this system: a domestic one {HQ_{EM}, R_{EM}, P_{EM}, M_{EM}} and an MNE {HQ_{EM}, R_{AD}+R_{EM}, P_{EM}, M_{EM}} possessing R&D activities abroad (Hertenstein, Sutherland and Anderson, 2017). The upper part of Figure 2c below depicts this solution.

Post anti-globalization, configurations 1, 13, 22 and 38 will become the only sustainable configurations for type C products. These configurations will have the following firm boundaries: for configuration 1-{HQ_{AD}, R_{AD}, P_{AD}, M_{AD}}, for configuration 13- {HQ_{AD}, R_{AD}, P_{AD}+P_{EM}, M_{AD}}, for configuration 22- {HQ_{AD}, R_{AD}, P_{AD}, M_{AD}+M_{EM}}, and for configuration 38- {$HQ_{EM,}$ R_{EM}, P_{EM}, M_{EM}}. Hence, the global system for type C products is likely to be dominated by three AD based firms (a domestic one and a multinational one), with only one EM based domestic firm remaining in equilibrium. The recent downsizing of its Asian operations by the Swiss cement producer Lafrage-Holcim and the concentration of operations by the US engineering services firm, Emerson, in its home region (The Economist, 2017) demonstrate two cases of MNEs concentrating their global configurations into a smaller number of countries. This new global system is shown in the lower part of Figure 2c.

[Insert Figure 2c about here]

Non-technology intensive and differentiated products. Pre anti-globalization the following configurations dominate all others for type D products: configurations 1, 13, 35, 38 and 53. Because type D products are differentiated, inter- vs. intra-firm technological knowledge flow costs considerations imply the following firm boundaries: for location configuration 1 three firms emerge- {HQ_{AD}}, {P_{AD}} and {R_{AD}, M_{AD}}. For configuration 13 - {HQ_{AD}}, {P_{AD}}, {P_{EM}} and {R_{AD}, M_{AD}}. For configuration 35 - {HQ_{EM}}, {P_{EM}}, and {R_{EM}, M_{AD}}, for configuration 38: {HQ_{EM}}, {P_{EM}} and (R_{EM}, M_{EM}}, and for configuration 53 a four firm configuration with the boundaries: {HQ_{EM}}, {P_{EM}} and {R_{EM},M_{EM}}, and {R_{EM},M_{AD}}. These configurations, depicted in the upper part of Figure 4d, indicate entrepreneurs either in AD or EM (represented by HQ) sourcing production activities in either AD or EM and join R&D with marketing activities in both countries. The national identity of all such activities is represented by their location, where the only firm for which we cannot determine national identity is {R_{EM}, M_{AD}} in configurations 35 and 53. Figure 2d below depicts this solution.

For type D products, configurations 1, 13, 38 and 53 will remain the sustainable solutions post anti-globalization, with the following firm boundaries: for configuration 1 three firms spanning the boundaries-{HQ_{AD}}, {P_{AD}} and {R_{AD}, M_{AD}}. For configuration 13 – four firms with the boundaries {HQ_{AD}}, {P_{AD}}, {P_{EM}} and {R_{AD}, M_{AD}}. For configuration 38: {HQ_{EM}}, {P_{EM}} and (R_{EM}, M_{EM}} and for configuration 53 a four firm configuration emerges with the boundaries: {HQ_{EM}}, {P_{EM}} and (R_{EM}, M_{EM}}, and (R_{EM}, M_{AD}}, as shown in the lower part of Figure 2d.

[Insert Figure 2d about here]

Combining international trade and FDI restrictions

Given scepticism to globalization, one might expect that significant constraints on international technological knowledge flows are unlikely to come on their own. In other words, it is likely that restrictions to the international flow of complex technological knowledge will be accompanied by restrictions to international trade and FDI. We next examine how the results of our model change if such additional restrictions are imposed. We start with an analysis of how the addition of international trade restrictions, in form of bilaterally imposing high tariffs between AD and EM affects the emerging global system. Then we turn to an analysis of how the addition of banning FDI between the two countries changes the global system.

In the case where tariffs between AD and EM become extremely high, the domestic configurations 1 and 38 become more prevalent for all product types. Yet, our analysis further shows that in this case, configuration 13 that includes production sites in both AD and EM becomes even more attractive for product types A, C and D. This configuration takes the form of an AD headquartered MNE for product types A and C and of three AD firms that contract with a production EM firm for product type D. In addition, configurations 16, 19 and 25 become more attractive for product type C. These configuration are all AD headquartered MNEs that possess production sites both in AD and EM.

In the case where FDI between AD and EM is banned once again, the domestic configurations 1 and 38, serving their own home markets, become more attractive for all product types. In addition, for type A, C and D products, configuration 13 remains sustainable only if production in EM is outsourced. For type C products configuration 22 remains sustainable if marketing is outsourced to EM. For type D products, configuration 53 remains sustainable only if the R&D activities in EM and marketing activities in AD are separated into independent EM and AD entities.

Discussion

This study puts forward the argument that scepticism towards globalization and its resulting anti-globalization policies may strongly influence FDI through their effect on increased international technological knowledge transfer costs. Since the efficiency in the international transfer of complex firm specific technological knowledge is, to a large extent, the raison d'etre of MNEs, any measure taken to increase the costs of such knowledge transfer, be it through restrictions on the international mobility of intellectual property, intangible assets and innovations, restrictions on the free movement of skilled scientific, technological, and engineering labor between countries or through dis-harmonization of regulations across nations, regions and economic blocks, may therefore become an existential threat for MNEs. There is considerable contextual evidence for the assertion than international technological knowledge transfer costs are impacted by anti-globalization policies. Concerns for national security and sovereignty lead to legal and regulatory controls on international technology transfer, migration including visa restrictions controls limit the ability of MNEs to transfer firm specific technological knowledge and an anti-internationalist intellectual atmosphere limits exchanges between scientists, engineers and technologists to the detriment of technological knowledge dissemination. To substantiate this point of view, we introduce a model that predicts the origin of firms dominating different types of products, and the location of value adding activities in a world comprised of two countries – an advanced country and an emerging one, that represent the dominance of MNEs from these countries in our global system (Bonaglia, Goldstein and Mathews, 2007).

