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Exchange Rate Strategies in the Competition for Attracting FDI

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TABLE OF CONTENTS

SUMMARY

The financial crises of 1997-1998 have highlighted the destabilizing impact of short run capital flows to emerging countries. By contrast, foreign direct investment (FDI) is widely viewed as a stable source of financing for developing countries. However, the debate on the way to re-orient capital flows towards long term financing (through microeconomic reforms or capital controls) does not generally include the choice of an exchange-rate regime.

Here the choice of an exchange-rate regime is re-considered by integrating the determinants of multinational firms locations. We consider the case of a risk-adverse multinational firm which contemplates relocating two alternative foreign locations in order to re-export. We explicit the trade-off between price competitiveness and a stable nominal exchange rate. We also show that the firm will consider both locations as substitutes or as complements depending on whether the two exchange rates against the investing country's currency are positively or negatively correlated.

The theoretical model is estimated on a panel of 42 developing countries receiving FDI from 17 OECD countries, over 1984-1996. The results confirm the importance of the exchange-rate regime. Specifically, nominal exchange rate instability is detrimental to foreign direct investment, and its impact compares with that of misalignments. In addition, from the perspective of the host country, the correlation between its bilateral exchange rate against the origin country and the one of alternative locations has a sizable impact on inward FDI.

These results draw three policy implications, which are illustrated through numerical simulations. Firstly, the exchange-rate instability induced by a free floating regime is detrimental to FDI inflows, even if it prevents the real exchange rate to appreciate. Secondly, the choice of a foreign anchor should be consistent with geography. This is because geography is a crucial determinant of the origin of FDI for each developing country: each country should stabilize its currency against the country or area which would potentially be its major FDI supplier. Lastly, and overall, the building of currency blocs could be a way of increasing FDI to emerging countries, since if would allow investors to diversify the exchange rate risk across various locations. Such a "monetary architecture" would work better the more differentiated the specialization patterns within each currency area, which contrasts with optimum currency areas criteria.

JEL: F21, F23, F31, F33.

RÉSUMÉ

Les crises financières de 1997-1998 ont souligné l'impact déstabilisant des flux de capitaux à court terme dans les pays émergents. Par opposition, l'investissement direct étranger (IDE) est perçu comme un mode de financement stable pour le développement. Néanmoins, le débat sur la manière de réorienter les flux de capitaux vers le long terme (à travers des réformes microéconomiques ou des contrôles de capitaux) ne fait généralement pas référence au choix du régime de change.

Ici, nous ré-examinons le choix d'un régime de change en intégrant les déterminants des localisations des firmes multinationales. Nous considérons le cas d'une firme multinationale ayant de l'aversion pour le risque. Cette firme hésite entre deux implantations étrangères, dans un but de ré-export vers son marché domestique. Nous modélisons l'arbitrage entre compétitivité-prix et stabilité du taux de change nominal. Nous montrons aussi que la firme va considérer les deux implantations comme substituables ou complémentaires, selon que les taux de change des deux devises par rapport à la monnaie du pays qui investit sont positivement ou négativement corrélés.

Le modèle théorique est testé sur un panel de 42 pays en développement recevant de l'IDE en provenance de 17 pays de l'OCDE, sur la période 1984-1996. Les estimations confirment l'importance du régime de change. En particulier, l'instabilité du taux de change nominal est défavorable à l'IDE, avec un impact d'ampleur comparable à celui d'une surévaluation. En outre, du point de vue du pays d'accueil de l'IDE, la corrélation entre son taux de change réel vis-à-vis du pays investisseur et ceux des localisation alternatives est un déterminant significatif de l'IDE entrant.

Les implications en matière de politique de change sont illustrées au moyen de simulations numériques. Premièrement, l'instabilité du taux de change induite par un régime de change flottant est défavorable à l'IDE, même si elle empêche le taux de change réel de s'apprécier. Deuxièmement, le choix d'un régime de change devrait être cohérent avec la géographie. En effet, la géographie conditionne largement l'origine de l'IDE pour chaque pays en développement. Or chaque pays a intérêt à stabiliser sa monnaie par rapport au pays ou à la zone susceptible de lui apporter le plus possible d'IDE. Enfin et surtout, la formation de blocs monétaires pourrait être un moyen d'accroître l'IDE vers les pays émergents, car il permettrait aux investisseurs de diversifier le risque de change au travers de leurs implantations. Une telle « architecture monétaire » fonctionnerait d'autant mieux qu'à l'intérieur de chaque bloc monétaire, les pays diffèreraient par leurs spécialisations, ce qui contraste avec les critères avancés par la théorie des zones monétaires optimales.

