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The effect of macroeconomic instability on FDI flows: A gravity estimation of the impact of regional integration in the case of Euro-Mediterranean agreements

Dalila Chenaf-Nicet

University of Bordeaux, LAREFI

Avenue Léon Duguit, 33008 Bordeaux, France

Dalila.chenaf-nicet@u-bordeaux.fr

&

Eric Rougier

University of Bordeaux, GREThA

Avenue Léon Duguit, 33008 Bordeaux, France

eric.rougier@u-bordeaux.fr

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GRETHA UMR CNRS 5113

Université de Bordeaux

Avenue Léon Duguit - 33608 PESSAC - FRANCE

Tel : +33 (0)5.56.84.25.75 - Fax : +33 (0)5.56.84.86.47 - www.gretha.fr

IDE, intégration régionale et instabilité macroéconomique: Une analyse gravitaire des pays MENA dans le cadre des accords Euro-Méditerranéens

Résumé

Afin de diversifier leurs risques, les entreprises confrontées à l'incertitude sur leur marché intérieur peuvent choisir d'augmenter leurs investissements à l'étranger en transférant la production vers des économies plus stables. En estimant un modèle de gravité de l'investissement direct à l'étranger (IDE) en provenance d'Europe et de la région méditerranéenne et à destination des quatre principaux bénéficiaires dans la région Afrique du Nord-Moyen-Orient (MENA) sur la période 1985-2009, cet article teste la mesure dans laquelle les entrées d'IDE sont affectées par la volatilité macroéconomique dans le pays d'origine et si les accords régionaux de commerce et d'investissement pourraient avoir augmenté la sensibilité des IDE à la volatilité macroéconomique dans le pays d'origine. Nous constatons que l'incidence de l'IDE entre deux pays augmente avec l'instabilité du PIB dans le pays source et avec la stabilité du PIB dans le pays hôte. En outre, les IDE vers les pays de la région MENA tendent à être contra-cyclique par rapport au cycle d'affaires du pays source. Nous constatons également que bien que la réactivité des IDE à l'incertitude macroéconomique des pays source ne soit pas conditionnée par des accords commerciaux et d'investissement Nord-Sud, cette réactivité devient négative pour l'intégration régionale Sud-Sud. Enfin, nous montrons que, bien que l'instabilité du pays d'origine compte certainement pour expliquer les flux bilatéraux d'IDE dans notre échantillon, son impact est plus limité lorsque les investissements sont dictés par les différentiels de coûts, ce qui est le cas pour les IDE vertical.

Mots-clés : Volatilité du PIB, IDE, modèle gravitaire, Union Européenne, Afrique du nord et moyen orient, intégration régionale, traités d'investissement bilatéraux, IDE horizontal, IDE vertical

The effect of macroeconomic instability on FDI flows: A gravity estimation of the impact of regional integration in the case of Euro-Mediterranean agreements

Abstract

In order to diversify their risks, firms facing uncertainty in their domestic market may choose to increase their investment abroad by transferring production to more stable host economies. By estimating a gravity model of foreign direct investment (FDI) flows from Europe and the Mediterranean region to the four main recipients of FDI in the Middle East and North Africa (MENA) region from 1985 to 2009, this article tests (1) the extent to which FDI inflows are affected by macroeconomic volatility in the source country and (2) whether regional trade and investment agreements could have increased this FDI sensitivity to source country's macroeconomic volatility. We find that the incidence of FDI between two countries increases with source GDP instability and with host GDP stability. Moreover, FDI to MENA countries tends to be countercyclical with respect to the source country's business cycle. We also find that although FDI reactivity to host country's uncertainty is not conditioned by North-South trade and investment agreements, it becomes negative for South-South regional integration. Last, we show that although the source country's instability certainly matters when explaining bilateral FDI flows in our sample, its impact may be less important when investments are driven by cost differentials, that is, for vertical investment.

Keywords: Output volatility, FDI, gravity model, source country instability, European Union, Middle East and North Africa, regional trade integration, bilateral investment treaties, horizontal FDI, vertical FDI

JEL: F21, F43, F4

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GRETHA UMR CNRS 5113
Université de Bordeaux
Avenue Léon Duguit - 33608 PESSAC - FRANCE
Tel : +33 (0)5.56.84.25.75 - Fax : +33 (0)5.56.84.86.47 - www.gretha.fr

1. Introduction

Foreign investment is supposed to convey positive effects, such as technological upgrading and trade expansion, to developing economies. Attracting FDI from multinational corporations (hereafter MNCs) has therefore become a priority goal of most developing countries. Nonetheless, although labor-abundant Middle East and North African (MENA) countries have made significant efforts, since the mid-nineties, to increase their attractiveness through adjustment, stabilization, and liberalization policies, they still receive few FDI flows when compared to other low- and middle-income economies.[1] Weak institutional governance and limited market size have been pointed by many studies as good candidate explanations for these disappointing outcomes (Malik and Awadallah, 2013; Chenaf-Nicet and Rougier, 2011). However, during the 1990s, MENA countries deeply reformed their institutions and opened up their economies to foreign trade and investment notably via various South-South (GAFTA, AMU) and North-South (Euro-Mediterranean) trade agreements (Alaya et al., 2009; Mina, 2012). As a result, although FDI inflows have been significantly augmented for the four main MENA recipient countries during the two last decades, FDI instability has simultaneously been amplified (UNCTAD, 2009).

We argue in this article that source countries' macroeconomic conditions influencing the decision of MNCs to invest abroad should be more closely investigated to understand the patterns of FDI flows to the Arab region. Over the last three decades, MENA economies, especially the labor-abundant ones, have become increasingly dependent on the European MNCs investment to modernize their productive structures and provide jobs to their educated workers[2]. Like all MNCs, European firms partially determine their investment decision by considering the demand conditions on their domestic market, with horizontal investment being stimulated by a more unstable demand home. Moreover, this dependence of FDI inflows to MENA on European demand instability has probably gone stronger as trade integration between the two regions got deeper over the last two decades. As a direct effect, the size and steadiness of European FDI flows to the MENA region have become increasingly dependent on the source countries' macroeconomic volatility.

Our aim in this article is to test this assumption by identifying the determinants of FDI flows going to MENA economies, not from the point of view of their own factors of attraction but rather by focusing our analysis on the way macroeconomic instability in source countries may condition them. In other words, we seek to identify how FDI reacts to the source country's macroeconomic conditions, which may increase uncertainty for their MNCs, and to the synchronization of business cycles in home and foreign economies. We also address the conditioning impact of regional trade integration, between European and MENA economies and between MENA economies, on this reaction.

In our article, macroeconomic uncertainty is assessed by the three-year GDP volatility measuring short-term demand instability. Demand instability is supposed to have either a positive or a negative impact on FDI flows.[3] On the one hand, firms facing increasing demand uncertainty at home may be willing to invest abroad in order to diversify their portfolio of consumption markets and to limit their exposure to the risk of instability of their revenue on their domestic market. On the other hand,

[1] Moreover, they still fail to experience the technological spillovers they initially expected. Sadik and Bolbol (2001) explained this fact by the nature of FDI inflows, mostly resource-based, during the 1990s. Chenaf-Nicet and Rougier (2011) have provided evidence based on more recent data that this failure could be because of the low absorption capacities of poorly innovative MENA economies.

[2] FDI sourced in Gulf countries has also become increasingly strategic for MENA countries. However, we don't introduce it into our estimations since it is a more recent phenomenon on which we lack of a sufficiently long time perspective.

[3] Productivity shock may also spur GDP trend instability over the longer run, but we don't measure and address this dimension in our article. Moreover, we also control for the productivity shocks that may condition vertical investment by introducing a proxy for the cost differential between the source and the host countries.

seeking lower production costs abroad through vertical investment may help maintaining MNCs' margins, despite the instability of demand in home markets. Conversely, during a period of higher revenue instability in their home market, firms may nevertheless be unable to invest abroad because of financial restrictions[4]. Even though the sign of the effect of GDP volatility on FDI is thus a priori uncertain, we could anticipate that, if MNCs are not financially constrained, both horizontal and vertical FDI would be increased by higher demand instability home.

Understandably, governments in developing host countries have no direct influence over source countries' macroeconomic conditions. Trade and investment regional integration policies may, nevertheless, condition the extent to which FDI inflows to the host country react to the uncertainty to which the MNCs are exposed in their home country. Deeper trade integration between source and host countries, notably via bilateral investment treaties (BITs) and free trade agreements (FTAs), may well magnify the impact of source countries' volatility on FDI outflows by reducing the costs of reallocating production abroad and re-exporting from abroad. By reducing taxation and transaction costs, regional integration may lessen, for a given level of macroeconomic risks, the average risk threshold below which MNCs would accept to invest abroad. For instance, higher trade and investment integration may ease production relocation abroad in the case of increased uncertainty in the home market, therefore stimulating FDI outflows to the more stable host economies of the trading zone. We thus test if trade agreements involving MENA countries – notably but not exclusively with European countries – have worked as a magnifying force and increased FDI responsiveness to external macroeconomic conditions or, on the contrary, if they have reduced it by promoting the substitution of direct trade to horizontal FDI.

Although the determinants of FDI concerning the host country are now well known,[5] those concerning the source country's macroeconomic characteristics have seldom been studied.[6] In particular, the sensitivity of FDI to uncertainty in the source country has hardly been investigated so far, even though this issue is certainly of considerable importance for those developing countries whose external balance of trade and financing of growth rely heavily on foreign capital inflows. Several studies have sought to explain aggregate FDI outflows or inflows by aggregate measures of global instability (Albuquerque et al., 2005; Méon and Sekkat, 2012). However, using such aggregate measures does not enable addressing the source country's macroeconomic characteristics, which may condition FDI. Indeed, very few papers have tried to address the impact of the source country's macroeconomic conditions on bilateral flows. By estimating a gravity model of bilateral FDI flows between OECD economies covering the 1985-2007 period, Cavallari and D'Addona (2013) have found that FDI has tended to increase when the source country had higher output volatility. Focusing on North-South FDI, Levy-Yeyati et al. (2007) have estimated a gravity model and found that FDI sourced in Europe and the United States tended to be countercyclical with respect to both output and interest rate cycles in the source country. According to the authors, investor arbitrage among different investment opportunities explains that FDI outflows and local investment tend to move in opposite directions during cycles in the United States and Europe. We can see that FDI sensibility to a source country's output instability and business cycle are two important issues for whoever wants to understand FDI instability. To our knowledge, the conditioning impact of trade integration on the macroeconomic volatility–FDI relationship has never been tested thus far.

By estimating a gravity model of foreign direct investment (FDI) flows from Europe and the Mediterranean region to the four main recipients of FDI in the Middle East and North Africa (MENA)

[4] On the revenue and substitution effects of output instability, see Nicet-Chenaf and Rougier (2014).

[5] Good institutions, a low-cost and highly productive workforce, the availability of natural resources, and market size are, among other things, key determinants of between-country differences in the attraction of FDI. See Bloningen (2005) for an overview of the literature on the determinants of FDI.