Overall, in the post anti-globalization phase, a very different global system emerges. First, a much smaller number of configurations remains sustainable in this global system, rendering many of the pre anti-globalization configurations irrelevant. As detailed in Table 1 below, rather than 37 firm types that operated before anti-globalization, after anti-globalization only 26 firm types will remain sustainable (a drop of about 30%). Most of this drop occurs in type C products (technology intensive, but non-differentiated) and type D products (non-technology intensive, but differentiated). Apparently having moderate technological knowledge flow demands (either for technology intensive products *or* for differentiated ones) has allowed firm types that rely on international technological knowledge flows before shock, but many of these firm types became unsustainable due to the significant increase in international technological knowledge transfer costs. Second, the newly emergent system is more dominated by domestic firms, and also by MNEs that mostly concentrate their value chain activities in specific locations, but locate one value adding activity in a different country (to benefit from costs advantages). In that, respect the new system includes a much smaller number of MNE types. As Table 1 shows, if in the pre anti-globalization phase there were 13 configurations containing international subsidiaries there are only four such configurations in the new global system. Most of the reduction in the number of MNE types results in type C products (technology intensive, but non-differentiated) that could maintain a large variety of MNE types (nine), but after the shock in international technological knowledge transfer costs are limited to only two types.

[Insert Table 1 about here]

In terms of firm origin, Table 1 shows that for technology intensive and differentiated products there will be one less AD firm types in the post anti-globalization phase (two instead of three) with no change in the number of EM based firm types (one). There will be no change in the number and origin of firms producing non-technological undifferentiated products (four EM firm types emerge before and after anti-globalization). The sharpest reduction in number of firm types will be for technology intensive and non-differentiated products where the number of AD firms reduces from nine to three while the number of EM firms reduces from two to one. Finally, for non-technology intensive and differentiated products there will be no change in the number of AD firm types (seven) with a decrease in the number of EM firms in equilibrium (seven instead of nine before anti-globalization). For this type of product, there are also a number of firms whose origin is ambiguous (two before anti-globalization and one after). If before the anti-globalization shock EM dominance (in terms of the number of EM originated firm types that dominate the global system) was mainly in non-technological products (type B and type D), after anti-globalization EM firms seem to maintain their dominancy in type B products (that do not require any international technological knowledge transfer costs). The dominancy of AD firms in high technology products (type A and type C) is reduced, mainly because the number of AD based MNE types that could gain cost advantages by locating value adding activities in EM reduces significantly once the costs of international technological knowledge transfer heightened. In contrast, EM based firms initially had no MNEs for type A and type C products (pre anti-globalization), but only domestic firms, and hence are less affected by the shock. Finally, AD firms somewhat improve their position (relative to EM firms) in non-technological differentiated products (type D). This happens because the configuration of an EM firm outsourcing marketing to AD (configuration 35) becomes unsustainable.

Our model shows that the effect of anti-globalization policies on increasing international technological knowledge transfer costs is indeed likely to have a significant effect on the global system. First, the model predicts a decrease in the number of different types of firms in general operating in the world (about a third of the firm types in the current global system are predicted to be eliminated). The driver of this decrease is that configurations that enjoy a comparative advantage in the location of specific value adding activities, but also include significant international technological knowledge flow costs, will become dominated by similar configurations that require less international technological knowledge flows. For instance, in the case of technology intensive and differentiated products, configuration 13 becomes superior to configuration 7, because it holds one of its production units in proximity to its R&D unit. In contrast, in configuration 7 production is remote from R&D. Likewise, for technology intensive and non-differentiated products, configuration 22 becomes superior to configurations 19 and 25 because it focuses its production in a single location, hence saving international knowledge transfer between R&D and production. General Electric, for instance, has been gradually moving to such localized structures, while Ford has also decided recently to invest at home, rather than in Mexico (The Economist, 2017). Likewise, Apple has recently announced its plan to create jobs in the US and invest in domestic suppliers and manufactures (Apple Press Release, 2018).

In terms of firm origin, the model predicts a shift in the relative dominancy of EM firms. In the pre anti-globalization global system, such dominancy predominantly focuses on non-technological products. Yet, given the fact that many AD based MNEs become unsustainable after the shock of increased international technological knowledge transfer costs, the relative position of EM firms in technology intensive products, where the EM firms pre and post anti-globalization are domestic, improves. These predictions are striking as, unlike previous studies (e.g. Buckley and Hashai, 2014; Yip and McKern, 2016) they do not assume that EM based firms will close the technological gap with AD based firms. We predict that that the newly emergent global system will be centred on focal brand owners that may be termed "the global factory" (Buckley, 2009; Buckley and Ghauri, 2004). Such brand owners may originate in AD or in EM, where EM originated firms will possess strong enough capabilities to challenge AD based firms despite their (assumed) comparative disadvantages in technology and in marketing differentiated products.

Interestingly, when we add to these predictions the effect of additional restrictions, in terms of high tariffs or banning FDI, the number of firms that emerge as optimal actually increases. As Table 2 indicates, the number of firm types in the case where international trade restrictions are added to those on international technological knowledge flows is 28 (14 AD firms, 13 EM firms and one firm with an undetermined origin), while the number of firms types in the case where FDI restrictions are added to international technological knowledge flows restrictions is 30 (14 AD firms and 16 EM firms). The number of MNE types in the case of imposing international trade restrictions also increases to 6. Apparently, imposing international trade or FDI restrictions actually increases the number of firm types (relative to the case of only limiting international technological knowledge flows). This happens because in the case of international trade restrictions more sustainable configurations are allowed (configurations with production located both in AD and EM) and because of the breakup of MNEs into domestic firms that contract with each other, in the case of FDI restrictions.