JEL : F21, F23, F31, F33.

Exchange Rate Strategies in the Competition for Attracting FDI

Agnès BÉNASSY-QUÉRÉ[(*)], Lionel FONTAGNÉ[(**)] and Amina LAHRÈCHE-RÉVIL[(#)]

1. INTRODUCTION

Empirical studies have shown that the structure of capital inflows in a low developed country is not neutral for growth and for macroeconomic stability. In particular, foreign direct investment (FDI) is a more stable source of financing than portfolio investment (Lipsey, 1999), and it raises the global factor productivity through technological spillovers (Borenzstein and De Gregorio, 1995). The financial crises of 1997-1998 have reinforced that point of view: short run capital inflows have been pointed out as one of the major causes of the crises, both as inflows (through an excess of credit) and as outflows (triggering default).

In order to re-orient capital flows to longer term investment, the needs for microeconomic reforms is often stressed (see, for instance, Stiglitz, 1999). In addition, some economists have been prudently advocating capital controls (for instance, Cooper, 1999). This debate has been generally been separated from the debate on the choice of an exchange rate regime which highlights the difficulty of intermediate regimes in a world of free capital flows (see, for instance, Eichengreen, 1999 versus Frankel, 1999). However the exchange rate regime should have an impact on the composition of capital inflows. Portfolio investors should be indifferent to the exchange rate regime as far as derivative markets allow them to hedge. Conversely, foreign direct investors should worry about the exchange rate regime, because they cannot hedge at their horizon and are mainly interested in macroeconomic variables such as relative labor costs or purchasing power.

This leads to reconsider the choice of an exchange rate regime by integrating the determinants of location of multinationals. Traditional determinants like comparative costs of production are impacted by the level of the real exchange rate. In addition, the new trade theory stresses the so-called "proximity-concentration trade off" (Brainard, 1993), a combination of increasing returns to scale and transportation costs explaining location

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choices of multinational companies. Lastly, a recent strand of papers looks at the location choices of risk adverse firms facing exchange rate variability: the latter affects the location of firms and hence the degree of specialization of countries (Goldberg and Kolstad, 1994; Ricci, 1997; Fontagné and Freudenberg, 1999). Hence it is worthwhile adopting an exchange rate regime capitalizing on micro-economic location strategies of risk adverse firms facing uncertainty, in order to attract the stable part of international capital flows, namely FDI.

Here, we provide a framework for designing an exchange rate strategy aiming at attracting FDI inflows. We explicit the trade-off between price competitiveness and a stable nominal exchange rate. We also show that exchange rate regimes in other emerging countries affect FDI in each specific country. Our findings justify the building of currency blocks as a way of increasing the total amount of FDI (foreign direct investment) towards developing countries and hence providing stability to international capital flows.

2. THE THEORETICAL MODEL

2.1 Existing literature

Broadly speaking, FDI is a *transfer of capital* and hence can be interpreted in terms of comparison of expected returns on alternative decisions of investment. Accordingly, the impact of exchange rates on investment decisions is twofold: the level and the variability of the exchange rate matter.

Firstly, the *level* of the real exchange rate affects FDI in various ways, depending on the destination of the goods produced.

If the investor aims at serving the local market, FDI and trade are substitutes. Various mechanisms then can be considered. An appreciation of the local currency increases FDI inflows due to higher purchasing power of the local consumers. Conversely, a depreciation in the real exchange rate of the recipient country increases FDI through reduced cost of capital. The increase in foreign acquisitions of US firms during the depreciation of the dollar after 1985 has led to a burgeoning literature, of which Froot and Stein (1991) is a central quotation: a strong dollar is associated with low inward FDI in the US. Finally, a depreciation of the dollar increases the relative wealth of foreign firms and hence their capacity to invest in the U.S. in a context of imperfections on the capital market.

Alternatively, if FDI aims at producing for re-export, it complements trade, and an appreciation of the local currency reduces FDI inflows through lower competitiveness (higher labor costs).

