For Whom is MAI? A Theoretical Perspective on Multilateral Agreements on Investment

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Abstract

Why do we observe some LDCs objecting the prospect of a Multilateral Agreement on Investment (MAI), although they have been keen to liberalize investment in preferential agreements in recent years? In this paper, we analyse the issue of MAI implementation and assess the welfare consequences of such kind of agreements. In our model, participation to MAI involves a trade-off between less rent extraction from multinational firms (MNEs) and more abundant FDI inflows. At equilibrium, either all countries enter MAI, or all countries stay out, or only some of them enter. Coordination problems may induce multiple equilibria: the three types of equilibria may coexist. So, the implementation of MAI may depend not only on structural factors but also on the general "political climate". When all countries join MAI, world welfare is maximized because this minimizes the hold-up problem faced by MNEs and stimulates investment. However, in an asymmetric world, welfare gains are not guaranteed for all countries.

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1 Introduction

What is the economic rationale for a Multilateral Agreement on Investment (MAI)?[1] Why do we observe some Least Developed Countries (LDCs) objecting strongly the prospect of MAI, even though they are not forced to join? What are the likely consequences of MAI on world welfare? How will the possible gains be divided? The aim of this paper is that of offering a theoretical framework for MAI in which the above questions can find an answer.

In the past decades, multilateralism has substantially contributed to maintain a free trade climate in a world with wide economic, social, and political differences. As trade integration deepens the need for a multilateral approach extends from manufacture trade to new issues such as trade in services, intellectual property rights, or right of establishment. The growing importance of FDI and FDI-related trade issues has led the OECD to propose in 1995 a draft for a Multilateral Agreement on Investment, directed to OECD and non-OECD member countries, with the aim of fostering FDI liberalization and protecting investment on a multilateral basis, under the working of a dispute settlement procedure different from that of the WTO. Negotiations on the OECD MAI draft stopped in 1998. Since then, the desirability and the feasibility of a multilateral investment agreement is under study by a WTO working group.

The MAI proposal has been strongly debated world-wide, receiving criticism by several interest and opinion groups within advanced countries (NGOs, environmentalists, trade unions) and a fierce opposition by some LDCs. This is somewhat puzzling. In fact, the countries that do not agree with the conditions of a proposed MAI are perfectly free to opt out. So, why was there such a strong opposition to the simple eventuality that some nations could join this agreement? Second, the negative reactions to MAI deeply contrast with the growing positive attitude towards FDIs that is spreading especially in the developing world. Almost all LDCs have recently adopted measures that are more favorable to FDIs, not less.[2] Finally, the opposition to MAI clashes with the proliferation of Bilateral Investment Treaties (BITs) and regional agreements on foreign direct investments that aim at protecting and liberalizing FDI in member countries.[3]

In this paper we present a model to study international investment agreements in which the above puzzle can find an explanation. We develop a framework of analysis in which the desirability of MAI has a sound economic justification, but in which it is also possible to provide an explanation of the observed difficulties in its implementation.

Our paper is only loosely related with the existing literature on the effects of FDI policies and on subsidy competition among countries to attract investments (see, e.g., Bond and Samuelson (1986), Black and Hoyt (1989), Fumagalli (1998),

[1] Throughout the paper, the acronym MAI is used generically with reference to any Multilateral Investment Agreement.

[2] For example, see UNCTAD (1998) for a review of FDI policies across the world.

[3] Consider, for instance, the recent initiatives by Asean and Mercosur (UNCTAD (1998)).

Haaparanta (1996), Haaland and Wooton (1999), Haufler and Wooton (1999)). In our model, the focus is on the externalities that are inherent to international FDI agreements, on problems of implementation, and on welfare.[4]

To build a model, we need first to isolate the basic ingredients of the proposed investment agreements, and to identify their economic implications. When entering MAI, countries commit to limit their own freedom of action vis-à-vis MNEs. As already suggested in Markusen (1998b), this commitment translates into a reduction in countries' bargaining power that might have real effects. If investments are specific to the particular firm-country match and investment cannot be contracted ex-ante, then MNEs are likely to underinvest due to a hold-up problem. By reducing countries' freedom of action, MAI has the desirable effect of reducing the extent of the hold-up problem and the corresponding inefficiency. This is the basic rational behind the desirability of MAI implementation. What is at stake is not only the distribution of FDI rents between MNEs and host countries. Rather, the economic rational for MAI is that of fostering investment world-wide through improved transparency and discipline on governments' attitude towards MNEs.

Second, we need a model where the distributive implications of MAI are consistent with stylized facts. Here, we note that multilateral investment agreements cannot really be assimilated to trade agreements. While multilateral liberalization is likely to produce gains for all countries – due, primarily, to the exploitation of comparative advantages and scale economies – this is not necessarily the case for investment agreements. Among the hard-core stylized facts about FDIs, we know (see, e.g., Markusen (1995)) that foreign direct investments are found in sectors where firms' intangible assets are important and that FDIs normally originate from countries with abundant "knowledge capital". The economic actors (managers, workers, scientists,...) that embody the knowledge capital key to MNEs are unequally distributed across the world, are relatively immobile internationally, and, in general, cannot be acquired overnight. This explains the very unequal distribution of FDIs across the world, and its persistency. In this framework, we expect two possible gainers from MAI: MNEs in general, which will find a more favorable environment for their operations, and those host countries that are able to attract more FDIs, which will benefit from FDI-generated positive spillovers. Some country, however, may not receive more FDI inflows after MAI. Equally, some country may not benefit from boosted own MNEs' profits. We also note that MAI, as compared with trade agreements, is likely to produce more substantial externalities. When some countries agree on a set of rules to liberalize and protect investments of foreign origin, they are likely to divert FDI flows from the countries that remain outside of the agreement. This, in turn, alters the cost-benefit comparisons concerning MAI on the part of outsiders.

[4] The focus of our paper is analogous, for instance, to that of Baldwin (1995). There, the externalities associated with the formation of common markets are anlysed. The fact that a group of countries enters this type of agreement may affect the willingness of the others to do the same, i.e., may produce a "domino effect".

The final ingredient of our model is a mechanism through which countries self-select between MAI members and MAI outsiders. The gain from MAI membership is associated with larger FDI inflows. This could be offset, however, by the loss of freedom and the bargaining power that the countries undergo when joining MAI. When countries are heterogenous in their institutions, laws, or habits, we find that the countries that are more keen to join MAI are those with higher bargaining power: for them, the loss of freedom due to MAI membership has a relatively low weight.

In order to capture relevant effects, we must develop a model where countries are many, where firms make profits, and where MNEs and countries (governments) interact in a rather complex way. The level of investment undertaken by MNEs in the different countries, the partition of countries in MAI-members and outsiders, and the direction of FDI flows must all be determined endogenously in equilibrium. As will be clear, we have to economize on the analysis by making quite radical simplifications, basically a highly symmetric world without differences in factor endowments across countries and equal production techniques. The model set-up borrows from Murphy, Shleifer and Vishny (1989) the use of a dual-technology production representation. As Grossman and Helpman (1999), we also resort to a world with incomplete contracting.

We analyze how the size of MAI depends on the strictness of its rules, e.g., on the loss of discretion (bargaining power) that countries have to accept by joining MAI. We find that, depending on the degree of severity of the discipline imposed by MAI, equilibrium may either exhibit no MAI participants, or all countries entering MAI, or only some countries as members. Roughly, we observe the equilibrium size of MAI rising, and then falling as MAI becomes stricter. It is to note, however, that coordination problems might be particularly strong. In some cases, the three types of equilibria may coexist. So, the implementation of MAI may depend in some circumstances not only on structural factors, but also on expectations and the general "political climate". Finally, we find that, in spite of the desirability of MAI from a world viewpoint, the countries that are not endowed with sufficient MNEs' holdings may end up losing from MAI. A country owning no MNEs can hope to gain from the implementation of MAI only when MAI does not reach full participation, thanks to larger FDI inflows.