[Insert Table 2 about here]

A key prediction of the model is that the newly emergent system is likely to be dominated by domestic firms, but also by MNEs that mostly concentrate their value chain activities in specific locations, yet still locating one value adding activity in a different country in order to exploit comparative cost advantages (unless international trade restrictions also exist and then configurations where production is located in both AD and EM in addition to other marketing activities, also become feasible). This finding is consistent with recent observations on the increased dominance of local firms vis-à-vis MNEs, particularly in emerging markets (Santos and Williamson, 2015). It further means that even in a world where international technological knowledge flows are more costly, comparative advantage considerations matter and somewhat counterbalance increased international technological knowledge transfer costs, unless the latter are assumed to be extreme. If this trend comes about, we expect to see a decrease in the number of MNE types, operating in the global system, as well as by the level of FDI activity (in terms of possessing foreign subsidiaries) of the existing MNEs. This will be reflected in a reduction in FDI flows, where depending on the height of international trade barriers (that are not part of this paper's model) firms will either concentrate on serving their home markets or engage in international trade.

To some extent, this type of transaction indicates the emergence of a global system that resembles the global system as it was in the first globalization wave of 1860-1913 (James, 2001). This global system was characterized by the dominance of British MNEs, in terms of technological advance, but also by the rapid rise of European and American MNEs (Dunning and Lundan, 2008: 158). Foreign trade and later foreign investments were the engines of this global system where much of the FDI was "market seeking" as means to avoid high tariff barriers and high international communication costs (Jones, 1986). Furthermore, the global system predicted seems to lean towards MNEs that possess a multi-domestic structure, where mostly their activities, per a given market, are self-sufficient – that is, R&D, production and marketing activities are co-located in specific locations. This multi-domestic structure was popular before World War II (Bartlett and Ghoshal, 1989; Prahalad and Doz, 1999) where, due to the high tariffs that existed at that time (one of the consequences of the 1930s Great Depression), MNE subsidiaries were designed to be mostly self-sufficient per specific locations and relied only marginally on intra-MNE product and technological knowledge flows. Hence, our model predicts that scepticism towards globalization may well bring us back to the global systems that existed before WW1 and WW2. In current terms, the implications of our model might be profound for many of the technology based MNEs, where the restrictions on the international flows of technological knowledge flows might well lead to 'balkanization' of the internet, or the creation of incompatible platforms of different technology based MNEs, located in different parts of the world. To some extant such separation already exists between the US based technology giants (Amazon, Google and Facebook) and the Chinese based ones (Alibabal, Tencent and Baidu).

Model limitations and Future Research Avenues

All models need to be carefully placed into context in order to address real-world issues. The context that this model is intended to illustrate is the effect of anti-globalization on technological knowledge flows within MNEs. The internal development and transfer of complex technological knowledge is a key raison d'etre of MNEs (Buckley and Casson, 1976) and its disruption represents an existential threat to their existence. There are other consequences of the backlash against globalization, but they are, in contrast, unlikely to challenge the very existence of knowledge–intensive MNEs. Other effects result in massive readjustments to the global economy (and therefore great readjustment costs) but international knowledge transfer is at the heart of the global system, through the agency of the MNE.

Clearly, our model is limited to its base assumptions. In that respect, one may challenge our key assumptions, concerning the comparative advantage AD firms have in skilled labor, relative to EM ones. In essence, challenging this assumption, implies, in terms of our model, that it is not AD firms having costs advantages in technology intensive products (type A and type C), but EM ones. Given the richness of our model relating to four types of products (see Figure 1), the relaxation of this assumption implies that one should effectively relate to two types of products (differentiated and non-differentiated). This implies that one should refer only to our predictions for firms producing product types B and D when studying the possible configurations that can emerge in the global system. Indeed, if one challenges the comparative advantage of AD based firms in differentiated products as well, our model analysis essentially boils down to the predictions we make for type B products, while all other predictions might be ignored. Yet, we believe that one of the strengths of our model is its ability to simultaneously relate to different types of products, as this makes the model much richer in its predictions.

In addition, the proposed model can be expanded to include also firms originated from smaller countries with no significant home market (see Buckley and Hashai, 2004). In our model, AD based firms and EM based firms respectively represent and advanced- and emerging country firms with a home market that is of a considerable size. Adding firms originating from advanced or emerging countries with a negligible home market can offer a wide range of new predictions, not only due to the increase in the number of countries modelled, but also as it would add the dimension of countries that possess some comparative advantages but are forced to internationalize due to the absence of a significantly large home market.

It is further noteworthy that our model allows us to predict the number of configurations (firm types) that might exist in the global system after the anti-globalization shock, but not the number of firms. To reflect on the latter, one would need to relate to the relative demand and supply which is beyond the scope of the current model. So, while our model predicts a smaller number of firm types, there might well be more firms operating in specific configurations. Here, the only meaningful prediction that our model can yield, is that the reduced number of possible firm types is likely to hamper the flexibility of firms to cater the demand in AD and EM in different ways. We can speculate that this reduced flexibility is likely to result in reduced firm efficiency and hence in higher costs, as well as lead to greater level of competition among firms using similar configurations due to their reduced capability to distinguish their configuration from other firms.

In this paper, our main point was to demonstrate, that even seemingly subtle consequences of anti-globalization scepticism, such as limiting international technological knowledge transfer, may have dramatic effects on the emerging global system. We demonstrate that the world does not have to go to a 'trade war' or to specific restrictions on FDI flows between countries to become less global. Since countries can unilaterally restrict international technological knowledge flows, it is enough that countries will limit the ability to transfer intellectual property, technological knowledge assets and innovations from their jurisdictions, that the mobility of skilled labor will be reduced or that countries will dis-harmonize regulation across them, to make the global system less 'globalized'.