[6] For recent empirical analyses of the adverse effects of macroeconomic volatility on economic development, see Loayza et al. (2007). Lensink and Morrissey (2006) have shown that economic growth is more reactive to FDI volatility than to FDI levels.

region from 1985 to 2009, we fill this literature gap and find evidence that the incidence of FDI between two countries increases with source GDP instability and with host GDP stability. Moreover, FDI to MENA countries tends to be countercyclical with respect to the source country's business cycle. We also find that although FDI reactivity to host country's uncertainty is not conditioned by North-South trade and investment agreements, it becomes negative for South-South regional integration. Last, we show that although the source country's instability certainly matters when explaining bilateral FDI flows in our sample, its impact may be less important when investments are driven by cost differentials, that is, for vertical investment. In a nutshell, our estimations show that, in our sample of countries, FDI tends to flow from the more volatile source countries to the less volatile host countries and that the sensitivity of these FDI flows to source country volatility is, as expected, affected by trade integration and by the type of investment.

The remainder of this article is organized in five sections. Section 2 draws our main assumptions from the relevant literature and Section 3 discusses the indicators of macroeconomic instability selected for the empirical study and the estimation strategy. In Section 4, we first present and then discuss the results of our gravitational model panel data estimation, paying specific attention to source countries and to several issues relating to the robustness of our results. Section 5 discusses robustness checks and Section 6 concludes.

2. FDI, uncertainty, and trade integration: Hypotheses and existing empirical results

Does FDI increase or decrease with source country demand volatility? Does trade integration amplify or mitigate FDI sensibility to source country's instability? This section investigates theoretical and empirical works that will help formulating the paper's empirical approach.

Although the theoretical predictions concerning the impact of source country demand instability on FDI are not convergent, they tend to predict a positive impact of source country's demand instability on FDI, notably when firms are not financially constrained.

In a model where the multinational making investment decisions faces demand shocks, Aizenman and Marion (2004) have shown that higher volatility of demand reduces the expected profit associated with both horizontal FDI and vertical FDI. They describe the specific mechanisms underlying the adverse FDI impact of demand shocks and claim that they are applicable for both horizontal and vertical FDI. However, their prediction of a systematically adverse impact relies on strong restrictions[7] and they assume a multiplicative demand instability combining instabilities on both home and foreign markets. Their prediction is therefore not relevant for our purpose since we aim at isolating the FDI effect of source country's demand volatility.

If we want to make the distinction between source and host country's demand conditions, we must consider that the decision to invest abroad in response to macroeconomic uncertainty, and the ensuing level of FDI flows between two countries, is in fact the result of two simultaneous decisions of investment under uncertainty in home and foreign markets. Firms actually choose whether they will invest or not, and whether they will invest in home or in foreign economies. According to the standard option-pricing analysis of investment under uncertainty, the return threshold that is required for performing an irreversible investment, that is, an investment characterized by positive sunk cost and low convertibility or liquidity, increases with uncertainty at home (Dixit, 1989; Dixit and Pindyck, 1994; Marschak, 1949). In a context of increasing uncertainty concerning home demand,

[7] They assume that profits are concave with respect of the demand shocks. A positive demand shock, by inducing tensions on the supply-side of the market, will increase price and may therefore reduce future sales and profits of firms, especially for sectors such as manufacturing that feature high price elasticity. A negative demand shock will cut profits by adversely affecting the current amount of sales, provided that the positive effect of decreasing prices on sales remains limited (Aizenman and Marion, 2004: 131).

delaying investment may therefore constitute an optimal strategy for a firm because waiting for new information potentially raises the investment's expected value (Bernanke, 1983; McDonald and Siegel, 1986; Pindyck, 1988). Delaying investment therefore may turn out to be a valuable option for the MNC reacting to the anticipated instability of its expected profits by holding back on all its investment projects, including planned foreign investment (Aizenman, 2003; Wang and Wong, 2007)[8]. In the context of internationally integrated economies, however, if macroeconomic uncertainty is lower in the foreign economies with which the home economy trades, investing abroad may constitute an additional option, besides delaying domestic investment, available to the firms experiencing uncertainty in their home market (De Brito and De Mello-Sampayo, 2005).

When uncertainty is lower in the foreign than in the home economy, however, setting up a subsidiary abroad may constitute a possible alternative to delaying investment. In a nutshell, a firm will be particularly responsive to demand uncertainty in the source country when it decides *ex ante* to invest abroad or not, and simultaneously to uncertainty in the host country when it comes to choosing in which country to invest[9]. Moreover, since risk-reducing FDI might increase when the home and foreign short run business cycles are negatively correlated, FDI outflows accordingly may be higher from more volatile home countries, while FDI inflows may be higher for those host economies where uncertainty is the lowest.

These theoretical predictions have hardly been empirically tested thus far. Cavallari and D'Addona (2013) have found that FDI between OECD countries tended to increase during the period from 1985 to 2007 when the source country had higher output volatility. Although Cavallari and D'Addona (2013) do not specify the type of investment for which their results hold, we may assume that it is essentially North-North FDI, which is mostly horizontal. By estimating a gravity model of North-South FDI, however, Levy-Yeyati et al. (2007) have found evidence that FDI flows tend to be countercyclical with respect to output cycles in the United States and Europe. These results would confirm that investors choose between investment options at home and abroad on the basis of the volatility differential between the source and host economies.

An additional issue raised by the latter study concerns the conditioning impact of trade integration. Levy-Yeyati et al. (2007) finds evidence that recessions in industrial countries are likely to increase FDI flows to developing countries with close ties to the United States and Europe. This latter result suggests that FDI sensibility to uncertainty may well be magnified when the host and source economies are interlinked by trade or investment treaties. It is now well documented that FDI tends to be triggered by global (Büthe and Milner, 2008) as well as by regional (Busse et al., 2010; Daude et al., 2003; Medvedev, 2012) trade integration. Stein and Daude (2007) and Jaumotte (2004) have provided convincing evidence of this positive effect in the case of both North-South and South-South trade agreements. Similarly, bilateral investment treaties have positive effects on FDI inflows to developing economies in general (Desbordes and Vicard, 2009) and to MENA economies in particular (Mina, 2012). In addition, RTAs offering more liberal rules for admission and provisions for foreign investment logically have a higher positive impact on FDI (Berger et al., 2013). Lower tariffs and regulatory obstacles between two countries may be favorable to vertical FDI because the cost of importing components and re-exporting is minimal and, on the contrary, detrimental to horizontal FDI by enabling trade substitution for FDI (Caves, 1996; Markusen, 1984, 2002). As for horizontal investment, it may be affected differently by trade integration (Markusen and Maskus, 2001). First, this type of FDI is essentially relevant to countries with similar characteristics. Second, it may be

[8] Of course, this prediction assumes that firms are not financially constrained as a consequence of growing uncertainty home.

[9] When choosing the localization of its foreign investment, the MNC will therefore consider the host country's characteristics in terms of average growth and instability in the case of a horizontal investment and in terms of costs in the case of vertical investment. See de Mello-Sampayo et al. (2010) and Brandão de Brito and de Mello-Sampayo (2005) for two recent theoretical and empirical analyses of the option theory applied to FDI.

adversely affected by trade integration because trade costs reduction may prompt onshoring and exporting.

The net conditioning impact of free trade agreements on FDI responsiveness to demand instability may therefore depend on the dominant form of FDI. Because it might be more vertical than horizontal (Bloningen and Wang, 2005), European investment to MENA might react differently to source volatility than South-South investment, which is more likely to be horizontal. We will control for these two possible regimes in this article's estimations.

3. Methodological issues

In order to assess FDI responsiveness to source country instability, we use a gravity model that links thirty-two countries that were, during the period 1985–2009, sources of investment to the four largest recipient countries in the MENA region (Egypt, Morocco, Tunisia, and Turkey).[10] MENA countries are particularly concerned by the trends described in this article because they have had to overcome a significant increase of inward FDI levels after the 1995 Barcelona Agreement (Chenaf-Nicet and Rougier, 2014a, 2014b), their economies becoming increasingly dependent on FDI sourced in European economies as well as in other countries of the MENA region. We expect that European investment to MENA economies may have become more reactive to source macroeconomic conditions with the extension of regional trade integration as well with the bilateral trade agreements between these two regions. Insofar as the source countries of our sample include the European Union (EU) economies, plus the MENA countries (Mauritania, Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Syria, and Turkey), our sample encompasses both North-South and South-South trade agreements and resulting flows of FDI.[11]

Because cross-sectional or time series studies of FDI determinants are constrained by their framework to use a single average measurement of external conditions, thereby failing to address source-related determinants of FDI,[12] we had to use a gravity model to properly assess source-related macroeconomic determinants of FDI levels. The gravity model is increasingly used to explain bilateral flows of FDI because it enables the effect of host country characteristics on FDI to be differentiated according to a series of distance-related factors.[13] Gravity models consider that capital flows between a pair of countries increase as a function of their national incomes (measured by GDP per capita) and decrease as a function of the distance between them (measured by the kilometric distance between countries). Control variables that relate to origin or destination individual countries can be incorporated into the equations of gravity models. These control variables enable multilateral resistance factors to be taken into account. Resistance factors explain why natural relationships can be blocked even when countries are close (Anderson and Van Wincoop, 2003). They include the existence of special transaction costs, capital movement controls, information costs, trade or monetary agreements, or differences in commercial practices and in languages. Empirical studies inspired by the works of Anderson and Van Wincoop (2003) and Anderson (2011) generally use an equation of the form:

[10] Even though Algeria is also a big FDI recipient, this country was not included in the host country sample because inward FDI is highly concentrated on oil and is likely to adopt a very different pattern. MENA Gulf countries are therefore considered neither as host nor as source countries in our analysis because they are not as closely associated with European trade and investment as Mediterranean ones.

[11] The list of countries included in the panel is presented in Appendix 2, Table A2.

[12] Méon and Sekkat (2012) is a recent illustration: they proxy external macroeconomic volatility using an aggregate ratio of world FDI to world GDP.

[13] Gravity models are inspired by equations of gravity in physics that relate the force with which two bodies attract each other proportionally to the product of their masses and inversely to the square of the distance between them (Frankel, 1997). For a theoretical analysis of gravity models in economics, see Anderson (1979). For recent studies using gravity models to analyze FDI flows, see Bevan and Estrin (2004), Busse et al. (2010), Desbordes and Vicard (2009) and Frenkel et al. (2004).

$$G_{ijt} = \left[g * \frac{M_{it}^{s_i} * M_{jt}^{s_j}}{d_{ij}^{n}} \right] * \sum_{ijt} exp^{\theta_{ij} * T_{ijt}} \quad (1)$$

where d_{ij} is the kilometer distance between countries *i* and *j*, M_{it} and M_{jt} are attraction variables such as economic size of markets, T_{ijt} are resistance factors, and s_i, s_j, and θ_{ij} are parameters to be estimated.