The remainder of the paper is structured as follows. In the next section we summarize stylized facts of international investment agreements and outline the main features of the economics of MAI. In section 3, we develope the set-up of our model. Section 4 is devoted to the equilibrium analysis, while section 5 focuses on the welfare properties of MAI. In section 6, we discuss our results. Concluding comments are found in section 7.

2 What is MAI?

2.1 Stylized Facts

The negotiations for a multilateral agreement on investment were launched in 1995 among the twenty-nine member states of the OECD and stopped in 1998, without success. Since then, the task of exploring the desirability and the feasibility of a multilateral investment agreement has been deferred to a WTO working group.

The core rules of any possible MAI draft are similar to those of existing bilateral or regional investment agreements. What really distinguishes MAI with respect to other existing investment treaties is that the agreement is not preferential. To be consistent with multilateralism, the agreement must be open to all the countries that are willing to obey its rules. So, compared with bilateral or regional agreements, all countries are potential members. International investment agreements are characterized by four basic elements: the definition of the investments covered by the agreement, the rules aimed at protecting investment, those directed at investment liberalization, and a set of rules defining a dispute settlement mechanism. Foreign investment may either be defined in a narrow (e.g. FDI in manufacturing) or in a broad sense (FDI in all sectors and activities and portfolio investment). Concerning the rules aimed at providing investment protection, they basically consist of provisions against expropriation and to guarantee free transfer of funds. The rules that are directed at fostering investment liberalization may act both ex-ante (right of establishment) and ex-post (guarantees against performance requirements) and should be applied in a non-discriminatory way. Finally, concerning the dispute settlement mechanism (DSP), it may work only on a State-State basis, or also on a Investor-to-state basis. The OECD MAI proposal contemplated investment defined in a broad sense (all FDIs plus portfolio investment), non discrimination consistent with the MFN and national treatment principles, and a DSP working both on a State-State basis and on an Investor-State basis.

The rules concerning the principle of non-discrimination, the definition of expropriation, and the working of the DSP are among the most disputed. Non-discrimination is not surprisingly a sensitive issue: it corresponds to a loss of policy tools used by governments to deter or attract different types of investments. As for expropriation, there are controversies around its definition. Investors might feel expropriated whenever a so-called "regulatory taking" occurs, i.e., whenever a government action reduces the value of their assets. However, some takings may correspond to outright expropriation (confiscation, nationalization...), while others may be justified on the ground of health, safety, environmental or social concerns. Regarding the working of the DSP, the Investor-State arbitration is often criticized. Since this way MNEs can directly sue governments, the fear is that MNEs may use the DSP as a device to discourage governments from introducing legitimate regulations. Because the concepts of expropriation and non-discrimination are subtle, MNEs may have an incentive to contest any government action that is felt as detrimental. Governments,

fearing costly law-suits, may be induced in some circumstances to abstain from introducing or enforcing regulations even when they serve a social goal as the correction of externalities.[5]

The failure of the OECD MAI negotiations has been attributed, separately, to two set of causes.[6] On one side there are issues related to the design of the agreement. The MAI draft has been considered quite demanding for participating countries: the rules were rather "strict" compared with those of existing international investment treaties. On the other side, there is an unfavorable general political climate. In particular, a rising role of NGOs in the international scene and a deepening divide between developed and developing countries on multilateral issues have been felt as working against the success of the negotiations.

2.2 Towards the Economics of MAI

The stake of countries in international agreements on foreign direct investment has been discussed in recent literature. In WTO (1996) and Drabek and Payne (1998) are summarized a series of "institutional" arguments that may motivate countries, especially LDCs, to object a multilateral investment agreement. First, there are fears of loss of political control and consensus. By joining MAI, governments lose power of action on MNEs, thus partly losing control on the economy. FDI may also break up the social balance among different social groups and induce a political change.[7]. Furthermore, uncontrolled FDI inflows may entail a politically costly process of adjustment associated with the replacement of domestic by foreign production or with the enforcement of a change in budgetary practises of governments.[8] Second, countries may object MAI for the fear of increased economic insecurity and inequality. For instance, there may be an increased risk of capital flight (see, e.g., UNCTAD, 1996 and 1997, and Rodrik, 1997).

Markusen (1998b) proposes an approach to the economic analysis of the advantages and disadvantages of MAI-membership for LDCs.[9] The basic trade-off involved is that of *rules versus discretion*. By joining MAI, countries can credibly "tie their hands", giving up some policy tools. There are advantages from that. Adhering to strict rules may attract FDIs and foster investment due to higher transparency, reduced transaction costs for MNEs and reduced political risk. The loss of discretion entails also evident costs: reduced bargaining power and the loss of discriminatory policy instruments.

[5] Examples of possible misuse of the DSP by MNEs are reported within NAFTA, that has rules on investment similar to that of MAI (UNCTAD, 1998, p. 61).

[6] See, for instance, Unctad (1999).

[7] The experience of Indonesia during the Asian crises may serve as a recent example of political instability in the presence of free capital flows.

[8] See also Rodrik (1997) on this point.

[9] See also Hoekman and Saggi (1999) for an analysis of the economic trade-off faced by LDCs in participating into multilateral investment agreements.

Several theoretical arguments and abundant empirical evidence support the thesis that MNEs, when transferring knowledge capital, create positive spillovers in host countries (see, e.g., Blomstrom (1989)). It follows that any provision that is likely to attract FDIs (like improved transparency of investment procedures and reduced risk of expropriation) is possibly beneficial to host countries. The loss of discretion has also costs for host countries. The loss of bargaining power and freedom of action will probably correspond to a smaller gain that the host countries can derive from a *given* stock of FDI (foregone tax revenue, unregulated negative externalities,...). The loss of discriminatory policy tools to handle MNEs differently is also costly. Some MNEs may create positive spillovers and benefit local production factors. Others may instead be largely polluting and unwilling to invest in the skills of the local workforce. If MAI forbids treating these cases differently, some MNEs will be deterred unnecessarily, and others will obtain a free lunch. In general, if MAI does not really contribute much in fostering investment and attracting FDI, the negative effect of MAI associated with reduced discretion and bargaining power may prevail.[10]

The concern of this paper is especially with the position of LDCs. Some of them have been vigorously against the OECD negotiations (Drabek, 1998).[11] The position taken by these LDCs during the OECD negotiations of MAI is at odds with some facts.

First, most countries, especially LDCs, seem to consider that the political costs associated with uncontrolled FDI inflows are largely outweighed by economic gains. In the last couple of decades, countries started to be keen on liberalizing investment. This is understood, for instance, by looking at the distribution of new policy measures towards FDI. During the nineties almost all countries shifted to more liberal policies (Table 1).

Regulatory changes	1992	1993	1994	1995	1996	1997	1998
More favorable to FDI	79	101	108	106	98	135	136
Less favorable to FDI	..	1	2	6	16	16	9

Table 1 : National Regulatory Changes, 1992-97
(Source, UNCTAD 1999, table IV.1, p. 115.)

Second, the objections to MAI are also hardly justified by the loss of discretion. Countries, in general, do not seem to escape from international commitments on FDI. We observe instead a recent surge of Bilateral Investment Treaties

[10] Overall, Markusen (1998b) assesses that MAI will probably bring more gains than losses to LDCs. He suggests however to leave out of negotiations matters related with intellectual property rights.

[11] In particular, India, Indonesia, and Malaysia were critical. The vigour with which the representatives of these countries reacted against the MAI draft can be found in the words of Manmohan Singh, the former Finance Minister of India : "*You have to remember our history as a colony. The East India Company came here as a trader and ended up owning the country.*" (The Economist, 1998).

(BITs), regional arrangements on international investment, and Double Taxation Treaties (DTTs).[12] While until the sixties there were no BITs in place, the number of BITs has risen to 1513 in 1997 and has been growing throughout all the nineties (see UNCTAD, 1998).

The puzzle is obvious. Most countries, including LDCs, are likely to benefit from investment liberalization. Even when LDCs estimate losses from entering an agreement on investment liberalization, they are free to opt out. Nevertheless, we observe countries (some LDCs especially) that are against the prospect of MAI, even when they do not consider to enter. What they do object is the eventuality that other countries form a club with liberal rules on investment.