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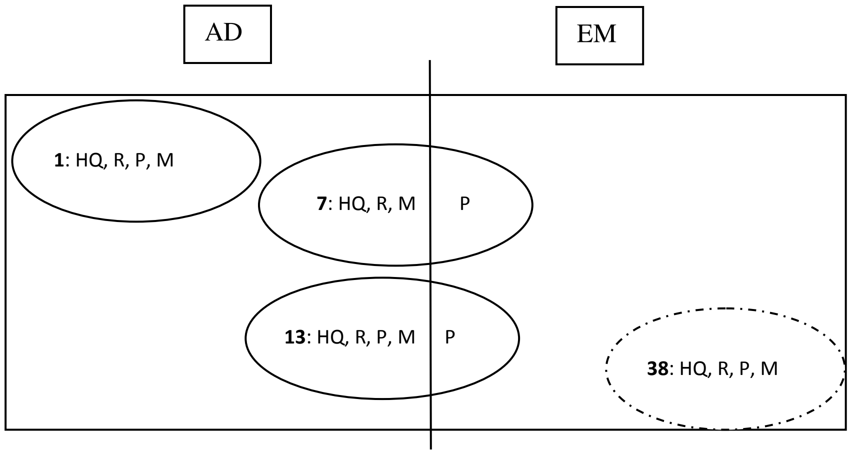
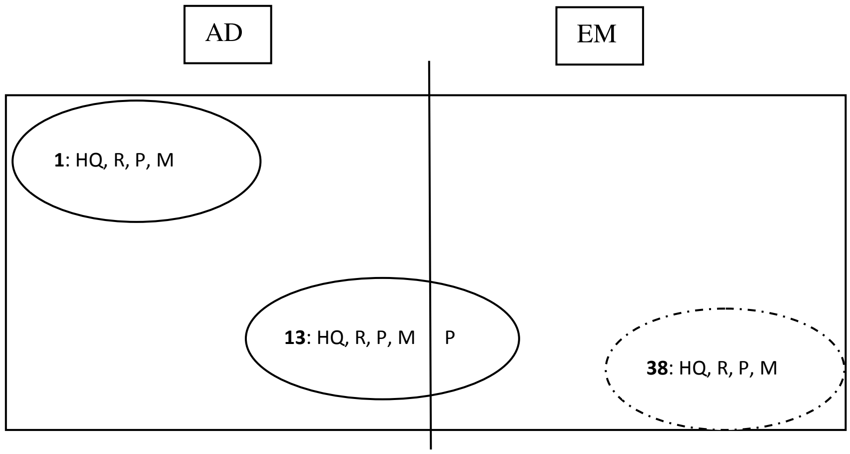
Figure 1 – Product types by knowledge intensity and differentiation

	High Technological Intensity	**Low Technological Intensity**
High Differentiation	Technology intensive and differentiated products (Type **A**)	Non-technology intensive and differentiated products (Type **D**)
Low Differentiation	Technology intensive and non-differentiated products (Type **C**)	Non-technology intensive and non-differentiated products (Type **B**)

Figure 2a – Dominant location and control configuration for technology intensive and differentiated products – pre and post anti-globalization



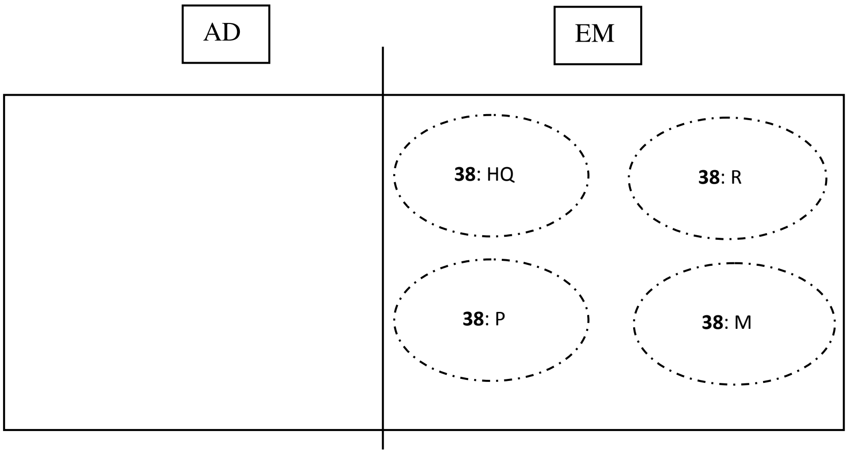
Pre anti-globalization



Post anti-globalization

Legend: numbers indicate configuration number; straight line ellipse= AD firm, broken line ellipse= EM firm