To be tested with standard estimators, Equation (1) has to take a linear form. Log linearization is a robust method (Deardorff, 1998) if the dependent variable does not take the value 0 and if there are no heteroskedasticity problems (Arvis and Shepherd, 2013; Burger et al., 2009; Gómez-Herrera, 2013; Santos Silva and Tenreyro, 2006).[14] When log-linearized, Equation (1) becomes:

$$LogG_{ijt} = Log(g) + S_i Log(M_{it}) + S_j Log(M_{jt}) - nLog(d_{ij}) + \sum_{ijt} \theta_{ij} * T_{ijt} + \varepsilon_{ijt} \quad (2)$$

where log(g) is a gravitational constant, M_{it} and M_{jt} represent the economic size of countries *i* and *j*, s_i and s_j are positive coefficients (attractive strength), and n a negative coefficient (repulsive strength). The sign of θ_{ij} depends on hypotheses about variable $T_{ijt,}$ which may be resistance factors such as differences in language, practices, the existence of capital flow controls, taxes on capital flows, the presence or absence of bilateral or multilateral agreement, exchange rate risk, and so on. The expression ε_{ijt} is a white noise. When masses and observable elements of multilateral resistance are formally expressed, Equation (2) becomes:

$$Ln(FDI_{ijt}) = \alpha + \beta_1 Ln(GDP_{it}) + \beta_2 Ln(GDP_{jt}) + \beta_3 Ln(D_{ij}) + \beta_4 Source\ instability_t + \beta_5 Host\ instability_t + \beta_6 RTAs_{ijt} + \beta_7 BITs_{ijt} + \beta_8 Institutional\ profile_{jt} + u_i + u_j + v_t + \varepsilon_{ijt} \quad (3)$$

where FDI_{ijt} represents the value in dollars of the inflows of FDI from a country *i* (source country) entering country *j* (host country) at time *t.*[15] If we now consider the right-hand side of equation (1b), $Ln(GDP_{it})$ and $Ln(GDP_{jt})$ stand for the natural logarithm of GDP levels of the source and host countries, respectively, and β_1 and β_2 take a positive sign if there is a "mass" effect operating in determining bilateral direct investment flows. By extension, higher host country GDP is generally considered to increase horizontal FDI because the size of the local market is worth being served by a multinational firm's production subsidiary.

D_{ij} is the vector of the various concepts of distance controlling for the most typical sources of transaction and transport costs involved in an investment moving from one country to another. The physical bilateral distance (*distance*) corresponds to the distance between the countries' capitals; FDI is generally taken as being inversely proportional to the distance between the two countries involved. However, when the host country shares a common border, language, or a former colonial link with the source country, it is generally considered that FDI will be higher. We use also two variables noted *adjacency* and *common language,* which take the value 1 if the source and host countries respectively share a common border or have a common language; otherwise, they take the value 0.[16] The variable *past colonial links* takes value 1 if the source country had colonized the host country, and 0 otherwise.[17]

In the literature, demand volatility is generally measured as the standard deviation of the annual growth rate of GDP within a rolling five-year window (Aghion and Banerjee, 2005; Aizenman and Ito,

[14] In our calculations we tested for the presence of any heteroskedasticity problem with the Breuch-Pagan test and when we detected heteroskedasticity we estimated a robust OLS equation using White's correction.
[15] Data sources and definitions can be found in Appendix A1.
[16] Bénassy-Quéré et al. (2007) and Abderrezak (2008) have provided evidence supporting the view that former colonial links, through the institutional, linguistic, and cultural proximities that they produce between source and host countries, may have a positive influence on the creation of international trade or FDI networks.
[17] It should be noted that *past colonial links* is a good proxy for legal origin, which appears to be significant in explaining bilateral portfolio investment flows (Lane and Milesi-Ferretti, 2008) as well as bilateral FDI flows (Daude and Stein, 2007).

2012; Blanchard and Simon, 2001; Ramey and Ramey, 1995). Other methodologies exist although they are less common and straightforward. A measure of GDP growth volatility based on the standard deviation of the output gap has also been applied, but it is reported to overestimate short-term volatility (Kent et al., 2005). Aizenman and Marion (2004) use the standard deviation of the innovation from a first-order autoregressive process based on twenty years of annual data. This approach requires a sufficiently long series of past data in order to be able to estimate autoregressive processes for the first sample years, which is not our case. In our study, for each time period, *host* and *source instability* were calculated as the standard deviation of GDP growth. Mean and standard deviation values at time *t* have been computed as a five-year moving average over *t-4*, *t-3*, *t-2*, *t-1,* and *t*. We have supposed that investors observe short-term past volatility and compare it for different potential destinations. In order to avoid a null average value, we have chosen to compute absolute values of standard deviations and then to express them in logarithmic form.[18] As argued, FDI inflows also depend on the characteristics of the source country and source region in terms of GDP growth instability. The expected sign of the *source instability* coefficient was discussed in the previous section. It may be positive if FDI is countercyclical or if MNCs choose to invest abroad instead of simply delaying domestic investment when source country's demand instability increases. We can anticipate that the coefficient for *host instability* could be either negative or positive, but the opportunity-driven positive effect seems to be plausible for MENA economies, given the nature of the foreign investments they tend to attract.

As for the factors associated with trade and investment integration, two variables have been introduced. *RTAs* is a vector of dummy variables measuring each pair of countries' participation in a regional trade agreement or investment treaty. This means that prior to the agreement being effective, the dummies take the value 0. For each consecutive year, the value 1 is given to the FDI flow whose source and host countries are bound by an active RTA. Because our study uses a sample of both MENA and European countries, we explicitly introduce controls for membership of three regional trade agreements (*GAFTA*, *AMU,* and Euro-Mediterranean Free Trade Area*,* noted as *MED*). The perimeter and content of these three RTAs are fairly different. AMU (for Arab Maghreb Union) is the oldest trade agreement among MENA countries. It was originally designed in 1989 to prepare for an economic and future political unity among the Arab countries of North Africa (Algeria, Libya, Mauritania, Morocco, and Tunisia) but has remained fairly ineffective because of political tensions and rivalries. GAFTA (for Greater Arab Free Trade Area) was introduced in 1997 through an initiative made by the Arab League. The agreement involved progressive reductions in customs duties and was extended to the gradual elimination of trade barriers among seventeen Arab countries (Algeria, Bahrain, Egypt, Iraq, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates, and Yemen). The Euro-Mediterranean Free Trade Area (EMFTA) is a free trade zone, introduced by the Barcelona Agreement adopted in 1995, which is built through (1) a series of bilateral free trade agreements between the European Union and each state bordering the Mediterranean and (2) horizontal free trade agreements between the non-EU Mediterranean countries themselves, such as the Agadir Agreement, which came into force in March 2007. The MENA countries involved are Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestinian Territories, Syria, Tunisia, and Turkey. Here, we focus exclusively on bilateral trade agreements between the European Union and the MENA individual host countries of our sample because they are often associated with increased export-processing FDI. Likewise, *BITs* is a vector of dummy variables measuring each pair of countries' participation in an FDI agreement. These agreements cover both bilateral and multilateral (regional) agreements such as those associating the European Union with each MENA host country. Data on both *RTAs* and *BITs* are taken from UNCTAD.

[18] Although *source instability* is not likely to be endogenous to FDI levels, host volatility theoretically may be affected by the contemporary level of incoming FDI. To limit this risk, *source instability* in period *t* is computed as a three-year moving average including periods t-3, t-2, and t-1. The same lags have been used to compute all our average variables: MENA instability, MENA growth, and European instability.

Last, because investment decisions made by MNCs generally use a global evaluation of host country business regulations (Ali et al., 2008), any empirical assessment of FDI flows requires the introduction of a variable to control for institutional quality. Moreover, omitting indexes of institutional quality biases typical gravity model estimates of trade, as was shown by Anderson and Marcouiller (2002). Accordingly, the ICRG investment profile comprehensive indicator[19] (denoted *investment profile*) has been introduced into the estimations to control for these institutional elements of transaction costs.

As is now standard in the gravity literature (Mátyás, 1997; Feenstra, 2004; Redding and Venables, 2004), time and source country and host country fixed effects (u_t, u_i, and u_j) have been introduced in order to control for the multilateral resistance terms identified by Anderson (1979) and popularized by Anderson and Wincoop (2003). Because our model does not include time-invariant explanatory factors, the inclusion of country fixed effects would be theoretically possible without causing multicolinearity. Similar to various recent papers (Andrés et al., 2013; Cezar and Escobar, 2015; Kleinert and Toubal, 2010), we have estimated a gravity FDI model including time-invariant country fixed effects.[20] The Hausman tests that were conducted have confirmed that the fixed effect model should be preferred to the random effect model because it is more consistent and more efficient.

All data and variables used in our estimations are presented in Appendix 1: Table A1 (data and definitions) and the list of countries in the sample is shown in Appendix 2: Table A2.

FDI datasets generally contain a large number of zeros. Several methods are used in the panel gravity model literature to deal with the issue of zero-value FDI flows in a logarithmic model.[21] Santos Silva and Tenreyro (2006), however, showed that when the model does suffer from heteroskedasticity, the gravity model Poisson estimation is preferred. The Breush-Pagan tests reported in the lower panel of columns A3.1 and A3.2 (Table A3) show that we cannot reject the hypothesis of heteroskedasticity in our case. As a result, our preferred estimator is the Poisson Pseudo Maximum Likelihood. Results of our Poisson regressions are reported in Sections 4 and 5. Because the coefficients of interaction terms in nonlinear models such as Poisson Pseudo Maximum Likelihood cannot be directly interpreted, as discussed in Gill (2001), we follow the literature (Andrés et al., 2013) by estimating the model in incidence rate ratios (IRRs). IRRs can be interpreted directly as the odds of a source country choosing to invest in a host country versus the odds of not choosing

[19] This index captures the quality of the enforcement of business regulations and property rights by combining ratings of contract viability, risks of expropriation, repatriation of profits, and delays in payments.

[20] For panels with a sufficiently large number of years for the underlying factors of multilateral resistance to be able to change, however, source and host fixed effects can be time varying (Head and Mayer, 2013). Because this would lead time-varying country fixed effects to be collinear to our variables of interest, for example, source and host country volatility, we could not opt for this strategy. One possible solution to deal with this problem is to estimate the gravity model with time-varying fixed effects and to use the multiplicative term of source and host country volatility. However, the estimated coefficient for the latter variable is difficult to interpret, which is inappropriate given our purpose of understanding how source and host volatility independently affect FDI flows between two countries. Moreover, for panels with limited time variation, such as ours, it is reasonable to assume that sources of multilateral resistance move only slowly (Bergstrand and Egger, 2007).

[21] The most common is the Eichengreen correction, coupled with random effect estimation, which consists of using a transformation of the form *ln*(1+FDI). This method is widely used because it is simple and it enables the coefficient to be interpreted as elasticity when the value *ln*(1+FDI) is approximately equal to *ln*(FDI), which is accepted as a reasonable assumption (Eichengreen and Irwin, 1998). The model can also be estimated by using the Tobit method, which explicitly accounts for zero FDI flows, without excluding them. This increases the variation of the dependent variable, thereby producing higher values and significance for the estimated coefficients of the various determinants of FDI (Eaton and Tamura, 1994; Head and Ries, 2008; Wei, 2000). Our baseline model random effect estimations, with the Eichengreen correction and with the random effect Tobit estimator, are reported in Table A4.

that host country, instead of in mere probabilities.[22] Note that IRRs less than 1 reveal a negative impact of the corresponding determinant on bilateral FDI flows, whereas ratios greater than 1 reveal a positive impact.