Given that available data does not disentangle the various motivations of investors, a depreciation in real terms is generally shown to induce more FDI inflows (see Ito et alii, 1996 or Goldberg and Klein, 1997). In the same way, Cushman (1988) and Barrel and Pain (1998) highlight the negative impact of an appreciation of the real exchange rate on inward FDI. Klein and Rosengren (1994) disentangle the relative wealth versus labor costs channels for seven industrial countries investing in the U.S. over the period 1979-91. Not surprisingly, given the host economy under consideration, they find that only the former channel has played a significant role.

Having such perspective of capital transfer in mind, the second impact of exchange rates on FDI decisions is associated with its *variability.* Darby et al. (1999) emphasize the value of

the option to wait, in the line of Dixit and Pindyick (1994), in presence of uncertainty and sunk costs. Notwithstanding such option, exchange rate volatility affects FDI in various ways. Cushman (1988) advocates that producing on the destination market is a good substitute to exports if there is a strong uncertainty on exchange rates. However, if the production is partially re-exported this benefit vanishes. As a whole, if the theoretical effect of exchange rate volatility is quite ambiguous, from an empirical point of view, Cushman (1988) finds a positive impact of volatility on outward FDI.

However, FDI decisions can also be referred to as *location strategies*. Interestingly, the location of multinational activities depends on comparative advantages, but also on transportation/transaction costs and increasing returns (Horstman and Markusen, 1992, Brainard, 1993, Markusen, 1995). As a whole, the choice of locating abroad is motivated by lower costs, a decision depending once again on the investor's structure of sales. In case the multinational firm intends to sell on the host market, transportation costs reinforce the incentive for producing locally. Conversely, transportation costs reduce the incentive for FDI if production is to be re-exported. In both cases, high transportation costs limit the benefits of concentrating the production in a small number of locations. As referred to above, the level of the real exchange rate determines the production costs in the host economy. More interestingly, turning to the exchange rate instability, the impact is theoretically ambiguous. A foreign firm facing large exchange rate volatility will produce in the local country if it intends to sell on the local market, but refrain from doing so if it intends to re-export.

Lastly, FDI occurs in a context of high uncertainty, as compared to domestic investment. In theory, risk aversion should lead firms to diversify across possible locations. According to Aizenmann (1992), FDI permits to allocate production in the subsidiary that is the cheapest and thus to adjust to various shocks. Accordingly, investing abroad and bearing an exchange rate risk means, broadly speaking[1], buying the option to face alternative sets of production costs if such shocks occur. In total, "countries whose exchange rates are negatively correlated with global returns to capital (such as oil-exporting countries) may actually benefit from their role as portfolio hedges. An increase in these countries' exchange rates may actually raise their FDI inflows on diversification grounds" (Ito et alii (1996), p. 54). Similarly, investing in countries with negatively correlated exchange rates should be a way of diversifying FDI. In this paper, we investigate this possibility and highlight its role in the choice of an exchange rate regime.

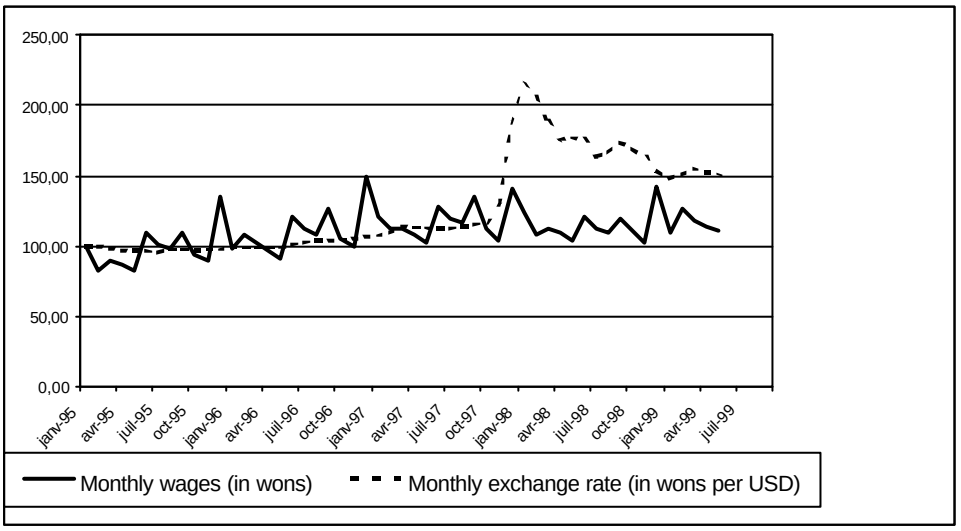
[1] More precisely, buying an option would mean unbounded potential gains and bounded losses, whereas the investor here bears the entire exchange risk.