In the following sections we present a model in which the choice of MAI membership for the single country involves the basic trade-off identified in Markusen (1998b) and the puzzle mentioned above finds a possible explanation.

3 The Model

3.1 The World Economy

We assume a world with many countries. For simplicity, we index countries by h on a continuum of unit measure. In the world, there is also a unit continuum of goods, indexed by i. Labor is the only production factor, and each country has the same endowment L. Labor is perfectly mobile across sectors or firms, and perfectly immobile across countries. Consumers are identical everywhere. They have Cobb-Douglas preferences described by the following utility function

$$U = \int_0^1 \ln C(i)\, di, \tag{1}$$

where $C(i)$ is consumption of good i. All goods are freely tradable, so, their price is equalized worldwide.

Production technologies are identical across sectors and countries. Each good can be produced either out of a CRS technology by competitive firms, or with an IRS technology by a monopolist.[13] Moreover, monopolistic firms can exploit their knowledge capital internationally by choosing the location of their operations. Consequently, we call these firms MNEs, henceforth.

3.2 MNEs

There is a one-to-one correspondence between sectors and MNEs. So, in the world there is a unit mass of MNEs, and the distribution of their "headquarters" across the world is exogenous and fixed. The share of MNEs having their home

[12] It also appears that the same countries that object MAI recently negotiated new BITs. An example is India (see The Economist, 1998).

[13] This set up is analogous to that used in Murphy, Shleifer and Vishny (1989).

country in country h is denoted by μ_h. MNEs repatriate all their profits to the home country.

Each MNE operates from a single plant, and is required to make a plant-level, cost reducing, investment I before starting production. Plants have a fixed size.[14] We assume that in each plant one unit of labor is turned into $1/c(I)$ units of whichever manufacture i. The higher the investment I, the lower is $c(I)$. Hence, the higher is the efficiency of the plant in transforming inputs into outputs. Investment expenditures consists of $\phi(I)$ units of labor.

Consider a MNE that has decided to locate its production facility for good i in country h (possibly its own home country). It has to solve a two-stage game. In the first stage, the MNE chooses how much to invest in order to reduce its unit production costs; in the second stage, the price for its good is set.

As for the second stage, recall that each MNE can produce and sell a given good i at a world-wide level using its IRS technology (trade is free). However, the same good can also be supplied by competitive firms belonging to any country using a CRS technology. We restrict the analysis to cases in which the labor supply L is sufficiently big to ensure that world demand of any good i is partly satisfied by the competitive fringe (recall that the employment size of MNEs is fixed). By choice of units, we assume that one unit of each good i is produced by competitive firms using one unit of labor in all locations. This implies that wages must be equalized across countries. Using labor as the numeraire, each manufacture i will be supplied by competitive firms at a unit-price. From the assumption of Cobb-Douglas preferences, monopolistic MNEs would like to charge an infinite mark-up over marginal costs in all markets. Hence, the only solution to the second stage of the MNE problem is the limit-pricing one: MNEs will fix a price equal to unity.

Turning to the first stage, the MNE sets its investment by equating marginal costs and marginal returns of investment. The costs are due to plant-level fixed labor expenditures. Once the investment is made, plant-level fixed costs are sunk. So, the investment "ties" the MNE to country h. The benefits of the investment are due to increased efficiency in production that results into a higher mark-up. The returns of investment are not fully appropriated by the MNE. Countries are able to appropriate part of the rents of MNEs. We assume that, because of unforeseeable contingencies, negotiations between MNEs and countries' representatives concerning rent division can only occur ex-post, once investment costs are sunk (incomplete contracting).[15] Thus, in deciding about the investment, the MNE knows that country h will extract a fraction β_h of its operating profits. This fraction represents the bargaining power of country h, and bargaining power differs across countries. We think of this rent extraction in a broad sense. Obviously, it can simply be interpreted as a tax on profit repatriation, but it can also include more indirect measures of rent sharing like

[14] The assumption that firms' size is given can be justified, for instance, on the ground of monitoring and coordination costs (see, e.g., Holmstrom and Tirole (1989)).

[15] See also Schnitzer (1999) for a formalization of the hold-up problem faced by MNEs vis-à-vis host countries.

performance requirements or other regulatory restrictions. [16]

Since perfect symmetry holds across sectors, we can omit index i and express the profits of a MNE in country h as follows

$$\pi_h = (1 - \beta_h)(1 - c(I))\frac{1}{c(I)} - \phi(I). \tag{2}$$

The lower the marginal cost in terms of labor units, the higher labor productivity and the output that firms can obtain $(1/c(I))$. As for $c(I)$ and $\phi(I)$, we assume, consistently, that $c' < 0$, $c(0) = 1$, and $\lim_{I\to\infty} c = 0$, and that $\phi' > 0$ and $\phi(0) = 0$. Moreover, in order to have a well behaved maximum problem we further assume that $\phi'' > 0$. For concreteness, we use the following functional forms that satisfy the above requirements: $c(I) = 1/(1 + I)$, $\phi(I) = (1/2)I^2$. Solving the MNE problem it is derived that $I = (1 - \beta_h)$. Notice that this solution is suboptimal: the MNE underinvests due to a hold-up problem. If the parties were able to contract ex-ante, the optimal investment would amount to $I = 1$, and they could reach a Pareto-superior solution. However, due to contract incompleteness, investment and total rents are suboptimal. Note finally that MNEs' profits can differ across countries only because of differences in bargaining power β_h. Moreover, this result will hold also allowing for any possible cross-country asymmetry resulting in productivity differences. The differential in productivity would be compensated by an equal difference in wages.[17]

3.3 Modeling MAI

Countries differ in their bargaining power with respect to MNEs. Though, it is not a-priori obvious which countries may be "high-beta" and which countries may be "low-beta" countries. Quite often, the actual (economic, fiscal, legal, administrative) costs of doing business in a country are only known ex-post, once negotiations with local authorities are dealt or establishments are set.[18]

Hence, we assume in the following analysis that β_h is revealed to MNEs only after their commitment to invest in country h. MNEs, however, know ex-ante how β_h is distributed across countries. For simplicity, we will assume a uniform distribution of bargaining power on the range $[\beta_l, \beta_u]$.

The MAI imposes a cost on joining countries. If a country decides to enter MAI, it has to accept a limitation of its own policy discretion vis-à-vis MNEs. We model this loss of discretion as a reduction in countries' bargaining power. The reduction is assumed to be of size γ, so that, if country h enters MAI, its bargaining power falls to $\beta_h - \gamma$.[19] We assume the reduction of bargaining

[16] Alternatively, in a broader framework, it can be thought as a share of MNE rents accruing to local factors when property rights are not fully enforced (see, e.g. Markusen (1998a)).

[17] So, as will be clear, the results that follow would hold also allowing for ex-ante cross-country asymmetries.

[18] Anecdotal evidence on MNEs that shut down operations in foreign countries or that regret about their FDI decisions is quite abundant.

[19] The assumption of a fixed loss of bargaining power matters for our results. Of course, in reality high-beta countries might be those that have to accept larger concessions. However,

power γ to be exogenously given. In the subsequent analysis the term γ will be referred to as the "strictness" of MAI. The higher is γ, the higher is the foregone share of FDI rents extracted by countries.

We can now describe the whole game. In the first stage, countries choose whether or not to participate in MAI and announce it to MNEs. In a second stage, firms choose in which country to locate without knowledge of β_h, but with knowledge of its distribution function. At this stage, firms have therefore only to choose whether to invest in a country that belongs to MAI or in a country that does not belong to it. MNEs may also randomize their choice, attributing a probability p to MAI members and a probability $(1-p)$ to countries that are not members. Since MNEs are ex-ante identical, this choice will be the same for all firms. In the third stage, the bargaining power of countries is revealed to MNEs, and investments are chosen. Finally, goods' prices are chosen.