4. FDI, macroeconomic volatility, and trade integration

4.1. The effect of source GDP volatility on FDI

In Table 1, the gravity model was estimated first by the now standard Pseudo-Poisson Maximum Likelihood method (column 1.1) and then, with the coefficients expressed in IRR (column 1.2). Source instability, host instability, and the ICRG investment profile are being introduced step by step in columns (1.3) and (1.4).[23] First of all, the estimation of the standard gravity model (column 1.2) is in accordance with the typical results reported in the literature, although both *source GDP* and *host GDP* significantly increase FDI flows to the four MENA countries. As far as physical distance is concerned, our results are contrasting. Although FDI flows between two countries seem to be unaffected by the existence of common borders, they nevertheless tend to decrease with geographical distance. A common language shared by the source and host countries increases FDI flows whereas the existence of past colonial links between two countries has no effect.

If we now turn to our variables of interest, that is, *source* and *host country instability*, column 1.3 confirms that they leave column 1.2's results unchanged. Nonetheless, column 1.3 indicates that *source instability* and *host instability* have opposite effects on FDI. *Host instability* has a significant and negative impact on FDI flows whereas *source instability* has a significant and positive impact. In column 1.4, the positive coefficient for *host investment profile* indicates that good institutional governance has a strong influence on FDI to MENA countries. Moreover, the introduction of *host investment profile* does not modify the results for source and host instabilities, thereby indicating that the risks raised by macroeconomic characteristics must not be confused with the risks imposed by bad institutional governance and high transaction costs. Last, a multiplicative variable has been introduced to test the assumption that source and host uncertainties may have cumulated effects on FDI bilateral flows. The results reported in column 1.5 indicate that uncertainties in source and host countries do not cumulate their individual impact on FDI.

[22] According to Gill (2001) and Andrés et al. (2013), this transformation renders the specification of interaction terms straightforward as in a linear model so that they can be estimated with standard numerical procedures for maximum likelihood.

[23] Time series' stationarity tests for the variables of interest have been reported in Table A5 of the Appendix. The results of the Levin-Lin-Chu unit-root test have been confirmed for the Im-Pesaran-Shin unit-root test.

Table 1: Poisson Pseudo Maximum Likelihood model with country and time fixed effects: Baseline model and baseline with controls

Dependent variable FDI levels	1.1 PPML	1.2 IRR	1.3 IRR	1.4 IRR	1.5 IRR
Source GDP	.561 (16.62)***	1.754 (16.62)***	1.566 (11.04)***	1.637 (13.28)***	1.639 (13.27)***
Host GDP	.330 (11.17)***	1.391 (11.17)***	1.599 (13.21)***	1.2172 (4.46)***	1.216 (4.46)***
Distance	-.608 (-2.63)***	.544(-2.63)***	.597 (-2.18)***	.645 (-1.93)**	.645 (-1.93)**
Adjacency	-.335 (-1.20)	.715 (-1.20)	.732 (-1.12)	.730(-1.17)	.729 (-1.17)
Past colonial links	-.191 (-0.33)	.825 (-0.33)	1.056 (-0.09)	.909 (-0.17)	.907 (0.17)
Common language	.831 (2.95)***	2.296 (2.95)***	1.957 (2.38)**	1.805 (2.16)**	1.808 (2.16)**
Source instability	-	-	1.030 (2.29)**	1.037 (2.87)***	1.027 (0.85)
Host instability	-	-	.214 (-10.66)***	.470 (-4.63)***	.466 (-4.63)***
Host investment profile	-	-	-	1.089 (10.16)***	1.089 (10.13)***
Source instability*host instability	-	-	-	-	1.0407 (0.36)
Constant	-10.81 (-6.00)***	.00002 (-6.00)***	9.47^{E-06}(-6.20)***	.0001 (-4.42)***	.0001 (4.92)***
Log-Likelihood	-7024.5758	-6011.887	-5960.4606	-5960.3967	
Log-Likelihood ratio test	χ^2 = 5337.16 ***	χ^2 = 4945.80***	χ^2 = 4699.39 ***	χ^2 = 4684.4 ***	
Wald test	χ^2= 2182.49***	χ^2= 1246.37***	χ^2= 1311.78***	χ^2= 1311.9***	
Country FE *vs.* pooled	Yes***	Yes***	Yes***	Yes***	
Time effects *vs.* pooled	Yes***	Yes**	Yes	Yes	
Hausman test	χ2 (6) = 44.45 Prob>chi2 = 0.00	χ2 (8) = 44.22 Prob>chi2 = 0.00	χ2 (9) = 85.34 Prob>chi2 = 0.00	χ2 (9) = 55.93 Prob>chi2 = 0.00	

Notes: *, **, *** significant at 10%, 5%, and 1% risk, respectively. IRRs of less than 1 reveal a negative impact of the corresponding determinant on bilateral FDI flows, whereas ratios greater than 1 reveal a positive impact.

A related issue concerns pro-cyclical or countercyclical behavior of bilateral FDI in our sample of countries. If firms seek to diversify their risks by investing more in a dynamic foreign market when their home economy is depressed, then FDI will increase when home and foreign country business cycles are negatively correlated. The fact that bilateral FDI flows tend to be higher when the source and destination business cycles are not synchronized therefore signals that MNCs tend to substitute foreign production to domestic production so as to reduce the microeconomic risks linked with macroeconomic cyclical volatility. In order to test the existence of such a countercyclical pattern of bilateral FDI, we have created a dummy *de-synchro* in three steps. As a first step, we have used a Hodrick-Prescott filter in order to single out the source and host countries' GDP growth trends over the whole period and kept the yearly cyclical component. Then, we have computed for each source (host) country a dummy variable called *source cycle* (resp. *host cycle*) taking the value 1 for the years when GDP growth was lower than the trend and taking 0 when GDP growth was above the trend. We finally have ascribed to each country pair a dummy labeled *de-synchro* taking the value 1 in the years when the two cycles were not synchronized and 0 otherwise.

We suppose that (1) the dummy *source cycle* will have a positive coefficient if bilateral FDI is higher when the source country's GDP growth cycle is located below its trend and (2) the *de-synchro* dummy will have a positive coefficient if bilateral FDI is higher when the source and host countries' cycles are not synchronized. *De-synchro* alone, however, does not inform about which pattern of de-synchronization leads to the highest FDI levels. We may expect that FDI will be higher when the source country is in a low conjuncture and host countries are in high conjuncture. In this case, FDI will be countercyclical in the source country because it tends to increase when the source economy is in a contraction period and procyclical in the host economy because it tends to increase in a period of expansion. Because the interaction of the *source cycle* with *de-synchro* dummies gives the value 1 to the episodes of de-synchronization with low conjuncture in the source country and 0 otherwise, a positive value of its estimated coefficient would enable identifying this procyclical pattern. In addition, a positive and significant coefficient for *de-synchro***source volatility* might inform about the

prospect that the positive impact of source volatility on FDI flows would be higher when cycles are not synchronized.

Results of the estimations of the gravity equation including the described dummies are reported in Table 2. In column 2.1, the positive coefficient for *source cycle* first indicates that, other things being equal, FDI increases when the source country's GDP growth is low. Next, column 2.2 shows that the *de-synchro*'s coefficient is positive and significant indicating only that FDI flows tend to be higher when the source and host countries have de-synchronized cycles. However, in column 2.3, the interaction *de-synchro*source cycle* takes a positive and significant coefficient making it clear that FDI is higher when the source country is in the downward phase of its cycle and the host country is in its upward phase[24]. The assumption that FDI is procyclical for the source and host countries is thus supported by our estimations: not only does bilateral FDI increase when business cycles are not synchronized but also it tends to depress investment in the source country when it is in a low conjuncture while stimulating investment in booming host countries. In column 2.4, however, the interaction between *source cycle* and *source instability* is not significantly different from 0, therefore indicating that the effect of source instability is neither magnified nor minored by economic downturns in the source country. These two mechanisms actually independently affect FDI flows in our sample of countries.

Table 2: Poisson Pseudo Maximum Likelihood model with country and time fixed effects: With business cycles

Dependent variable FDI levels	2.1 IRR	2.2 IRR	2.3 IRR	2.4 IRR
Source GDP	1.717 (13.89)***	1.668 (13.72)***	1.695 (13.84)***	2.231 (14.97)***
Host GDP	1.203 (4.22)***	1.243 (4.94)***	1.217 (4.48)***	1.028 (0.57)
Distance	.620 (-2.12)**	.622 (-2.08)**	.623 (-2.09)**	.498 (-3.00)***
Adjacency	.730 (-1.16)	.734 (-1.14)	.733 (-1.15)	.686(-1.31)
Past colonial links	.824 (-0.34)	.881 (-0.22)	.849 (-0.29)	.480 (-1.26)
Common language	1.968 (2.46)***	1.916 (2.36)**	1.939 (2.41)***	3.232 (3.89)***
Source instability	1.042 (3.24)**	1.042 (3.20)**	1.042 (3.24)***	1.040 (3.05)***
Host instability	0.545 (-3.62)***	.655 (-2.43)***	.592 (-3.07)***	.710 (-2.04)**
Host investment profile	1.076 (8.06)***	1.069 (7.23)***	1.073 (7.61)***	1.056 (6.01)***
Source cycle	1.093 (3.77)***	-	-	.483 (-4.42)***
De-synchro	-	1.084 (5.26)***	-	-
De-synchro*source cycle	-	-	1.062 (4.32)***	-
Source cycle*source instability	-	-	-	-0.883 (-0.73)
Constant	.000092 (-5.16)***	.000085 (-5.15)***	.00009 (-5.14)***	.000063 (-5.35)
Log-Likelihood	-59553.3733	-5946.688	-5951.1972	-5921.3883
Log-Likelihood ratio test	χ^2 = 4713.46 ***	χ^2 = 4713.82***	χ^2 = 4717.60***	χ^2 = 4763.21 ***
Wald test	χ^2= 1323.49***	χ^2= 1330.17***	χ^2= 1325.20***	χ^2= 1351.02***
Country FE *vs.* pooled	Yes***	Yes***	Yes***	Yes***
Time effects *vs.* pooled	Yes***	Yes**	Yes	Yes
Hausman test	χ2 (10) = 60.13 Prob>chi2 = 0.0000	χ2 (10) = 265.7 Prob>chi2 = 0.0000	χ2 (10) = 53.25 Prob>chi2 = 0.0004	χ2 (11) = 33.43 Prob>chi2 = 0.0004

Notes: *, **, *** significant at 10%, 5%, and 1% risk, respectively. IRRs of less than 1 reveal a negative impact of the corresponding determinant on bilateral FDI flows, whereas ratios greater than 1 reveal a positive impact.