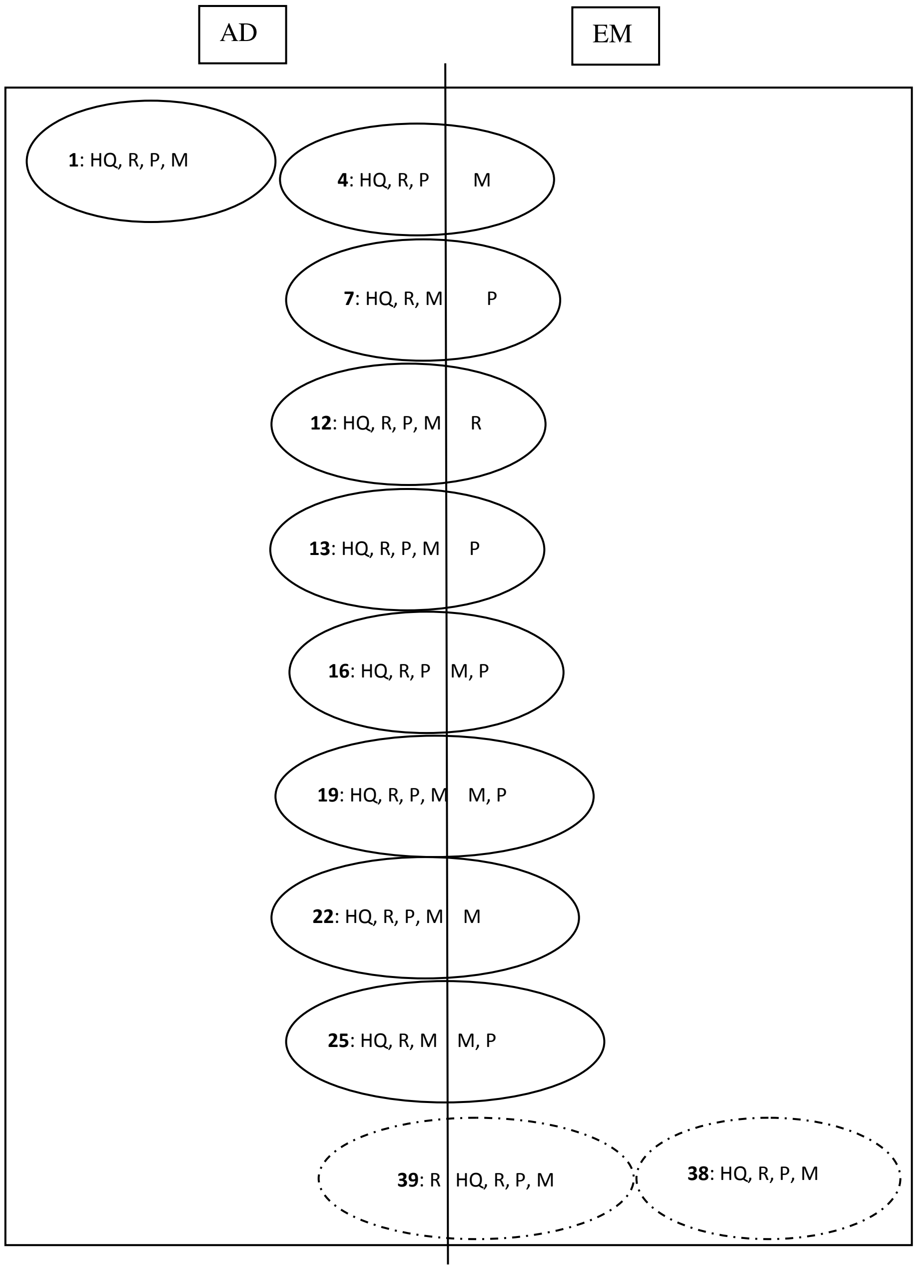
Figure 2b – Dominant location and control configuration for non-technology intensive and non-differentiated products – pre and post anti-globalization



Pre and post anti-globalization

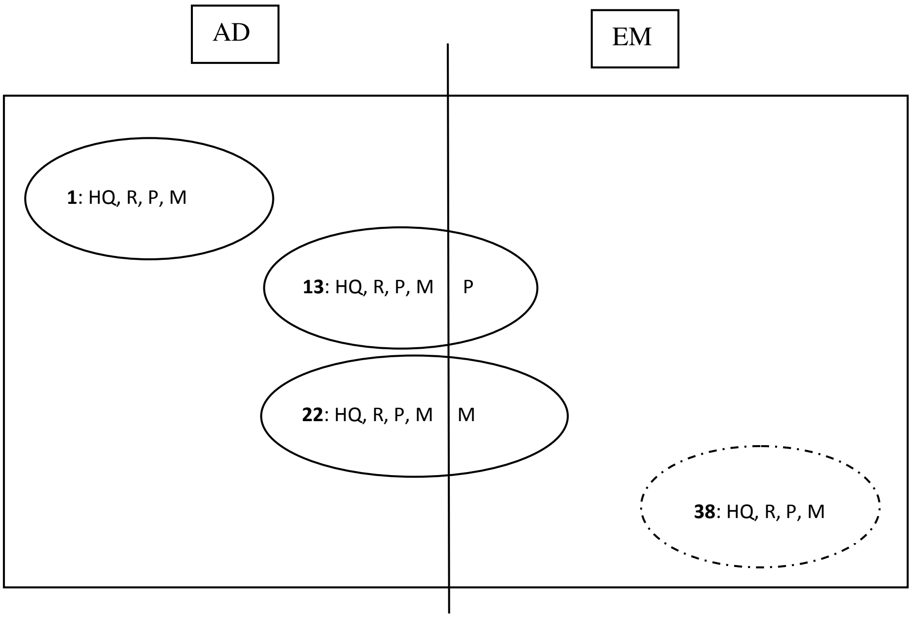
Legend: number indicates configuration number; Broken line ellipse= EM firm

Figure 2c – Dominant location and control configuration for technology intensive and non-differentiated products – pre and post anti-globalization