Three remarks are in order. First, we restrict the analysis to cases in which the mass of labor in each country, L, is big enough not to be completely used up by MNEs located there. Second, note that the sequence of the first two stages is immaterial. Since countries are atomistic, they will not take into account the effects of their own actions on the behavior of MNEs. The solution is therefore *as if* countries and firms are acting together. Third, it is to be noted that in the present set-up countries will not be willing to signal their own bargaining power (for instance, through the use of subsidies) to MNEs.[20] The reason is that a separating equilibrium cannot be realized. The intuition runs as follows. Subsidy competition when β_h is known leads to a full transfer of FDI rents to MNEs. Countries with low bargaining power are bound to use subsidies of lower magnitude, if they want to break even. However, when β_h is unknown, countries with high bargaining power will surely mimic "low-beta" countries, using low subsidies.[21]

The objective of MNEs in the first stage is to choose the location of their plant (in a MAI or in a non-MAI country) that maximizes expected profits. Profits at this stage can only be defined in expected value because the bargaining power of the particular country chosen is still unknown. After having solved for the equilibrium in the last two stages of the game, the profits π_h of a MNE choosing to produce in country h belonging or not belonging to MAI are as follows

$$\pi_h = 0.5\left(1-\beta_h\right)^2, \tag{3}$$

$$\pi_h = 0.5\left(1-\beta_h+\gamma\right)^2. \tag{4}$$

as long as the reduction in bargaining power is less than proportional for high-beta countries, our results hold qualitatively unchanged.

[20] Bond and Samuelson (1986) find an opposite result. In that paper, firms are not informed about a productivity parameter characterizing countries. Countries with high productivity can then signal through subsidies and tax-holidays their superior business environment without fear of being jeopardized by low-productivity countries: a separating equilibrium exists.

[21] Note also that the only pooling equilibrium is with zero subsidies. The reason is trivial: with positive subsidies countries will only transfer resources to MNEs without affecting the probability of receiving FDIs.

Firms' profits decrease with β_h for two reasons. The higher is countries' bargaining power, the lower is the share of FDI profits repatriated by MNEs, and the lower is the amount of investment undertaken. This explains why any increase in β_h produces a more than proportional reduction in π_h. At given β_h, the participation in MAI is beneficial for MNEs because of the same reasons: larger repatriation of FDI profits and more abundant investment. Firms observe ex-ante MAI membership of all countries and know the distribution of β_h across countries. However, they are not able to associate country h with a value of β_h. Hence, firms can only form expectations on the profits that can be realized in countries belonging to MAI and in those that are outside of MAI. In the following, we denote, respectively, by Z and $-Z$ the set of MAI and non-MAI countries. The location decision of *each* MNE is therefore based on the comparison between $E_Z\pi \equiv E[\pi_h|h \in Z]$ and $E_{-Z}\pi \equiv E[\pi_h|h \in -Z]$, where $E[.|.]$ denotes the conditional expectations operator. One observes from (3) and (4) that locating in non-MAI countries could be preferable for firms only if the countries that belong to MAI have, on average, higher bargaining power. Only in this case we can have MNEs choosing $p = 0$. In case of indifference, $E_Z\pi = E_{-Z}\pi$, p may have any value between 0 and 1.

As for countries, they choose to participate in MAI only if this leads to higher expected income.[22] The choice of entering MAI matters for countries' expected income because this directly affects countries bargaining power, their ability to extract FDIs' rents, and the amount of investment undertaken by multinationals. Participation in MAI affects also countries' expected income indirectly, by shaping the expected FDI inflows. This occurs for two reasons. First, because MNEs attach different probabilities to the alternative of investing in MAI or in non-MAI countries. Second, because the mass of countries belonging to MAI may differ from that remaining outside of MAI. Denoting by z, $z \in [0,1]$, the fraction of countries joining MAI, the expected FDI inflows of an arbitrary country h if, respectively, participating and not participating in MAI are given by p/z and $(1-p)/(1-z)$. Expected income of country h in the two alternatives are easily obtained:

$$E_Z y_h = L + \left(\frac{p}{z}\right)(\beta_h - \gamma)(1 - \beta_h + \gamma) + \mu_h \Pi(p,z), \tag{5}$$

$$E_{-Z} y_h = L + \left(\frac{1-p}{1-z}\right)\beta_h (1 - \beta_h) + \mu_h \Pi(p,z), \tag{6}$$

where $\Pi(z)$ are the expected profits of a representative MNE, which in turn depend upon the values of p and z. The first term in (5) and (6) is labor income, the second term is the expected rent-extraction from MNEs locating in country h, and the last term are the aggregate expected profits repatriated from MNEs to country h. Note that since each country is atomistic, its decision

[22] Note that, given symmetric preferences and pricing, countries' income is also a utilitarian measure of countries' welfare.

about whether to enter MAI or not does not alter the last term in the sum of (5) and (6), i.e., expected repatriated profits are not affected. Note also that countries have no incentive to exert a bargaining power larger than a half. Above a half the loss of income from reduced investments weighs out the gains from an increased share of profits. Consistently, since countries are not obliged to exercise their bargaining power when this is unprofitable to them, we can fix henceforth $\beta_u = 0.5$.[23] From this follows that, at given z and p, *the stricter is MAI* (i.e., the higher is γ), *the lower is countries' rent extraction.* A higher γ not only reduces the share of rents appropriated by host countries but also raises investments undertaken by MNEs. However, since $\beta_h - \gamma < 0.5$, the first effect always prevails, and the term $(\beta_h - \gamma)(1 - \beta_h + \gamma)$ necessarily falls with γ.

4 Equilibrium Analysis

In this section, we analyze the location of firms and the choice of countries about their participation to MAI that emerge at equilibrium. MNEs are identical, and each is faced with the same problem. Their behavior is summarized by a probability p of locating MNEs in MAI countries. Countries instead differ among themselves, and may solve their problem differently. The strategy of a given country h is an element in $\{Z, -Z\}$. Countries' behavior is summarized by the fraction z of countries that decide to join the set Z of MAI members.

A Nash equilibrium of this game is defined by a pair of values (p, z), $p \in [0, 1]$ and $z \in [0, 1]$, such that no firm is willing to revise the probability of locating into MAI countries, and no country is willing to enter or exit MAI.

Consider first a sub-class of cases in which all countries can potentially agree on MAI, i.e., where $\gamma < \beta_l$. It is easy to ascertain (by inspection of (5) and (6)) that any candidate equilibrium enters one of the following characterizations:

i) "Full MAI", $p = 1$, $z = 1$, which occurs if and only if $E_Z\pi > E_{-Z}\pi$ and $E_Z y_h > E_{-Z} y_h$ for all h;
ii) "No MAI", $p = 0$, $z = 0$, which occurs if and only if $E_Z\pi < E_{-Z}\pi$ and $E_Z y_h < E_{-Z} y_h$ for all h;
iii) "Partial MAI", $p \in (0, 1)$, $z \in (0, 1)$, which occurs if and only if $E_Z\pi = E_{-Z}\pi$, $E_Z y_h > E_{-Z} y_h$ for some h and $E_Z y_h < E_{-Z} y_h$ for some other h.

To solve our game it is necessary to have a better description of the countries that are most keen to join MAI. The following Lemma allows a characterization of the countries that decide to be MAI members when the candidate equilibrium exhibits a partial MAI.

[23] As will be clear in the following analysis, what matters for our results is that $\beta_h \leq 0.5$ for all h, whereas the choice $\beta_u = 0.5$ only serves the scope of simplifying notations and the characterization of equilibrium.

Lemma 1 *If there exists* $\overline{\beta}$ *such that* $E_Z y_h = E_{-Z} y_h$ *for one* h*, then: i)* $E_Z y_h > E_{-Z} y_h$ *for all* h *such that* $\beta_h > \overline{\beta}$*; ii)* $E_Z y_h < E_{-Z} y_h$ *for all* h *such that* $\beta_h < \overline{\beta}$*.*

Proof: See Appendix 1.