To conclude, FDI tends to increase when a source country's demand instability increases and when source and host countries' GDP cycles are de-synchronized. Therefore, not only do MNCs delay investment when demand volatility increases in domestic economy but also they substitute production abroad to production home, most particularly by choosing destinations where GDP per

[24] As we intended to filter out the source instability impact for the de-synchronization episodes, not to test the interactive term, we didn't introduce all the components of the interaction terms alone. This is why *de-synchro* is not included in Estimation 2.3.

capita growth is more stable and follows a de-synchronized cycle. This result therefore confirms the assumption that in our sample, GDP instability is driven by demand shocks.

4.2. Does trade integration matter? Regional economic integration, source volatility, and FDI

Now that our model with instabilities has been estimated and a positive impact on FDI of source country instability has been highlighted for our sample of countries, several questions arise, all connected with the intermediary role of trade integration. Whole sample results could hide the fact that European and MENA firms may react differently to host country instability in terms of their foreign investment decisions. Such a distinct behavior could be because of differences in the European and MENA economies' exposure to foreign trade and to trade-led macroeconomic instability. More open economies often suffer from a higher level of macroeconomic instability, and firms from more open economies may also be more internationalized. As a result, the positive FDI effect of source country GDP instability observed for the whole sample may well reflect the fact that trade openness of the source country, which is correlated to GDP instability, has an influence on its FDI outflows. Furthermore, trade integration via RTAs may well, under these conditions, intensify the positive effect of source country instability on FDI by increasing trading opportunities and reducing transaction and fiscal costs of investing abroad and trading from abroad. Likewise, bilateral investment treaties (*BITs*) may increase FDI by reducing transaction and relocation costs.

Variables accounting for South-South (here *GAFTA* and *AMU*) and North-South (here *MED*) regional trade agreements have been included in the gravity equation. Although FDI flows to MENA countries have been increased by the GAFTA, they were influenced neither by Euro-Mediterranean trade agreements nor by the AMU agreement. However, having concluded a BIT has a positive impact on FDI flows between the signatory countries.

An additional test consists of checking if RTAs and BITs have amplified the positive relationship between source volatility and FDI. It was argued that deeper trade integration between source and host countries, via BITs and FTAs, may amplify the positive effect of source country volatility on FDI outflows by reducing the costs of reallocating production abroad and re-exporting from abroad (Aizenman and Marion, 2004; de Mello et al., 2010). It can therefore be expected that, by easing production reallocation abroad in the case of higher home uncertainty, trade and investment integration will increase FDI to the more stable host economies of the trading zone. In order to assess the extent to which North-South (here the Euro-Mediterranean trade agreement *MED*) and South-South RTAs (here GAFTA and AMU) have increased or not the sensitivity of FDI to host country macroeconomic conditions, we have successively estimated the gravity model with source and host volatilities and each one of the following four multiplicative terms: *source instability*MED, source instability*AMU, source instability*GAFTA,* and *source instability*BITs*. Results have been reported in Table 3.

When a continuous variable X is interacted with a dummy Z, the coefficient of the interactive term measures the extent to which the dependent variable Y increases with X when condition Z is met (Brambor et al., 2006: 65). In our specific case, the interaction term's coefficient must therefore be interpreted as the impact of a variable (here source instability) on the dependent variable (FDI bilateral flow) when the population is limited to the individual observations for which the condition Z (here participation to a bilateral trade or investment agreement) is met. Column 3.1 in Table 3 first shows that neither the significance nor the sign of the source instability's individual FDI impact are removed when the four interactive terms are simultaneously introduced in the regression. If we now turn our attention to the interactions, we can check that the coefficient of the *source instability*MED* interaction is not significant (column 3.2) whereas, on the contrary, *source instability*UMA* and

*source instability*GAFTA* both show a lower-than-1 estimated coefficient indicating a negative impact (columns 3.3 and 3.4). Similar to the case of *MED*, the coefficient of the *source instability*BITs* interaction is not significant (column 3.5). This suggests that whereas the positive FDI impact of source instability is not conditioned by the existence of North-South trade integration (*MED*) and bilateral investment treaties (*BITs*), it is reduced in the case of South-South trade agreements (notably GAFTA). Indeed, when model 3.1 is estimated only for the subsample of GAFTA countries, the value of the coefficient of *source instability* is negative (IRR is lower than 1), indicating that, in the case of South-South trade integration, macroeconomic instability in source countries even has a negative impact on FDI flows.[25] One possible explanation is that MNCs from MENA countries are more likely to be financially constrained than those from European economies during periods of high demand instability in their home market. The former are consequently more likely to reduce or delay their operations abroad because they are financially constraint.

Table 3: Poisson Pseudo Maximum Likelihood model with country and time fixed effects: Regional trade agreements and bilateral investment agreements

Dependent variable FDI levels	3.1 IRR	3.2 IRR	3.3 IRR	3.4 IRR	3.5 IRR
Source GDP	1.481 (9.82)***	1.472 (9.39)***	1.481 (9.76)***	1.497 (14.10)***	1.474 (9.66)***
Host GDP	1.213 (3.78)***	1.188 (3.34)***	1.192 (3.42)***	1.203 (3.60)***	1.187 (3.33)***
Distance	.673 (-1.90)**	.668 (-1.90)**	.662 (-1.95)**	.654 (-2.01)**	.667 (-1.91)**
Adjacency	.735 (-1.37)	.729 (-1.42)	.727 (-1.43)	.729 (-1.42)	.729 (-1.42)
Past colonial links	1.278 (0.48)	1.245 (0.43)	1.243 (0.43)	1.212 (0.38)	1.240 (0.42)
Common language	1.058 (0.22)	1.055 (0.21)	1.054 (0.21)	1.083 (0.31)	1.057 (0.22)
Source instability	1.040 (3.02)***	1.043 (3.26)***	1.043 (3.25)***	1.042 (3.22)***	1.057 (3.41)***
Host instability	.589 (-2.69)***	.582 (-2.69)***	.580 (-2.77)***	.584 (-2.73)***	.5691 (-2.87)***
Host investment profile	1.085 (9.38)***	1.079 (8.59)***	1.079 (8.61)***	1.077 (8.40)***	1.078 (8.60)***
MED	1.034 (1.05)	1.043 (0.87)	1.028 (0.85)	1.017 (0.53)	1.035 (1.07)
AMU	1.879 (1.39)	1.893 (1.41)	2.122 (1.64)	1.944 (1.47)	1.896 (1.41)
GAFTA	1.239 (2.97)***	1.202 (2.55)***	1.238 (2.89)***	1.577 (4.91)***	1.202 (2.54)***
BITs	1.153 (3.69)***	1.153 (3.69)***	1.151 (3.65)***	1.153 (3.69)***	1.160 (3.83)***
Source instability*MED	-	.940 (-0.22)	-	-	-
Source instability*AMU	-	-	.471 (-1.86)*	-	-
Sourceinstability*GAFTA	-	-	-	.188 (-4.51)***	-
Source instability*BITs	-	-	-	-	.965 (-1.32)
Constant	.0008 (4.07)***	.001 (-3.72)***	.0013 (-3.72)***	.0009 (-3.97)***	.0014 (-3.73)***
Log-Likelihood	-5277.964	-5268.7747	-5267.0546	-5258.4314	-5267.921
Log-Likelihood ratio test	χ^2 = 2572.83 ***	χ^2= 2561.87 ***	χ^2 = 2567.23 ***	χ^2 = 2566.66 ***	χ^2 = 2565.36 ***
Wald test	χ^2 = 1076.08***	χ^2 = 1084.39***	χ^2 = 1085.76***	χ^2 = 1103.70***	χ^2 = 1086.22***
Country FE *vs.* pooled	Yes***	Yes***	Yes***	Yes***	Yes***
Time effects *vs.* pooled	Yes*	Yes**	Yes**	Yes**	Yes**
Hausman test	χ2 (13) = 41.70 Prob>chi2 = 0.0000	χ2 (13) = 22.25 Prob>chi2 = 0.07	χ2 (14) = 48.95 Prob>chi2 = 0.0000	χ2 (14) = 36.39 Prob>chi2 = 0.0000	χ2 (14) = 73.73 Prob>chi2 = 0.0000

Notes: *, **, *** significant at 10%, 5%, and 1% risk, respectively. IRRs of less than 1 reveal a negative impact of the corresponding determinant on bilateral FDI flows, whereas ratios greater than 1 reveal a positive impact

This section's results thus suggest that only South-South intraregional trade agreements seem to have had an impact on FDI responsiveness to source instability. For the countries linked by GAFTA agreements, the FDI impact of the source country's demand instability becomes negative. As explained in Section 2, however, the theory predicts that vertical and horizontal investment might react differently to increased uncertainty in source countries. Our main result that FDI flows from highly volatile to weakly volatile economies must therefore be further investigated in a gravity model that is fitted to explain vertical investment.

[25] Estimations made for UMA subsamples give similar results.

4.3. Regional integration, source volatility, and vertical-horizontal FDI

The model described by Equation 2 is specifically fitted to analyze horizontal FDI because it includes the size of the host economy as an explaining factor (Kleinert and Toubal, 2010). It can nevertheless be adapted easily to account for both horizontal and vertical FDI by adding an indicator of the relative factor endowment and the joint size of home and host country (the sum of their GDP), imposing no restrictions on the individual country sizes (Kleinert and Toubal, 2010: 8).[26] According to the knowledge-capital model, skill differences between the labor force in the source and the host countries would be the ideal indicator to identify drivers of vertical investment (Carr et al., 2001). Because relevant data are missing for developing host countries, the *difference in GDP per capita* between the two countries is generally used as a proxy for the differences in factor endowments or in the level of economic and technological development in each country (Busse et al., 2010). The *difference in GDP per capita*'s coefficient will take a positive sign if FDI is attracted by low labor costs.

As shown by Kleinert and Toubal (2010), an additional determinant of vertical FDI, the sum of source and host countries' GDP (*market size*), can be derived from the theoretical knowledge-capital model of FDI. It is therefore expected that in the case of vertical investment, the GDP per capita difference as well as the size of the demand by the two countries will take a positive coefficient (Kleinert and Toubal, 2010).[27] Moreover, the estimated coefficient on adjacency also informs about the nature of FDI: whereas a positive sign might be reflecting the fact that FDI may be predominantly of the vertical type since proximity eases investment for re-exporting, a negative sign would suggest FDI to be predominantly of the horizontal type, since low transport costs should render exporting more advantageous than FDI (de Mello-Sampayo, 2009).

[26] Various empirical specifications of the gravity model can be used to explain either horizontal or vertical FDI, with all of them being based on sound theoretical foundations (Anderson, 2011). Kleinert and Toubal (2010), for example, have derived two different empirical specifications of the FDI gravity model. The first one is derived from a proximity-concentration model explaining horizontal investment whereas the second one is derived from a factor-proportions model explaining vertical investment.