Pre anti-globalization

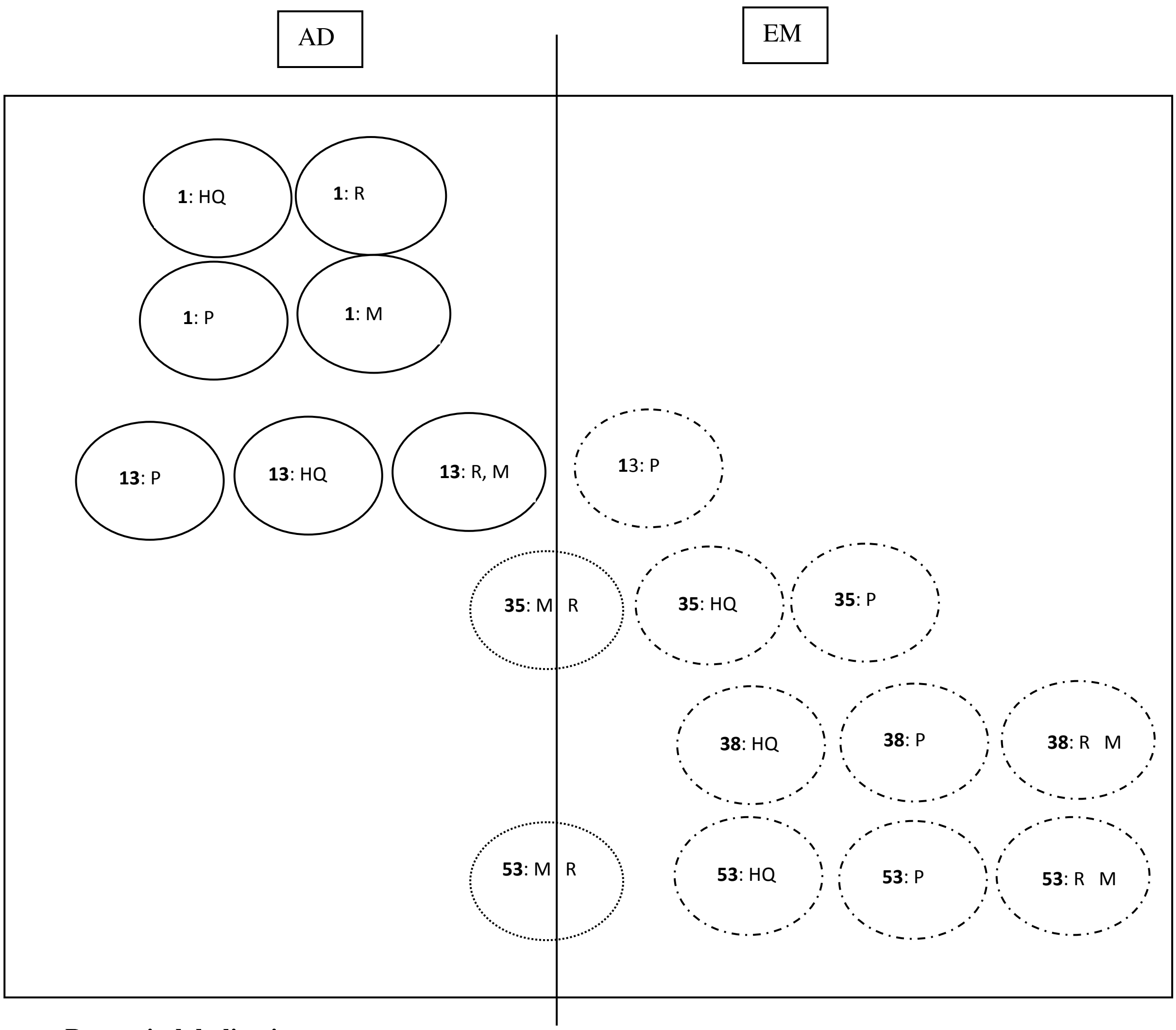
Legend: numbers indicate configuration number; straight line ellipse= AD firm, broken line ellipse= EM firm



Post anti-globalization

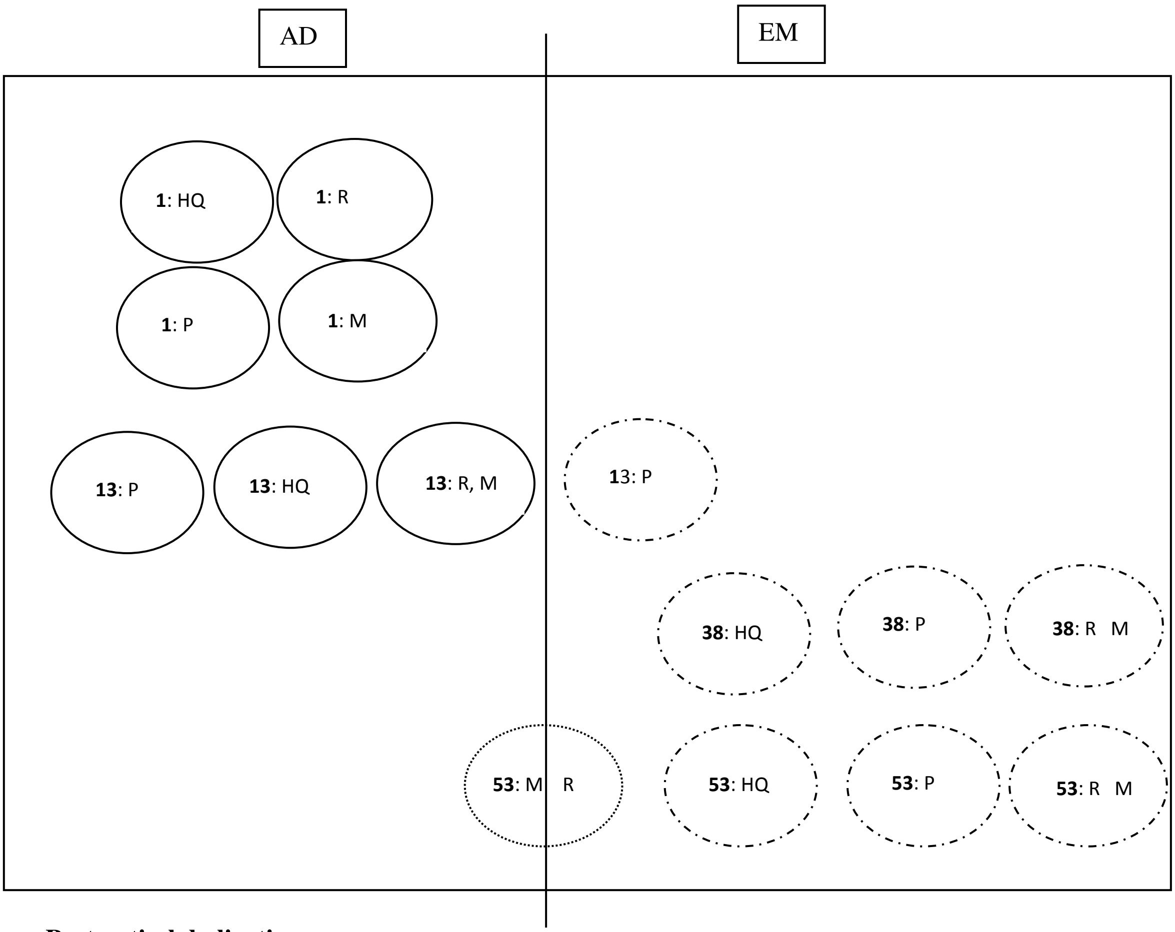
Legend: numbers indicate configuration number; straight line ellipse= AD firm, broken line ellipse= EM firm

Figure 2d – Dominant location and control configuration for non-technology intensive and differentiated products



Pre anti-globalization

Legend: numbers indicate configuration number; straight line ellipse= AD firm, broken line ellipse= EM firm, dotted line= undetermined origin