The intuition of the above Lemma is straightforward. Countries with high bargaining power suffer less in relative terms from MAI membership compared to countries with low bargaining power. Since the loss of bargaining power associated with participation in MAI is fixed at γ, the percentage loss of bargaining power from MAI is lower for "high-beta" countries. This explains why those countries that are most willing to participate in MAI are characterized by high bargaining power. This result has important implications. At given β_h, MNEs always prefer to invest in a country that belongs to MAI. This is due to "*increased discipline"* associated with MAI: any country reduces by assumption its rent extraction rate, if it becomes MAI member. However, β_h is revealed to firms only ex-post, so that the location decision is determined on the basis of the comparison of conditional expected profits in MAI and non-MAI countries. Since countries participating in MAI tend to be characterized by high bargaining power, the decision to invest in MAI is also shaped by the extent of the *adverse selection,* that tends to reduce expected MNE profits in MAI and gives a reason for a possible preference for locating FDIs in non-MAI countries.[24] Note also that *the extent of the adverse selection is higher when MAI is small*, because in this case only countries with very high bargaining power are in MAI.

Lemma 1 permits a simple characterization of z as a function of $\overline{\beta}$. From the uniform distribution function of β_h across countries we obtain

$$z = \frac{\overline{\beta} - \beta_l}{0.5 - \beta_l}. \tag{7}$$

Whenever $\overline{\beta} \leq \beta_l$ the *candidate* equilibrium is necessarily a full MAI, whereas, if $\overline{\beta} \geq 0.5$ we can only have no MAI at equilibrium, finally, when $\beta_l < \overline{\beta} < 0.5$ we have a value of z consistent with a partial MAI equilibrium.

Next, we proceed by characterizing the conditional expected profits of MNEs with respect to the bargaining power of the indifferent country $\overline{\beta}$. MNEs form expectations on the profits they may earn in a given country h using the information revealed by its decision on whether to enter MAI or not. Using Lemma 1, conditional expected profits in a MAI and in a non-MAI country, respectively, are formed as follows:

$$E_Z \pi = \frac{0.5 \int_{\overline{\beta}}^{0.5} (1 - \beta_h + \gamma)^2 \, d\beta_h}{0.5 - \overline{\beta}} \quad \text{and} \quad E_{-Z} \pi = \frac{0.5 \int_{\beta_l}^{\overline{\beta}} (1 - \beta_h)^2 \, d\beta_h}{\overline{\beta} - \beta_l}. \tag{8}$$

[24] Adverse selection comes from the assumption of a fixed loss in bargaining power, which guarantees that the proportional loss from MAI membership is higher for low-beta countries. If the loss were proportionally higher for high-beta countries, the only possible equilibrium would trivially be with MNEs always investing only in MAI countries, and full MAI membership by all countries.

Denote by ΔE the difference $E_Z\pi - E_{-Z}\pi$ and by β^* the value of $\overline{\beta}$ that satisfies the equality $\Delta E = 0$. The behavior of MNEs' expected profits is summarized in the following Lemma.

Lemma 2 *i) β^* exists in $(\beta_l, 0.5)$ and is unique if $\gamma_l < \gamma < \gamma_u$, with γ_l and γ_u monotonically decreasing functions of the parameter β_l; ii) β^* is monotonically increasing with γ; (iii) consider $\overline{\beta} = 0.5$, then $\Delta E > 0$ if and only if $\gamma < \gamma_u$; (iv) consider $\overline{\beta} = \beta_l$, then $\Delta E < 0$ if and only if $\gamma > \gamma_l$.*

Proof: See Appendix 2.

Result *i)* in Lemma 2 states that an equilibrium with partial MAI is feasible only for intermediate values of γ. When γ is sufficiently small, ΔE is surely negative, because $\beta^* < \beta_l$. The adverse selection effect of MAI prevails in this case. Conversely, when γ is sufficiently high, then $\beta^* > 1/2$ and ΔE is necessarily positive. The discipline effect prevails. For intermediate values of γ the two effects may offset each other, and an indifference solution for countries may emerge, together with a partial MAI equilibrium. We also see from result *ii*) that the size of MAI at which expected MNEs in and outside MAI are equalized is decreasing with γ. This means that the size z of a partial MAI is necessarily decreasing with γ. Finally, results *iii*) and *iv*) are crucial in checking for pure strategy equilibria.

A different question is that of the characterization and uniqueness of partial MAI equilibria. We see from (7) that, given β^*, there is only one value of z in (0,1). It is proven also that there exists only one value of p that sustains an equilibrium with $z \in (0,1)$.

Lemma 3 *i) There exists a unique value of $p \in (0,1)$ that sustains a partition of countries $z \in (0,1)$; ii) p rises monotonically with z in $(0,1)$; iii) $\lim_{z\to 0} p = 0$ and $\lim_{z\to 1} p = 1$; iv) $p > z$.*

Proof: See Appendix 3

We remark on result *iv)* in Lemma 3. The fact that $p > z$ *in any partial MAI* equilibrium means that *by joining MAI, countries are able to attract more FDIs*. The mere fact that a country belongs to MAI reduces its bargaining power, rent extraction, and income. To induce some countries to be in MAI, there must be higher expected FDI inflows for the countries in MAI, in order to compensate for the loss in bargaining power. As will be clear in the next section, this has important welfare implications.

Lemmas 1 to 3 are sufficient to give a full characterization of the equilibrium, when all countries can potentially enter MAI. In the next Proposition, we characterize which types of equilibria emerge with respect to the strictness of MAI (γ).

Proposition 4 *Consider $\gamma < \beta_l$. Then: i) if $\gamma < \gamma_l$ the only equilibrium is "no MAI"; ii) if $\gamma > \gamma_u$ the only equilibrium is "full MAI"; iii) if $\gamma_l < \gamma < \gamma_u$ the equilibrium may either be "no MAI", "partial MAI", or "full MAI".*

Proof: See Appendix 4.

We can consider now all cases where $\gamma > \beta_l$. Clearly, all countries with $\beta_h < \gamma$ will not enter MAI, since they will not be able to extract any rent from MNEs. We have then to replace the notion of full MAI equilibrium with that of "*residual MAI*" equilibrium, namely, a configuration where $p = 1$ and where all countries with $\beta_h > \gamma$ are willing to enter MAI. By arguments analogous to those used for the cases where $\gamma < \beta_l$ we can characterize equilibrium with respect to γ in the following Proposition.

Proposition 5 *Consider $\gamma > \beta_l$. Then, there exists γ_L, $\gamma_l < \gamma_L < \gamma_u$, such that: i) if $\gamma < \gamma_L$ the only equilibrium is "no MAI"; ii) if $\gamma > \gamma_u$ the only equilibrium is "residual MAI"; iii) if $\gamma_L < \gamma < \gamma_u$ the equilibrium may either be "no MAI", "partial MAI", or "residual MAI".*

Proof: See Appendix 5.

Results in Propositions 4 and 5 can be summarized with the help of Figure 1. In general, we observe that *the size of MAI rises and then falls as it becomes stricter*. For sufficiently low values of γ the discipline effect of MAI is not strong enough to offset the adverse selection effect, and this explains why the only equilibrium tends to be the no MAI equilibrium. In this case, FDIs would be directed only to non-MAI countries, and no country would choose to enter the agreement.

Insert figure 1 about here

As γ rises, the emergence of partial MAI becomes possible. The adverse selection effect can be offset by the discipline effect. In this case, *coordination problems* are very strong. The extent of adverse selection depends upon the size of MAI. A large MAI has small adverse selection problems, and can be self-sustaining even if the discipline effect is not too big. Conversely, a small MAI will strongly suffer from adverse selection, and could end up being unsustainable even with a rather high discipline gain. This explains the coexistence of equilibria with no MAI and with full (or residual) MAI when γ has intermediate values. Note also that in this region the size of partial MAI shrinks as γ rises, because, by Lemma 2, the threshold value β^* rises. A further growth in the value of γ leaves full or residual MAI as the only possible equilibrium configurations; the discipline effect is prevailing. As γ rises further, though, the

size of MAI inevitably shrinks: the countries with the lowest bargaining power will drop out, because MAI is becoming too strict for them. Note also that, at given γ, the size of MAI tends to rise with β_l. As the average bargaining power of countries rises, it will be easier to realize a successful MAI. By the argument presented in Lemma 1, few countries will choose to stay outside of MAI at a given γ.