[27] Busse et al. (2010) also take into account the fact that the host country's openness to trade may induce vertical FDI, arguing that closed economies are hardly attractive to vertical FDI, which involves fragmented production patterns and international trade in intermediates. We have tested this variable, but because it is never significant and may be correlated to RTAs, it is not included in our preferred specification.

Table 4: Poisson Pseudo Maximum Likelihood model with country and time fixed effects: Source and host instabilities and types of FDI

Dependent variable FDI levels	4.1 IRR	4.2 IRR	4.3 IRR	4.4 IRR	4.5 IRR
Source GDP	.836 (3.21)***	1.344 (6.51)***	.831 (3.23)***	1.328 (6.15)***	1.636 (13.21)***
Host GDP	.950 (3.66)***	1.186 (3.27)***	.949 (3.79)***	1.1913 (3.34)***	1.218 (4.47)***
Distance	.722 (-1.37)	.720 (-1.50)	.723 (-1.37)	.724 (-1.47)	.645 (-1.93)**
Adjacency	727 (-1.32)	735 (-1.37)	.727 (-1.32)	.822 (-0.87)	.730 (-1.17)
Past colonial links	1.152 (0.26)	.813 (0.92)	1.153 (0.26)	1.378 (0.63)	.911 (-0.17)
Common language	.969 (0.11)	1.152 (0.54)	.968 (0.12)	1.164 (0.57)	1.803 (2.15)**
Source instability	1.035 (2.67)***	1.048 (3.62)***	1.165 (0.27)	1.122 (3.03)***	1.091 (-0.55)
Host instability	.551 (-3.03)**	.567 (-2.88)***	.705 (-1.74)	.555 (-2.99)*	.470 (-4.62)***
Host investment profile	1.084 (9.04)***	1.079 (8.63)***	1.084 (-9.04)***	1.079 (8.61)***	1.090 (10.17)***
MED	1.042 (1.28)	1.019 (0.60)	1.043 (1.28)	1.018 (0.50)	-
AMU	2.104 (1.48)	1.947 (1.43)	2.106 (1.48)	1.953 (1.43)	-
GAFTA	1.216 (2.69)***	1.228 (2.83)***	1.216 (2.69)***	1.228 (2.83)***	-
BITs	1.151 (3.63)***	1.153 (3.70)***	1.150 (3.69)**	1.153 (3.68)***	-
Market size	2.213 (4.01)***	-	2.230 (3.98)***	-	-
GDP per capita difference	-	1.159 (5.16)***	-	1.180 (5.40)***	1.157 (5.14)***
Market size*source instability	-	-	.994 (-0.21)	-	-
GDPpcDiff.*source instability	-	-	-	.979 (-1.87)*	-
Host GDP*source instability	-	-	-	-	.997 (-0.29)
Constant	.0004 (-4.3)***	.003(-3.17)***	.0003 (-4.03)***	.0033 (-3.13)***	.0001 (-4.49)***
Log-Likelihood	-5260.51	-5254.06	-5262.27	-5252.43	-5960.41
Log-Likelihood ratio test	χ^2=2467.52***	χ^2 = 2507.47***	χ^2 = 2451.75***	χ^2 = 2469.95***	χ^2 = 4687.25***
Wald test	χ2= 1093.59***	χ2= 1102.55***	χ2= 1093.62***	χ2=1103.29***	χ^2= 1311.85***
Country FE *vs.* pooled	Yes***	Yes***	Yes***	Yes***	Yes***
Time effects *vs.* pooled	Yes**	Yes**	Yes***	Yes**	Yes
Hausman test	χ2 (14) = 25.48 Prob>chi2=0.0000	χ2 (14) = 33.38 Prob>chi2=0.0025	χ2 (15) = 30.48 Prob>chi2 =0.01	χ2 (15) = 32.75 Prob>chi2 =0.005	χ2 (10) = 70.32 Prob>chi2=0.0000

Notes: *, **, *** significant at 10%, 5%, and 1% risk, respectively. IRRs of less than 1 reveal a negative impact of the corresponding determinant on bilateral FDI flows, whereas ratios greater than 1 reveal a positive impact.

Because vertical FDI is essentially conditioned by productivity and labor cost differences, it can be expected that it will be affected only partially by the source country's volatility outcomes. Vertical FDI may therefore feature a lower sensibility to domestic demand volatility than horizontal FDI. Accordingly, the coefficients of the vertical FDI's two main drivers, that is, the *difference in GDP per capita* and *market size*, may be only marginally affected by an increase of source country's GDP volatility. On the contrary, the coefficient of the horizontal FDI's main driver (*host GDP*) may increase with volatility in the source country.

Table 4 shows the results of the estimations of the gravity model with volatilities, the determinants of vertical FDI, and the interactions of source volatility with the determinants of vertical and horizontal investment.

First, the two determinants of vertical FDI, the *difference in GDP per capita* and *market size,* have been successively included in Equation 2, with the results being reported in columns 4.1 and 4.2. The positive signs of these two variables' coefficients indicate that, for the countries in our sample, the technological distance and the aggregate market size between the two countries have a positive impact on FDI between these countries[28]. Our sample's bilateral FDI is thus partially vertical.

We have then introduced the interactions in the estimations, with the results being reported in columns 4.3 to 4.5. When two continuous variables X and Z interact, the coefficient of the interactive term measures the extent to which the variable Y reacts with X fixed at an average level but when variable Z varies. In column 4.4, the coefficient of the interaction of *GDP per capita difference* with *source instability* takes a significant and negative sign, albeit at 10%, indicating that the positive FDI impact of a given level of source instability is reduced when the cost differential increases. This

[28] The non-significant estimated coefficient on adjacency does not confirm this result, however. This may signal contradictory patterns of vertical and horizontal FDI over the whole sample, as in De Mello (2009).

indicates that when the investment toward MENA economies is driven by strong cost differentials, as is the case for vertical FDI, it is less sensible to source instability. As for the second determinant of vertical investment, that is, the aggregate *market size*, it also has a positive impact on the FDI flows between two countries (column 4.1), although its interaction with *source instability* is not statistically significant (column 4.3). Likewise, column 4.5 shows that the positive impact of source volatility on FDI flows is not significantly modified by an increase in *host GDP*, therefore confirming that FDI is mostly vertical in the overall sample. This would mean that if a source country's instability certainly matters to explain bilateral FDI flows in our sample, its impact may be less important when investments are driven by cost differentials, that is, for vertical investment.

5. Robustness checks

In this section, we address additional issues relating to the robustness of the results discussed in Section 4.

5.1. Robustness 1: Alternative sources of uncertainty

In order to test whether the positive effect of source countries' GDP instability on FDI is not an *artefact* produced by the correlation between our sample countries outward FDI but a more global trend of increased FDI, an indicator of global waves of FDI[29] and an indicator of European waves of FDI also have been successively introduced into the estimation of the gravity model with uncertainties. The results, reported in Table 5 columns 5.1 and 5.2, indicate that these two controls have a non-significant impact on FDI flows and their addition to the estimated model leaves the coefficient for source country instability unchanged.

Because there is a risk that source country macroeconomic instability may be correlated to a global or at least regional trend, we have to check whether the effects estimated for our overall sample hold when the perimeter of external instability is extended to the source country's region or to the world economy. Two alternative measurements of global and regional macroeconomic trends have been introduced successively as additional controls in the complete gravity model with instabilities, regional agreements, and vertical-horizontal FDI determinants: (1) the lagged three-year averaged world GDP growth and (2) the lagged three-year averaged standard deviation of world GDP growth. Results reported in columns 5.3 and 5.4 show that, as expected, the estimated coefficient of the first two variables takes a positive and significant value, whereas that of the last two variables is negative and significant. It means that although world GDP growth has a positive impact on FDI flows, growth instability has a negative impact. Moreover, the inclusion of these four variables in the standard gravity model does not change the values of the *source* and *host instability* estimated incidence ratios.

[29] Similarly to Méon and Sekkat (2012), the world FDI wave indicator consists of the annual value of world FDI outflows; similarly, the European FDI wave is computed as the annual value of European FDI outflows.

Table 5: Poisson Pseudo Maximum Likelihood model with country and time fixed effects: Instabilities, RTAs, and BITs and global instability

Dependent variable FDI levels	7.1 IRR Global FDI waves	7.2 IRR European FDI waves	7.3 IRR Three-year world GDP growth	7.4 IRR Three-year world GDP standard deviation
Source GDP	1.333 (6.26)***	1.339 (6.38)***	1.337 (6.38)***	1.386 (7.05)***
Host GDP	1.140 (2.13)**	1.169 (2.76)***	1.225 (3.78)***	1.204 (3.59)***
Distance	.733 (-1.41)	.725 (-1.47)	.709 (-1.59)	.708 (-1.60)
Adjacency	.812 (-0.93)	.813 (-0.98)	.813 (-0.91)	.819 (-0.89)
Past colonial links	1.371 (0.66)	1.366 (0.61)	1.381 (0.64)	1.283 (0.49)
Common language	1.111 (0.40)	1.136 (0.48)	1.157 (0.55)	1.264 (0.88)
Source instability	1.047 (3.55)***	1.048 (3.58)***	1.047 (3.55)***	1.051 (3.80)***
Host instability	1.879 (3.05)***	.583 (-2.68)***	.522 (-3.27)***	.662 (-2.00)***
Host investment profile	1.073 (7.78)***	1.076 (7.48)***	1.075 (8.20)***	1.074 (8.00) ***
MED	1.007 (1.22)	1.013 (0.39)	1.006 (1.20)	1.037 (1.10)
AMU	1.940 (1.43)	1.942 (1.43)	1.912 (1.39)	1.998 (1.50)
GAFTA	1.212 (2.62)***	1.220 (2.71)***	1.213 (2.66)***	1.230 (2.85)***
BITs	1.155 (3.72)***	1.154 (3.71)***	1.148 (3.55)***	1.154 (3.70)***
Market size	2.248 (4.49)***	2.471 (4.67)***	2.272 (4.02)***	2.625 (4.76)***
GDP per capita difference	1.1560 (5.01)***	1.157 (5.10)***	1.150 (4.86)***	1.170 (5.44)***
World FDI waves	1.035(1.19)	-	-	-
Europe FDI waves	-	1.015 (0.62)	-	-
Three-year world GDP growth	-	-	1.020(2.91)***	-
Three -year world GDP SD	-	-	-	.999 (-2.49)***
Constant	.0026 (-3.26)***	.002 (-3.21)***	.0022 (-3.34)***	.001 (-3.58)***
Log-Likelihood	-5253.3654	-5253.8557	-5249.7904	-5250.9783
Log-Likelihood ratio test	χ^2 = 2503.74 ***	χ^2 = 2502.15 ***	χ^2 = 2510.05***	χ^2 = 2488.99 ***
Wald test	χ^2 = 1104.54***	χ^2 = 1103.54***	χ^2 = 1107.69***	χ^2 = 1106.67***
Country FE *vs.* pooled	Yes***	Yes***	Yes***	Yes***
Time effects *vs.* pooled	Yes**	Yes**	Yes**	Yes**
Hausman test	χ2 (16) = 29.86 Prob>chi2=0.0142	χ2 (16) = 28.09 Prob>chi2=0.0138	χ2 (16) = 26.00 Prob>chi2 =0.025	χ2 (16) = 17.17 Prob>chi2 =0.24

Notes: *, **, *** significant at 10%, 5%, and 1% risk, respectively. IRRs of less than 1 reveal a negative impact of the corresponding determinant on bilateral FDI flows, whereas ratios greater than 1 reveal a positive impact.