Post anti-globalization

Legend: numbers indicate configuration number; straight line ellipse= AD firm, broken line ellipse= EM firm, dotted line= undetermined origin

Table 1 – Number of firms pre and post anti-globalization

Product type	Number of firm types		Number of MNE types		Number of AD firm types		Number of EM firm types	
	Pre anti-globalization	Post anti-globalization	Pre anti-globalization	Post anti-globalization	Pre anti-globalization	Post anti-globalization	Pre anti-globalization	Post anti-globalization
Technology intensive and differentiated	4	3	2	1	3	2	1	1
Non-technology intensive and non-differentiated	4	4	0	0	0	0	4	4
Technology intensive and non-differentiated	11	4	9	2	9	3	2	1
Non-technology intensive and differentiated	18	15	2	1	7*	7*	9*	7*
Total	**37**	**26**	**13**	**4**	**19**	**12**	**16**	**13**

*- for this type of products the origin of two firms is undetermined

Table 2 – Number of firm types when combined with international trade and FDI restrictions

Product type	Number of firm types		Number of MNE types	Number of AD firm types		Number of EM firm types	
	With international trade restrictions	With FDI restrictions	With international trade restrictions	With international trade restrictions	With FDI restrictions	With international trade restrictions	With FDI restrictions
Technology intensive and differentiated	3	4	1	2	3	1	1
Non-technology intensive and non-differentiated	4	4	0	0	0	4	4
Technology intensive and non-differentiated	6	6	4	5	3	1	3
Non-technology intensive and differentiated	15	16	1	7*	8	7*	8
Total	**28**	**30**	**6**	**14**	**14**	**13**	**16**

*- for this type of products, the origin of two firms is undetermined

Appendix Table 1 – Costs of alternative location configurations

Configuration No.	**HQ**	**Knowledge flow HQ-R&D**	**R&D**	**Production**	**Knowledge flow R&D-Production**	**Marketing**	**Knowledge flow R&D-marketing**	**Total knowledge flows**
1	AD	α	$C_{R,AD}$	$C_{P,\,AD}$	α	$C_{M,\,AD}$	α	3α
2	AD	β	$C_{R,\,EM}$	$C_{P,\,AD}$	β	$C_{M,\,AD}$	β	3β
3	AD	(α+β)/2	$C_{R,\,AD}+C_{R,EM}$	$C_{P,\,EM}$	(α+β)/2	$C_{M,\,EM}$	(α+β)/2	1.5α+1.5β
4	AD	α	$C_{R,\,AD}$	$C_{P,\,AD}$	α	$C_{M,\,EM}$	β	β+2α
5	AD	β	$C_{R,\,EM}$	$C_{P,\,AD}$	β	$C_{M,\,EM}$	α	2β+α
6	AD	(α+β)/2	$C_{R,AD}+C_{R,EM}$	$C_{P,\,AD}$	(α+β)/2	$C_{M,\,EM}$	(α+β)/2	1.5α+1.5β
7	AD	α	$C_{R,\,AD}$	$C_{P,\,EM}$	β	$C_{M,\,AD}$	α	β+2α
8	AD	β	$C_{R,\,EM}$	$C_{P,\,EM}$	α	$C_{M,\,AD}$	β	2β+α
9	AD	(α+β)/2	$C_{R,\,AD}+C_{R,EM}$	$C_{P,\,EM}$	(α+β)/2	$C_{M,\,AD}$	(α+β)/2	1.5α+1.5β
10	AD	α	$C_{R,\,AD}$	$C_{P,\,EM}$	β	$C_{M,\,EM}$	β	2β+α
11	AD	β	$C_{R,\,EM}$	$C_{P,\,EM}$	α	$C_{M,\,EM}$	α	β+2α
12	AD	(α+β)/2	$C_{R,\,AD}+C_{R,EM}$	$C_{P,\,EM}$	(α+β)/2	$C_{M,\,EM}$	(α+β)/2	1.5α+1.5β
13	AD	α	$C_{R,\,AD}$	$C_{P,\,AD}+C_{P,\,EM}$	(α+β)/2	$C_{M,\,AD}$	α	2.5α+0.5β
14	AD	β	$C_{R,\,EM}$	$C_{P,\,AD}+C_{P,\,EM}$	(α+β)/2	$C_{M,\,AD}$	β	0.5α+2.5β
15	AD	(α+β)/2	$C_{R,\,AD}+C_{R,EM}$	$C_{P,\,AD}+C_{P,\,EM}$	(α+β)/2	$C_{M,\,AD}$	(α+β)/2	1.5α+1.5β
16	AD	α	$C_{R,\,AD}$	$C_{P,\,AD}+C_{P,\,EM}$	(α+β)/2	$C_{M,\,EM}$	β	1.5α+1.5β
17	AD	β	$C_{R,\,EM}$	$C_{P,\,AD}+C_{P,\,EM}$	(α+β)/2	$C_{M,\,EM}$	α	1.5α+1.5β
18	AD	(α+β)/2	$C_{R,\,AD}+C_{R,\,EM}$	$C_{P,\,AD}+C_{P,\,EM}$	(α+β)/2	$C_{M,\,EM}$	(α+β)/2	1.5α+1.5β
19	AD	α	$C_{R,\,AD}$	$C_{P,\,AD}+C_{P,\,EM}$	(α+β)/2	$C_{M,AD}+C_{M,EM}$	(α+β)/2	β+2α
20	AD	β	$C_{R,\,EM}$	$C_{P,\,AD}+C_{P,\,EM}$	(α+β)/2	$C_{M,AD}+C_{M,EM}$	(α+β)/2	2β+α
21	AD	(α+β)/2	$C_{R,\,AD}+C_{R,\,EM}$	$C_{P,\,AD}+C_{P,\,EM}$	(α+β)/2	$C_{M,AD}+C_{M,EM}$	(α+β)/2	1.5α+1.5β
22	AD	α	$C_{R,\,AD}$	$C_{P,\,AD}$	α	$C_{M,AD}+C_{M,EM}$	(α+β)/2	2.5α+0.5β
23	AD	β	$C_{R,\,EM}$	$C_{P,\,AD}$	β	$C_{M,AD}+C_{M,EM}$	(α+β)/2	0.5α+2.5β
24	AD	(α+β)/2	$C_{R,\,AD}+C_{R,\,EM}$	$C_{P,\,AD}$	(α+β)/2	$C_{M,AD}+C_{M,EM}$	(α+β)/2	1.5α+1.5β
25	AD	α	$C_{R,\,AD}$	$C_{P,\,EM}$	β	$C_{M,AD}+C_{M,EM}$	(α+β)/2	1.5α+1.5β
26	AD	β	$C_{R,\,EM}$	$C_{P,\,EM}$	α	$C_{M,AD}+C_{M,EM}$	(α+β)/2	1.5α+1.5β