5 Welfare

In this section, we establish the welfare properties of the possible equilibrium configurations. We will limit the analysis to cases where $\gamma < \beta_l$, so that all countries are potential MAI members. We will ask in particular two questions. How does world-wide welfare change across the different possible configurations? Which countries are going to be better-off in a world with MAI compared to a situation where MAI is not in place?

By the choice of Cobb-Douglas preferences, and since all prices are 1, countries' welfare is just measured by their own expected income, and the utilitarian world welfare indicator corresponds to aggregate countries' income. The world welfare associated with an equilibrium MAI (p, z) writes as follows

$$\begin{aligned} W(p,z) &= L + \frac{p}{z} 0.5 \int_{0.5-(0.5-\beta_l)z}^{0.5} (1-(\beta_h-\gamma)^2) d\beta_h \\ &\quad + (\frac{1-p}{1-z}) 0.5 \int_{\beta_l}^{0.5-(0.5-\beta_l)z} (1-\beta_h^2) d\beta_h, \end{aligned} \tag{9}$$

where $0.5\left(1-(\beta_h-\gamma)^2\right)$ and $0.5(1-\beta_h^2)$ are the sum of country h rents and hosted MNEs' profits when country h is, respectively, in and outside MAI. It is easy to see that, whenever at equilibrium $z < 1$, world welfare can be improved upon by shifting some countries into MAI. This is checked by noting that

$$\begin{aligned} \frac{\partial W(p,z)}{\partial z} &= p \frac{(0.5-\beta_l)\left[1+4(0.5-(0.5-\beta_l)\,z)-6\gamma\right]}{12} + \\ &\quad + (1-p)\,\frac{(0.5-\beta_l)\left[2(0.5-(0.5-\beta_l)\,z)+\beta_l\right]}{6} > 0 \end{aligned} \tag{10}$$

The intuition is simple. Countries, when deciding upon entering MAI, just compare expected rent extraction from FDIs in the two alternatives. However, when participating into MAI, countries also boost the profits of hosted MNEs. Since this latter effect is neglected by countries, the size of MAI emerging at equilibrium is always suboptimal, except for the full MAI equilibrium.

The implementation of MAI improves world welfare as compared with a situation where MAI is not in place. The comparison between world welfare under full MAI and no MAI is readily obtained as

$$W(1,1) - W(0,0) = \frac{1}{4}\gamma[1+2(\beta_l-\gamma)] > 0, \tag{11}$$

while the welfare comparisons with the case of partial MAI are more involved.[25] Does this mean that all countries are always going to gain individually from MAI membership? Let's start by comparing the income of a generic country h in a world with full MAI with that it would achieve without MAI. One checks that country h gains from MAI provided the following condition is met

$$\mu_h > \frac{\gamma(1-2\beta_h+\gamma)}{\Pi^{FM}-\Pi^{NM}} = \frac{4(1-2\beta_h+\gamma)}{3-2(\beta_l-\gamma)} \equiv \mu_h^{FM}. \tag{12}$$

Observe first that μ_h^{FM} is always positive: countries can gain from MAI implementation only if they hold MNEs. Second, note that the cut-off value μ_h^{FM} falls with the bargaining power of country h and rises with γ.[26] This is because the percentage loss of bargaining power from MAI participation is lower for high-beta countries and because the impact on rent extraction associated with higher γ outweighs that on profit repatriation. Hence, in a full MAI equilibrium (that is realized by Proposition 5 for relatively high values of γ) those countries that are better off compared with a world with no MAI must hold a sufficient amount of MNE shares and are more likely characterized by a high bargaining power.

We compare now the welfare of countries in a world with no MAI and in one where partial MAI is in place. If country h is *not* joining MAI, it gains if and only if

$$\mu_h > \left(\frac{p-z}{1-z}\right)\frac{\beta_h(1-\beta_h)}{\Pi^{PM}-\Pi^{NM}} \equiv \mu_h^{PM_{-Z}}. \tag{13}$$

Again, since $p > z$ by Lemma 3, we see that countries need to hold some MNEs to gain from MAI implementation. Compared with full MAI, however, $\mu_h^{PM_{-Z}}$ rises with β_h. Now, in fact, we consider a country that does not belong to MAI. So, it is not losing bargaining power after the implementation of MAI. What happens instead is a loss of FDI flows due to the fact that h now is an outsider. So, the loss of rent extraction associated with the loss of FDIs is higher the higher its bargaining power.

When, instead, country h decides to join a partial MAI, it will gain compared with a situation in which MAI is not in place whenever

$$\mu_h > \frac{\beta_h(1-\beta_h)-\frac{p}{z}(\beta_h-\gamma)(1-\beta_h+\gamma)}{\Pi^{PM}-\Pi^{NM}} \equiv \mu_h^{PM_Z}. \tag{14}$$

From (14) it can be seen that a country might gain from MAI implementation even if it is not home of MNEs. In fact, as shown in Appendix 6, the threshold

[25] Unreported simulations show that, in all cases, full MAI is preferable to partial MAI which is in turn superior to no MAI. So, equilibria are welfare rankable.

[26] We see immediately that $\frac{\partial \mu_h^{FM}}{\partial \gamma} = 4\frac{1-2\beta_l+4\beta_h}{(3-2\beta_l+2\gamma)^2} > 0$.

value μ_h^{PMz} may in this case be negative. There are two conflicting forces that shape the value of μ_h^{PMz}: these can be seen in the numerator of its expression. On the one hand, the participation in MAI reduces the bargaining power of country h, so that, as for μ_h^{FM}, we need a country holding a larger share of MNEs the larger is γ to gain from a world with MAI. However, since $p > z$, by joining MAI a country will benefit compared with a world with no MAI just because of more abundant FDI inflows. We summarize the results of this section in the following Proposition.

Proposition 6 *i) Except for the case of "full MAI", the size of MAI emerging at equilibrium is always suboptimal; ii) When MAI is "full", single countries can gain from the implementation of MAI only if endowed with MNE shares; iii) When MAI is "partial", single countries have to hold MNEs to gain as outsider, while they can gain also without MNEs as insiders.*

The main message is that MAI rises world welfare without necessarily leading to a Pareto improvement. The implementation of MAI has three main effects: an *efficiency effect*, associated with a reduction in the hold-up problem, a *redistributive effect*, with a net average gain of MNEs vis-à-vis host countries, and a *FDI-redirection* effect, with MAI members receiving more inward investments. Countries that cannot benefit from repatriated MNE profits or bigger FDI inflows could end up being net losers after the implementation of MAI. In general, multilateral investment agreements produce externalities through the FDI-redirection effect. MAI losers may be willing to join MAI in any case: opting out will undermine FDI inflows. When a partial MAI is realized, those countries that opt out suffer from a reduction in FDI inflows; this loss can be compensated only by sufficient MNEs' holdings. Conversely, the countries that participate in a partial MAI can gain from larger FDI inflows even without MNEs' holdings.

6 Discussion

We have shown in the previous sections that the implementation of MAI is subject to coordination failures, and that in spite of the worldwide efficiency gain, Pareto improvements are not guaranteed with MAI. Some country might gain a lot, some other might lose. Coordination failures arise from the presence of an externality associated with the FDI-redirection effect of MAI. The fact that some countries agree to self-restrain from exerting bargaining power vis-à-vis MNEs tends to divert FDIs from other countries. This affects then the willingness of each country to enter MAI. The emergence of possible MAI losers comes from the unequal distribution of knowledge capital, and then MNEs, across the world. Some countries are the home of many giant multinational corporations, other countries instead are lacking knowledge capital and MNE holdings.