These results therefore suggest that the positive FDI effect is not driven by a global trend of macroeconomic instability.

5.2. Robustness 2: Alternative sources of uncertainty in the host country

It could be objected that our main results are driven by our measure of GDP instability. The more volatile domestic markets (as measured by the standard deviation) may also be the most dynamic ones (as measured by average GDP growth). The MNCs operating in these more open markets may therefore invest more abroad than those operating in less open economies because their revenues are higher and not because they want to trade home instability against foreign stability. In order to rule out this possible source of misinterpretation, a GDP growth coefficient of variation has been used as a replacement for the standard deviation. Column 6.1 of Table 6 shows that the coefficient of *source instability* remains positive even when the size effect is controlled for by measuring GDP instability by a coefficient of variation instead of a standard deviation. We can therefore rule out the argument that the positive impact of the standard deviation of GDP growth is driven by the fact that the most volatile countries are also those where the growth rates of aggregate income and corporate revenues are the highest.

Nominal instability in the host country may also affect the level of FDI inflows. Because inflation increases uncertainty about the future value of liabilities and assets acquired by the MNC, it should adversely influence FDI inflows because incoming investments that could have long-term higher returns generally are not implemented. The existing empirical evidence for this adverse effect is mixed: whereas more inflation does not appear to be a significant determinant of FDI inflows for

Frenkel et al. (2004), it does significantly reduce incoming investment for Garibaldi et al. (2001) and Tapsoba (2012). Column 6.2 shows that although a higher inflation rate in the host countries reduces FDI inflows, its inclusion leaves the coefficients unchanged for source and host instabilities.

Table 6: Poisson Pseudo Maximum Likelihood model with country and time fixed effects: Instabilities, RTAs, and BITs and other sources of macroeconomic instabilities

Dependent variable FDI levels	8.1 IRR Coefficient variation	8.2 IRR Inflation	8.3 IRR Exchange rate crisis
Source GDP	1.740 (2.72)***	1.788 (3.51)***	1.742 (2.92)***
Host GDP	1.944 (2.22)**	1.938 (2.82)***	1.944 (2.57)***
Distance	.776 (-1.08)	.783 (-1.07)	.773 (-1.05)
Adjacency	.819 (-0.82)	.817 (-0.84)	.813 (-0.87)
Past colonial links	1.287 (0.46)	1.244 (0.40)	1.279 (0.44)
Common language	1.052 (1.18)	1.050 (0.18)	1.047 (0.16)
Source instability (SE)	-	1.040 (2.98)***	1.042 (3.11)***
Source instability (CV)	1.879 (3.05)***	-	-
Host instability	.542 (-3.11)***	.530 (-3.22)***	.498 (-3.51)***
Host investment profile	1.083 (9.00) ***	1.075 (7.66) ***	1.080 (8.58)***
MED	2.218 (1.54)	1.029 (0.97)	1.034 (1.02)
AMU	1.927 (1.22)	2.225 (1.57)	2.208 (1.52)
GAFTA	1.240 (2.96)***	1.238 (2.93)***	1.246 (3.02)***
BITs	1.152 (3.66)***	1.141 (3.40)***	1.150 (3.60)***
Market size	2.288 (4.09)***	2.151 (3.76)***	2.289 (4.08)***
GDPpc. differential	1.161 (5.21)***	1.163 (5.29)***	1.151 (4.91)***
Crude oil price	-	-	-
Commodity price index	-	-	-
Host inflation	-	.964 (-2.34)***	-
Host exchange rate instability		-	.938 (-2.89)***
constant	.0008 (-3.48)***	.001 (-3.46)***	.0009 (-3.46)***
Log-Likelihood	-5245.3218	-5242.739	-5241.2839
Log-Likelihood ratio test	χ^2 = 2425.12 ***	χ^2 = 2429.58 ***	χ^2 = 2430.57 ***
Wald test	χ^2 = 1116.19***	χ^2 = 1119.59***	χ^2 = 1119.28***
Country FE *vs.* pooled	Yes***	Yes***	Yes***
Time effects *vs.* pooled	Yes**	Yes**	Yes**
Hausman test	χ2 (16) = 29.48 Prob>chi2=0.0142	χ2 (16) = 52.99 Prob>chi2 =0.0000	χ2 (16) = 27.39 Prob>chi2 =0.0374

Notes: *, **, *** significant at 10%, 5%, and 1% risk, respectively. IRRs of less than 1 reveal a negative impact of the corresponding determinant on bilateral FDI flows, whereas ratios greater than 1 reveal a positive impact.

As for exchange rate instability, its FDI impact is also ambiguous, theoretically and empirically.[30] Because we are interested mainly in the effect of nominal instabilities on FDI levels, we have chosen to test the impact of extreme forms of exchange rate volatility such as exchange rate crises. According to Kaminsky et al. (1998), an exchange rate crisis is typically a situation in which a speculative attack leads to a sharp depreciation of the local currency and to considerable losses in exchange reserves, especially in the case of fixed or pegged regimes. In line with Kaminsky et al. (1998) and Ahluwalia (2000), we have implemented for each host country an ex post identification of the periods during which they were affected by such a crisis between 1985 and 2009.[31] To this end, an index combining variations of the nominal exchange rates and variations in the foreign exchange reserves has been computed (see Appendix 5 for details). Results of estimations are reported in

[30] Because exchange rate volatility increases the risks related to export to and from developing countries, it tends to depress vertical FDI and stimulate horizontal investments (Aizenman and Marion, 2004). Takagi and Shi (2011) have shown that Japanese FDI to the region, mostly vertical, was positively affected by exchange rate volatility from 1987 to 2008.

[31] We do not use the evolution of the exchange rate as an indicator for external stability: that would be somewhat meaningless when only annual data are used for estimations. Nor do we introduce exchange rate regimes, as in Frenkel et al. (2004), because that would not enable the effect of external shocks on FDI inflows to be grasped.

columns 6.3 and show that more exchange rate instability reduces FDI inflows to MENA, without modifying the results for host and source real instabilities.

Our results concerning nominal instability therefore support the assumption that Europe-MENA foreign investment is mainly vertical because it tends to decrease with inflation and exchange rate instability. Although they reduce the incidence of FDI flows, nonetheless, nominal sources of host country instability (inflation and exchange rate instability) modify neither the magnitude of IRR nor the significance of host country instability.

6. Conclusion

Using a gravity model, this article tests the assumption that FDI is reactive to macroeconomic instability in source and host countries for a sample of European and MENA countries for the period from 1985 to 2009. The gravity model enables identifying the FDI impact of macroeconomic risks in both source and host countries while controlling for the other sources of risks and costs associated with distance (geographical, linguistic, and legal). Finally we could show that the incidence of FDI between two countries increases with source GDP instability and with host GDP stability. Both source country's instability and source host countries' cycle de-synchronization tend to increase FDI to MENA, with the less instable MENA countries receiving more FDI. Therefore, not only do MNCs delay investment when volatility increases in domestic economy but also they substitute production abroad to production home, most particularly by choosing the destinations where GDP per capita growth is more stable and follows a de-synchronized cycle. Our findings therefore indicate that FDI may constitute a genuine and valuable option for firms undergoing strong instability or downward conjuncture in their home market. Delaying their domestic investment is not the unique option open to them. The fact that FDI tends to flow from the most to the least instable macro-economies can indicate that both northern and southern firms trade between investing home and abroad through a function of macroeconomic features and not only for costs or market size considerations.

Moreover, we have also found that this reactivity is conditioned by (1) trade and investment agreements and (2) the type of FDI (vertical or horizontal). First, regional trade and investment agreements had an impact on these patterns during the period under study, but this effect is nonetheless confined to South-South RTAs. South-South trade integration (GAFTA), as well as bilateral investment treaties, directly increased FDI flows to MENA. For our four MENA host economies, however, the GAFTA agreement has significantly reduced the FDI responsiveness to the source country's instabilities. MNCs from MENA countries are more likely to be financially constrained than those from European economies during periods of high demand instability in their home market and consequently reduce or delay their operations abroad. By contrast, because of their implementation in the 1990s, the North-South Euro-Mediterranean agreements have neither spurred FDI flows to the MENA economies nor altered the FDI responsiveness to European countries' macroeconomic conditions.

Additionally, we find some evidence, albeit weak, that the sensibility of FDI to uncertainty in the source country decreases with the technological distance between the source and host countries. Put differently, if considering source country's instability certainly helps explain overall bilateral FDI flows in our sample, its impact may be less important when investments are driven by cost differentials, that is, for vertical investment. These results could indicate that by reducing the costs of investment in the least costly MENA economies, regional integration has reduced FDI reactiveness to source macroeconomic conditions and strengthened its dependence on the standard drivers of vertical investment. A more fine-grained analysis of the complex articulation among instabilities, trade integration, and the types of FDI would nevertheless be required at a next stage. Addressing this articulation would certainly necessitate using more disaggregated data on vertical and horizontal FDI, which are, unfortunately, not available.

Our results raise several policy issues. Two decades of sudden stops undergone by emerging economies have illustrated that attraction policies and a high GDP share of FDI are not sufficient conditions to stabilize capital inflows (Calvo, 1998). Obviously, developing countries' policies cannot influence source countries' macroeconomic conditions. Nonetheless, we show in this article that trade and investment policies aimed at more deeply integrating host and source countries certainly condition the extent to which FDI inflows to the former react to the uncertainty to which the latter's MNCs are exposed. Furthermore, we have found evidence of higher levels of North-South investment when the source and host country's cycles are not synchronized, with FDI flows tending to depress private investment in the source country in a bust cycle while increasing private investment in booming host countries. It follows that, in a world of growing trade integration, it is even more essential than before for DCs to prudently open their capital account. Moreover, even though FDI tends to be less unstable than portfolio investment (Hausmann and Fernandez-Arias, 2000; Lipsey, 2001), FDI reactivity to external macroeconomic instability requires the consideration of the latter as a potential source of shock diffusion from northern to southern economies.