27	AD	(α+β)/2	$C_{R, AD}$+ $C_{R,EM}$	$C_{P, EM}$	(α+β)/2	$C_{M,AD}$+ $C_{M,EM}$	(α+β)/2	1.5α+1.5β
28	EM	β	$C_{R, AD}$	$C_{P, AD}$	α	$C_{M,AD}$	α	β+2α
29	EM	β	$C_{R, AD}$	$C_{P, EM}$	β	$C_{M,AD}$	α	2β+α
30	EM	(α+β)/2	$C_{R, AD}$+ $C_{R, EM}$	$C_{P, EM}$	(α+β)/2	$C_{M, EM}$	(α+β)/2	1.5α+1.5β
31	EM	β	$C_{R, AD}$	$C_{P, AD}$	α	$C_{M, EM}$	β	2β+α
32	EM	α	$C_{R, EM}$	$C_{P, AD}$	β	$C_{M, EM}$	α	β+2α
33	EM	(α+β)/2	$C_{R, AD}$+ $C_{R, EM}$	$C_{P, AD}$	(α+β)/2	$C_{M, EM}$	(α+β)/2	1.5α+1.5β
34	EM	β	$C_{R, AD}$	$C_{P, EM}$	β	$C_{M,AD}$	α	2β+α
35	EM	α	$C_{R, EM}$	$C_{P, EM}$	α	$C_{M,AD}$	β	β+2α
36	EM	(α+β)/2	$C_{R, AD}$+ $C_{R, EM}$	$C_{P, EM}$	(α+β)/2	$C_{M,AD}$	(α+β)/2	1.5α+1.5β
37	EM	β	$C_{R, AD}$	$C_{P, EM}$	β	$C_{M, EM}$	β	3β
38	EM	α	$C_{R, EM}$	$C_{P, EM}$	α	$C_{M, EM}$	α	3α
39	EM	(α+β)/2	$C_{R,AD}$+ $C_{R, EM}$	$C_{P, EM}$	(α+β)/2	$C_{M, EM}$	(α+β)/2	1.5α+1.5β
40	EM	β	$C_{R, AD}$	$C_{P, AD}$+ $C_{P, EM}$	(α+β)/2	$C_{M,AD}$	α	1.5α+1.5β
41	EM	α	$C_{R, EM}$	$C_{P, AD}$+ $C_{P, EM}$	(α+β)/2	$C_{M,AD}$	β	1.5α+1.5β
42	EM	(α+β)/2	$C_{R, AD}$+ $C_{R, EM}$	$C_{P, AD}$+ $C_{P, EM}$	(α+β)/2	$C_{M,AD}$	(α+β)/2	1.5α+1.5β
43	EM	β	$C_{R, AD}$	$C_{P, AD}$+ $C_{P, EM}$	(α+β)/2	$C_{M, EM}$	β	0.5α+2.5β
44	EM	α	$C_{R, EM}$	$C_{P, AD}$+ $C_{P, EM}$	(α+β)/2	$C_{M, EM}$	α	2.5α+0.5β
45	EM	(α+β)/2	$C_{R, AD}$+ $C_{R, EM}$	$C_{P, AD}$+ $C_{P, EM}$	(α+β)/2	$C_{M,EM}$	(α+β)/2	1.5α+1.5β
46	EM	β	$C_{R, AD}$	$C_{P,AD}$+ $C_{P, EM}$	(α+β)/2	$C_{M,AD}$+ $C_{M,EM}$	(α+β)/2	2β+α
47	EM	α	$C_{R, EM}$	$C_{P,AD}$+ $C_{P, EM}$	(α+β)/2	$C_{M,AD}$+ $C_{M,EM}$	(α+β)/2	β+2α
48	EM	(α+β)/2	$C_{R, AD}$+ $C_{R, EM}$	$C_{P,AD}$+ $C_{P, EM}$	(α+β)/2	$C_{M,AD}$+ $C_{M,EM}$	(α+β)/2	1.5α+1.5β
49	EM	β	$C_{R, AD}$	$C_{P, AD}$	α	$C_{M,AD}$+ $C_{M,EM}$	(α+β)/2	1.5α+1.5β
50	EM	α	$C_{R, EM}$	$C_{P, AD}$	β	$C_{M,AD}$+ $C_{M,EM}$	(α+β)/2	1.5α+1.5β
51	EM	(α+β)/2	$C_{R, AD}$+ $C_{R, EM}$	$C_{P, AD}$	(α+β)/2	$C_{M,AD}$+ $C_{M,EM}$	(α+β)/2	1.5α+1.5β
52	EM	β	$C_{R, AD}$	$C_{P, EM}$	β	$C_{M,AD}$+ $C_{M,EM}$	(α+β)/2	0.5α+2.5β
53	EM	α	$C_{R, EM}$	$C_{P, EM}$	α	$C_{M,AD}$+ $C_{M,EM}$	(α+β)/2	2.5α+0.5β
54	EM	(α+β)/2	$C_{R, AD}$+ $C_{R, EM}$	$C_{P, EM}$	(α+β)/2	$C_{M,AD}$+ $C_{M,EM}$	(α+β)/2	1.5α+1.5β