We have discussed our results in terms of two key parameters: the degree of MAI strictness, γ, and the distribution of countries bargaining power, as expressed by β_l. The implementation of MAI requires a sufficiently "severe" agreement: the loss of countries' bargaining power γ must be high enough. This is necessary to offset the adverse selection problem that arises with the implementation of MAI. Those countries that are more likely to trade off their bargaining power for greater FDI inflows are those with high β_h. MNEs then rationally expect the "MAI club" to be formed by countries that are, on average, more "greedy" than others. Doing business there would be profitable only if MAI members commit to self-restrain their bargaining power vis-à-vis MNEs sufficiently. We also see that the realization of MAI would be facilitated when β_l is high, namely, in a world where, on average, the balance of power is in favor of countries, and not of MNEs. The leverage of a MAI agreement in attracting FDIs will be higher under this scenario. At intermediate levels of γ and β_l the extent of coordination failures is particularly acute. There, results depend a lot on expectations and "political climate". If there is widespread presumption that a MAI agreement will be implemented, this expectation will be fulfilled; if expectations are pessimistic, no agreement will be reached.

We did not discuss so far the determination of γ, namely the strictness of MAI. Parameter γ in the analysis has been taken as exogenous. This corresponds to a situation where the design of the investment agreement is decided independently by a third party, for instance, an international agency, and proposed to countries, that independently may decide to participate or not. We know that high γ is needed for the realization of MAI. Hence, if an international agency can independently and optimally choose γ, it will choose a rather "severe" agreement. However, in many real world instances the determination of γ requires the consensus of countries, for instance through a voting procedure. If this is the case, the implementation of MAI may be hard to achieve without some form of side-payments to MAI losers (obtainable, for instance, by linking the negotiations of MAI with those on some other issue).[27] The reason is that some countries might anticipate that they will lose from the implementation of MAI, and will consequently oppose a strict MAI (high γ). In the absence of side payments, the realization of an agreement on FDIs will be easy only in a world where the distribution of MNEs is relatively equal across countries. However, in the light of the results in Proposition 5, we see that things are different in the case of bilateral or regional investments treaties. When the agreement is ex-ante restricted to a subset of countries, we can expect a relatively easy implementation of preferential investment agreements. Also the countries with few or no MNEs' holdings might anticipate to gain from the agreement because of more abundant FDIs inflows.[28] This might explain why we have observed

[27] See also Hoekman and Saggi (1999) for arguments in favor to linking multilateral investment agreements with negotiations on other issues in a "grand bargain".

[28] Bilateral investment treaties between developed and developing countries are indeed quite common. Morevoer, as in the case of Nafta, regional investment agreements may involve countries at different stages of development.

in recent times a strong opposition of some countries to the implementation of a world-wide MAI together with the proliferation of bilateral and regional agreements on international investment.

7 Conclusion

We have developed a model that gives a rational to both the desirability of MAI and the observed problems in its implementation. We have shown that the externalities arising from the FDI-redirection effects of MAI might explain the failure to implement MAI and the emergency of coordination failures that give rise to multiple equilibria. We have also shown that after the implementation of MAI some countries (either MAI members or outsiders) could lose. This might explain why we have recently seen some countries strongly opposing the mere proposal of MAI.

Our model is highly stylized. However, the main message is likely to remain unchanged in a framework where MNEs decide upon their locations taking into account countries' market size, factor prices, or trade barriers. We expect instead that a more sophisticated representation of the process of MAI implementation may affect our conclusions. Future work should check the robustness of our results when, for instance, MNEs are engaged in active lobbying, or when countries weigh differently the welfare of different agents when deciding about MAI membership.

A Appendix

A.1 Appendix 1. Proof of Lemma 1.

From the definition of $\bar{\beta}$ we have

$$\left(\frac{1-p}{1-z}\right)\bar{\beta}\left(1-\bar{\beta}\right)=\left(\frac{p}{z}\right)\left(\bar{\beta}-\gamma\right)\left(1-\bar{\beta}+\gamma\right). \tag{15}$$

Next, from the partial derivatives of expected countries' income with respect to β_h at given z and p

$$\frac{\partial E_Z y_h}{\partial \beta_h} = 0.5\left(\frac{p}{z}\right)(1-2\beta_h+2\gamma), \tag{16}$$

$$\frac{\partial E_{-Z} y_h}{\partial \beta_h} = 0.5\left(\frac{1-p}{1-z}\right)(1-2\beta_h), \tag{17}$$

we can establish that $\frac{\partial E_{-Z} y_h}{\partial \beta_h} < \frac{\partial E_Z y_h}{\partial \beta_h}$ if and only if

$$\left(\bar{\beta}-\gamma\right)\left(1-\bar{\beta}+\gamma\right)(1-2\beta_h) < \bar{\beta}\left(1-\bar{\beta}\right)(1-2\beta_h+2\gamma), \tag{18}$$

where (15) has been used in (16) and (17). Inequality (18) is clearly satisfied, since $\bar{\beta} < 0.5$ and $\beta_h < 0.5$ for all h. The result of Lemma 1 follows directly from (15) and (18). □

A.2 Appendix 2: Proof of Lemma 2.

Using (8) and developing integrals the difference $\Delta E = E_Z\pi - E_{-Z}\pi$ can be evaluated as follows:

$$\Delta E = \frac{-5+18\gamma+12\gamma^2+\bar{\beta}(2-12\gamma-4\beta_l)+12\beta_l-4\beta_l^2}{24}, \tag{19}$$

where $\beta_l \leq \bar{\beta} \leq 0.5$. It is easily checked that the value β^* that equates to zero ΔE is given by

$$\beta^* = \frac{1}{2}\frac{5-18\gamma-12\gamma^2-12\beta_l+4\beta_l^2}{1-6\gamma-2\beta_l}. \tag{20}$$

One can see from (20) that β^* as a function of γ has an asymptote in $\gamma = \frac{0.5-\beta_l}{3} \equiv \gamma^*$. Moreover, $\frac{\partial \beta^*}{\partial \gamma} = 6\frac{1-3\beta_l+2\beta_l^2+6\gamma^2+4\beta_l\gamma-2\gamma}{(1-6\gamma-2\beta_l)^2} \geq 0$ in the admissible range of β_l and γ, so that $\lim_{\gamma\to\gamma^{*-}}\beta^* = +\infty$, and $\lim_{\gamma\to\gamma^{*+}}\beta^* = -\infty$. Since, when $\gamma = 0$, β^* is always higher than $1/2$, we necessarily have that $\beta^* > 1/2$ for $\gamma < \gamma^*$.

Furthermore, one easily checks that when $\gamma = 1/2$, then $\beta^* = \frac{1}{2}\frac{7+12\beta_l-4\beta_l^2}{2+2\beta_l}$ is always larger than 7/4. Hence, there must exist γ_l and γ_u, $0 < \gamma^* < \gamma_l < \gamma_u < 1/2$, such that $\beta_l < \beta^* < 0.5$ if and only if $\gamma_l < \gamma < \gamma_u$. The values of γ_l and γ_u are found to be, respectively,

$$\gamma_l = \frac{1}{2}\beta_l - \frac{3}{4} + \frac{1}{12}\sqrt{\left(132\beta_l^2 - 276\beta_l + 141\right)}, \tag{21}$$

$$\gamma_u = -\frac{1}{2} + \frac{1}{6}\sqrt{\left(21 + 12\beta_l^2 - 30\beta_l\right)}. \tag{22}$$

Next, we see that

$$\frac{\partial \Delta E}{\partial \gamma} = \frac{3}{4} + \gamma - \frac{1}{2}\bar{\beta} > 0 \tag{23}$$

for $\bar{\beta} < 0.5$. Consider then $\bar{\beta} = 0.5$. In this case, $\Delta E = 0$ iff. $\gamma = \gamma_u$. Thus, by (23), it must be that $\Delta E > 0$ if and only if $\gamma < \gamma_u$. Likewise, consider $\bar{\beta} = \beta_l$. Then, $\Delta E = 0$ iff. $\gamma = \gamma_l$. Thus, by (23), it must be that $\Delta E < 0$ if and only if $\gamma > \gamma_l$. The above findings are summarized in Lemma 2. □

A.3 Appendix 3. Proof of Lemma 3.