In addition, our results show that economic integration via regional trade or bilateral and investment agreements does not necessarily improve developing countries' capacity to attract vertical foreign investment. On the one hand, the reduction of microeconomic transaction costs and the increase of regional market size prompted by RTAs and BITs have tended to increase levels of FDI to MENA economies, but only in the case South-South trade integration. North-South trade agreements, the most likely to bring out vertical investment to MENA countries, have not triggered FDI. Moreover, our findings show that RTAs do not always smooth the constraints imposed on MNCs by the macroeconomic volatility in their home market and reduce the option price of delaying investment. In our sample, this is especially true of the FDI flows coming from European sources. Consequently, a major issue for MENA countries is certainly that they could end up individually competing one with another, spending high amounts of fiscal resources to attract European firms' vertical investment, as found by Chenaf-Nicet and Rougier (2009) in the case of Morocco and Tunisia. Cherif and Dreger (2015) have recently found that agglomeration effects are weaker for the MENA region than for Latin America and Southeast Asia, therefore confirming that vertical and platform investments, which are the most likely to agglomerate and generate technological spillovers, are underrepresented in the MENA region. The social cost of the policies aimed at vertical FDI attraction can therefore turn out to be considerably high, and their economic efficiency is limited to enclaves, as shown by Piveteau and Rougier (2011) in the case of Morocco. This is all the more the case as FDI tends to be highly sensitive to source countries' macroeconomic fluctuations. Further investigations would therefore be required to understand how the industrial and trade policies of MENA labor-abundant countries have evolved in reaction to deepening regional integration, notably in order to stabilize vertical FDI inflows and organize the regional supply chain integration that seems necessary to make these countries less dependent on short-term demand instabilities in source countries.

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Appendix

Appendix 1: Data sources and definitions

Table A1

Variables	*Description*	*Data Source*
FDI	The value in thousands of US dollars of flows of foreign direct investment (FDI) from one country (source country) toward another country (host country)	OECD, UNCTAD; Balance of payments of Morocco, Central Bank of Tunisia
Host GDP	GDP in thousands of US dollars	CEPII, CHELEM database
Source GDP	GDP in thousands of US dollars	
GDP per capita difference	Difference in GDP per capita (thousands of US dollars) between source and host country	CEPII and IMF International Financial statistics for population data
Distance	Distance in kilometers between source and host countries' capitals	CEPII, Geo dataset
Adjacency	Common border between source and host countries (takes the value 1 if the two countries share a common border and 0 otherwise)	CEPII, Geo dataset
Common language	Common official language for source and host countries (takes the value 1 if the two countries share a common language and 0 otherwise)	CEPII, Geo dataset
Common colonial power	Common colonizer for source and host countries (takes the value 1 if the two countries had a common colonizer and 0 otherwise)	CEPII, Geo dataset
Past colonial links	Dummy variable taking the value 1 if host country was colonized by source country and 0 otherwise	CEPII, Geo dataset
Investment profile	Host country's score for institutional risk to FDI including ratings of contract viability, risks of expropriation, profit repatriation, and payment delays. Highest score equates to very low risk.	ICRG database
Source instability	Three-year standard deviations of GDP growth for host and source countries	Authors' calculations
Host instability		CEPII, CHELEM database
De-synchro	Dummy taking the value 1 (the sum of the source and host dummies was equal to 1) and taking 0 when the cycles were synchronized (the sum of the source and host dummies was equal to 0 or 2)	Authors' calculations
MED, GAFTA, AMU	Dummy variables taking the value 1 for the country years covered by these bilateral or multilateral trade agreements and 0 otherwise	Authors' calculations based on UNCTAD
BITs	Dummy variable taking the value 1 for the country years covered by a bilateral international investment agreement and 0 otherwise	Authors' calculations based on UNCTAD
Market size	Sum of source and host GDPs	Authors' calculations CEPII, CHELEM database
GDP per capita difference	Source GDP per capita minus host GDP per capita	Authors' calculations CEPII, CHELEM database

World FDI wave	World levels of FDI flows in value	UNCTAD
Europe FDI wave	European Union (UE25) levels of FDI flows in US dollars	UNCTAD
Three-year world GDP growth	Three-year moving average of world GDP growth	Authors' calculations on the basis of IMF data
Three-year world GDP SD	Three-year moving standard deviation of world GDP growth	Authors' calculations on the basis of IMF data
Commodity price index	Commodity industrial inputs (including agricultural raw materials and metals) price index	IMF WEO
Crude oil price	Crude oil price	IMF WEO
Inflation host	Annual rate of inflation in the host country	Authors' calculations on the basis of IMF data
Exchange rate instability	Index taking the value 1 if the country has experienced a large variation in the value of the real exchange rate or of the foreign currencies reserves and 0 otherwise	Authors' calculations on the basis of IMF data

Appendix 2: List of countries in the sample

Table A2

Algeria	Germany	Mauritania	Sweden
Austria	Greece	**Morocco**	Switzerland
Belgium-Luxembourg	Hungary	Netherlands	Syria
Czech Republic	Ireland	Norway	**Tunisia**
Denmark	Italy	Poland	**Turkey**
Egypt	Jordan	Portugal	United Kingdom
Finland	Libya	Romania	
France	Malta	Spain	

Note: The four MENA host countries are shown in bold.

Appendix 3: FDI levels: Eichengreen correction and Tobit RE estimations

Table A3

Estimator	Eichengreen's correction RE estimator		Tobit RE estimator	
	A3.1	A3.2	A3.3	A3.4
GDP source	1.608 (16.29)***	1.532 (14.34)***	1.608 (16.45)***	1.522 (13.78)***
GDP host	1.081 (11.09)***	1.072 (9.70)***	1.079 (11.13)***	1.081 (9.58)***
Distance	- 1.016 (-2.85)***	-.996 (-2.70)***	-1.016 (-2.89)***	-.994 (-2.59)***
Adjacency	-.570 (-1.20)	-.679 (-1.39)	-.569 (-1.22)	-.676 (-1.34)
Past colonial links	.130 (0.13)	.649 (0.62)	.130 (0.13)	.676 (0.62)
Common language	1.862 (3.93)***	1.720 (3.50)***	1.862 (3.99)***	1.711 (3.34)***
Instability source	-	.237 (2.68)***	-	.237 (2.69)***
Instability host	-	-.634 (-1.04)	-	-.617 (-1.09)
Constant	-37.651 (-11.94)***	-36.047 (-10.57)***	-37.630 (-12.07)***	-36.041 (-10.24)***
R^2 within	0.20	0.15		
R^2 between	0.53	0.53		
R^2 total	0.39	0.39		
Tests	Fisher test: MCO vs. individual FE F(134, 3238) = 21.32 Pr>F=0.000 Fisher test: MCO vs. time: FE F(24, 3244) = 3.61 Pr>F=0.000 Hausman test χ^2 = 3.61 Pr>χ^2 = 0.1604 Wald χ^2= 990.96***	Fisher test: MCO vs. individual FE F(134, 2696) = 21.34 Pr>F=0.000 Fisher test: MCO vs. time: FE F(20, 2806) = 2.27 Pr>F=0.000 Hausman test χ^2 = 22.52 Pr>χ^2 =0.040 Wald χ^2= 651.60***	Log-Likelihood = -8472.271 Wald χ^2= 992.20*** Prob > chi2 = 0.0000	Log-Likelihood =-7087.8369 Wald χ2= 642.25*** Prob > chi2 =0.0000
Breush Pagan $\chi^2_{(1)}$ test	χ^2 = 6654.43 Pr>χ^2 =0.000	χ^2 = 5727.60 Pr>χ^2 =0.000		

Notes: *, **, *** significant at 10%, 5%, and 1% risk, respectively. Number of observations: 3375; number of years: 23; number of country pairs: 27 * 5 = 135.

Appendix 4: Stationarity test

Table A4: Panel A: Levin-Lin-Chu unit-root test

Variables	Adjusted t*	p-value
Source instability	-9.6729	0.0000
Host instability	-9.9008	0.0000
Host investment profile	-8.6225	0.0000
GDP source	-1.8616	0.0313
GDP host*	-5.5781	0.0000
GDP per capita difference	-8.0229	0.0000
FDI level	-3.1045	0.0010
Ho: Panels contain unit roots	Number of panels = 135	
Ha: Panels are stationary	Number of periods = 25	
AR parameter: common		
Panel means: included		
Time trend: not included		

*: *time trend included*

Panel B: Im-Pesaran-Shin unit-root test

Variables	Z-t-tilde-bar	p-value
Source instability	-3.6954	0.0001
Host instability	-6.1957	0.0000
Host investment profile*	-5.1270	0.0000
GDP source	-10.7791	0.0000
GDP host*	-7.5199	0.0000
GDP per capita difference	-10.3557	0.0000
FDI level*	-10.7478	0.0000
Ho: All panels contain unit roots	Number of panel = 135	
Ha: Some panels are stationary	Number of periods = 25	
AR parameter: panel-specific		
Panel means: included		
Time trend: not included		

**: time trend included*

Appendix 5: The exchange rate crisis indicator

In line with Kaminsky et al. (1998) and Ahluwalia (1998), we have computed an index of exchange rate instability. Equation 1 shows that the indicator consists of a weighted average of the variations of the nominal exchange rate and in the exchange reserves. These two variables, computed as quarterly variations on the basis of monthly average levels, are respectively named ΔTCN and ΔRES. The weights respectively measure the shares of the variance of the exchange rate and the foreign exchange reserves in the sum of these variances.

$$IND = \left(\frac{\frac{1}{\sigma^2_{TCN}}}{\left(\frac{1}{\sigma^2_{TCN}} + \frac{1}{\sigma^2_{RES}} \right)} \right) * \Delta TCN + \left(\frac{\frac{1}{\sigma^2_{RES}}}{\left(\frac{1}{\sigma^2_{TCN}} + \frac{1}{\sigma^2_{RES}} \right)} \right) * (-1) * \Delta RES \qquad (1)$$

This index, designed to reflect the intensity of the pressures that a national currency undergoes during an episode of balance of payments crisis, enables the severity of those periods of external instability to be assessed. It should be noted that a negative sign for the average monthly variation of the foreign exchange reserves enables obtaining the highest level of the index when the crisis is imminent (Ahluwalia, 2000). The instability threshold above which whether a country *j* is affected by a crisis at date *t* is defined on a country-by-country basis and not for the whole sample. It is obtained by considering both the average level ($mean_{IND}$) and the standard deviation (σ_{IND}) of IND. A crisis is detected when IND is superior or equal to $mean_{IND} + \sigma_{IND}$. That threshold definition corresponds to the minimal bound found in the literature. A higher threshold ($1{,}5*\beta_{IND} + \sigma_{IND}$) would have resulted in an insufficient variation of the variable. Subsequently, a binary variable *exchange rate instability* has been created, with this variable taking the value 1 if IND ≥ $mean_{IND} + \sigma_{IND}$ and 0 otherwise. In order to transpose these quarterly crises data into annual impacts, it is commonly admitted that any episode of crisis duration exceeding a period of three months will have effects on the current year, which means that the crisis could be regarded as annual. In order to avoid reverse causality with FDI inflows, a crisis in year *t* has been imputed in estimation as a determinant of FDI inflows in *t+1* (Ahluwalia, 1998; Kaminsky et al., 1998).

Equation 1 shows that the indicator consists of a weighted average of the variations of the nominal exchange rate and the exchange reserves. These two variables, computed as quarterly variations on the basis of monthly average levels, are respectively named ΔTCN and ΔRES. The weights respectively measure the shares of the variance of the exchange rate and the foreign exchange reserves in sum of these variances.

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