Since $E_Z y_h = E_{-Z} y_h$ for the country with bargaining power β^*, we have that

$$\left(\frac{p}{z}\right)(\beta^* - \gamma)(1 - \beta^* + \gamma) - \left(\frac{1-p}{1-z}\right)(\beta^*(1-\beta^*)) = 0. \tag{24}$$

Solving (24) for p we obtain

$$p = \frac{z\beta^*(1-\beta^*)}{(\beta^* - \gamma)(1 - \beta^* + \gamma)(1-z) + z\beta^*(1-\beta^*)}. \tag{25}$$

It is directly seen from (25) that p is in the range $(0,1)$ for any z in $(0,1)$ and that $\lim_{z\to 0} p = 0$ and $\lim_{z\to 1} p = 1$. It can also be checked that since $\beta^* < 1/2$, then $p > z$. Finally, we can show that p is monotonically rising with z. To do that, we need to recall that $\beta^* = 0.5 - z(0.5 - \beta_l)$ (this comes from (7)). >From total differentiation of p with respect to z we have $\frac{\partial p}{\partial z} = p_z + p_{\beta^*}\beta_z^*$. Partial derivatives are easily evaluated as follows:

$$p_z = \frac{\beta^*(1-\beta^*)(\beta^* - \gamma)(1 - \beta^* + \gamma)}{\left[(\beta^* - \gamma)(1 - \beta^* + \gamma)(1-z) + z\beta^*(1-\beta^*)\right]^2} > 0, \tag{26}$$

$$p_{\beta^*} = \frac{-z\gamma(1-z)\left[(1-2\beta^*)(1+\gamma) + 2\beta^{*2}\right]}{\left[(\beta^* - \gamma)(1 - \beta^* + \gamma)(1-z) + z\beta^*(1-\beta^*)\right]^2} < 0, \tag{27}$$

$$\beta_z^* = -(0.5 - \beta_l) < 0, \tag{28}$$

which yield an unambiguously negative sign for $\frac{\partial p}{\partial z}$. Summing up results, we have Lemma 3. □

A.4 Appendix 4. Proof of Proposition 4.

By definition, the pure strategy equilibrium no MAI requires $p = 0$ and $z = 0$, so that in this case $\beta^* = 0.5$. This collection of strategies is a Nash equilibrium if and only if *i)* $E_Z\pi < E_{-Z}\pi$ and *ii)* $E_Z y_h < E_{-Z} y_h$ for all h. By Lemma 2, requirement *i)* is satisfied if and only if $\gamma > \gamma_l$, while *ii)* is necessarily true for $p = 0$ (this is checked by inspection of (5) and (6)).

The pure strategy equilibrium full MAI requires $p = 1$ and $z = 1$, so that in this case $\beta^* = \beta_l$. This collection of strategies is a Nash equilibrium if and only if *iii)* $E_Z\pi > E_{-Z}\pi$ and *iv)* $E_Z y_h > E_{-Z} y_h$ for all h. By Lemma 2, *iii)* is satisfied if and only if $\gamma < \gamma_u$, while *iv)* is necessarily true for $p = 1$ (check (5) and (6)).

The mixed strategy equilibrium partial MAI exists if, at $p \in (0, 1)$ and $z \in (0, 1)$, *v)* $E_Z\pi = E_{-Z}\pi$ and *vi)* $E_Z y_h = E_{-Z} y_h$ for one h. By Lemma 2, *v)* is satisfied if and only if $\gamma_l < \gamma < \gamma_u$, while, *vi)* is true by Lemma 3 . Results are summarized in Proposition 4. □

A.5 Appendix 5. Proof of Proposition 5.

When $\beta_l < \gamma$ it must be checked whether β^*, as given by (20), is still higher than γ. If this is not the case, then in the expression for ΔE in (19) $\overline{\beta}$ must be replaced by γ. It is straightforward to show that $\beta^* < \gamma$ if and only if $\gamma \in (\gamma^*, \gamma_L)$, where

$$\gamma_L = \frac{1}{4} \frac{5 - 12\beta_l + 4\beta_l^2}{5 - \beta_l}. \tag{29}$$

At $\gamma = \gamma_L$ we have that $\beta^* = \gamma$. Moreover, one checks that $\gamma_u > \gamma_L$ and that $\gamma_l \gtreqless \gamma_L$ if and only if $\beta_l \gtreqless \frac{8-3\sqrt{6}}{4}$.

Consider first $\beta^* > \gamma$, i.e., $\gamma \notin (\gamma^*, \gamma_L)$. Note that in this case Lemma 3 holds unchanged. An equilibrium with partial MAI requires $\gamma < \beta^* < 1/2$ which corresponds to $\gamma_L < \gamma < \gamma_u$ by the above argument and Lemma 2. By the same argument as in the proof of Proposition 4, $\gamma < \gamma_u$ is also necessary and sufficient for the emergence of a no MAI equilibrium. To check for the existence of an equilibrium with residual MAI, we have to check whether $\Delta E > 0$ when $\overline{\beta} = \gamma$. It is easy to show that a necessary and sufficient condition for an equilibrium with residual MAI is $\gamma > \gamma_L$.

Consider then $\beta^* < \gamma$, i.e. $\gamma \in (\gamma^*, \gamma_L)$. In such a case, there cannot be a partial MAI because there is no country with $\beta_h > \gamma$ that splits the set of potential participants into a subset of actual participants and one of outsiders. No MAI is surely an equilibrium, because $\gamma < \gamma_L < \gamma_u$. An equilibrium with

residual MAI is instead impossible, because, when $\gamma < \gamma_L$, it occurs that $\Delta E < 0$, when $\overline{\beta} = \gamma$. □

A.6 Appendix 6.

We prove here that there exist parameter constellations where countries gain from participating to a partial MAI compared with what they could get in a world without MAI. The condition for having a negative value for μ_h^{PMz} is

$$\frac{p}{z} > \frac{\beta_h(1-\beta_h)}{(\beta_h-\gamma)(1-\beta_h+\gamma)} \equiv \Omega_h. \tag{30}$$

We see that

$$\frac{\partial \Omega_h}{\partial \beta_h} = -\frac{\gamma[1+\gamma-2\beta_h(1-2\beta_h+\gamma)]}{[(\beta_h-\gamma)(1-\beta_h+\gamma)]^2} < 0. \tag{31}$$

Recall that by (25) of appendix A.3

$$\frac{p}{z} = \frac{\beta^*(1-\beta^*)}{(\beta^*-\gamma)(1-\beta^*+\gamma)(1-z)+z\beta^*(1-\beta^*)}, \tag{32}$$

where $z = \frac{0.5-\beta^*}{0.5-\beta_l}$. Note that $\lim\limits_{\beta^*\to 0.5} \frac{p}{z} = \lim\limits_{\beta_h \to 0.5} \Omega_h = \frac{1}{4(0.5-\gamma)(0.5+\gamma)}$. By evaluating the *total* derivative of $\frac{p}{z}$ with respect to $\beta^* = 0.5$ we find

$$\frac{\partial (p/z)}{\partial \beta^*}_{|\beta^*=0.5} = -\frac{1}{2}\frac{(1-2\beta_l)(1-2\beta_l-\gamma)}{\left(\frac{1}{4}-\frac{1}{2}\beta_l+2\beta_l\gamma^2-\gamma^2\right)^2}. \tag{33}$$

Since we are considering a partial MAI equilibrium, by Proposition 4 we need $\gamma_l < \gamma < \gamma_u$. The only ambiguous term in (33) is $(1-2\beta_l-\gamma)$, which is decreasing in γ. Plugging the highest possible value for γ (i.e., γ_u) into this term we find

$$1-2\beta_l-\left(-\frac{1}{2}+\frac{1}{6}\sqrt{21+12\beta_l^2-30\beta_l}\right), \tag{34}$$

which is always positive for $\beta_l < 0.5$. It follows that $\frac{\partial(p/z)}{\partial\beta^*}_{|\beta^*=0.5} < 0$. So, one can always choose a pair (γ, β_l) such that $\beta^* < 1/2$ and some countries with β_h sufficiently close to $1/2$ for which $p/z > \Omega_h$. □

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Figure 1

MAI equilibrium configurations

(NM=No MAI; PM= Partial MAI; FM=Full MAI; RM=Residual MAI)