2.2 The model

We consider the case of a risk-averse multinational firm which contemplates relocating in two alternative foreign locations in order to re-export [2]. Like Cushman (1988), we follow a two-period framework. In the first period, the firm decides where to invest. The decision to relocate abroad is already taken although the investor does not yet know where to do it. There is no option to wait, as opposed to the strand of literature launched by Dixit and Pindyck. The capital cost and the interest rate are certain. In the second period, the firm produces.

We consider the decision of allocating production in alternative locations in order to sell on the investor's market (as defined by its currency). The firm faces labour costs which depend on local wages (which are known and do not react to exchange rate variations) and on the evolution of the exchange rate (which is unknown by the time the firm invests). The rigidity of wages can be justified by the low share of imported goods in local consumption. Indeed, local wages adjust very slowly to exchange rate fluctuations in LDCs as illustrated in Chart 1.

Chart 1: Nominal Exchange Rate and Nominal Wages: The Case of Korea



Sources: IMF (exchange rate) and Bank of Korea (wages).

In our model, the price is given in the investor's currency, and there is no residual market value of the capital after the production period. The latter assumption can be justified by the high level of sunk costs. We also assume that capital inflows have no impact in terms of real appreciation: they can be assimilated to a positive supply shock and do not carry inflation pressures in the host economy (Artus, 1999).

[2] Available data do not disentangle greenfield investments from mergers and acquisitions. Our approach matches better the former since mergers and acquisitions are less complementary to trade (Swenson, 1999).

Finally, we add both a fixed cost in local labor (to be interpreted as training costs) and transportation costs. The former is an incentive to invest in a single country in order to omit the replication of fixed costs. Transportation costs are an hindrance to trade in goods (Brainard, 1993). Hence, it could be advocated that transportation costs boost FDI and local production to serve the domestic market. However, since we are interested in modeling alternative strategies of relocation, we are conversely interested in trade in goods. In this respect, transportation costs are expected to have a negative impact on re-exports and thus on FDI. To put it differently, we assume complementarity between FDI and trade (Eaton and Tamura, 1994), not substitution. Here, transportation costs will influence the sensitiveness of FDI to costs and to exchange rate uncertainty.

The investing firm chooses between investing in country 1 or 2 according to their levels of wages, capital prices, exchange rates, according to the magnitude of transportation costs from the subsidiary to the destination market of goods produced, and according to the prospects for exchange rate variations. Due to its risk aversion, it also takes exchange rate uncertainty into account. Because there are two possible locations, the covariance between the two exchange rates will play a crucial role in our model.

The nominal profit of the investing firm is, in its own currency:

$$\boldsymbol{p} = P(Q_1 + Q_2) - W_1(F + L_1/\boldsymbol{t}_1)S_1^{'} - W_2(F + L_2/\boldsymbol{t}_2)S_2^{'} - r_1R_1K_1S_1/\boldsymbol{t}_1 - r_2R_2K_2S_2/\boldsymbol{t}_2 \quad (1)$$

Where P is the price of the goods on the investor's market; Q_i, L_i and K_i are output, labor and capital used by the firm in country *i*; W_i and R_i are nominal wage and capital price in country *i*, in local currency. Both W_i and R_i are assumed to be given for the investing firm (no pressure on the local markets of labour or capital goods). The fixed cost F is assumed identical in both locations, whereas the transportation cost $1/\boldsymbol{t}_i$ is different.[3] r_i is one plus the nominal interest rate related to FDI in country *i*.[4] S_i is the nominal exchange rate of currency *i* against the investor's currency (a rise in S_i means an appreciation of currency *i*). Finally, S'_i denotes the nominal exchange rate in the second period. Like in Cushman (1988), it is the only uncertainty introduced in the model.

The technology is similar in both locations (it is internal to the multinational). Departing from the factor proportion hypothesis, we use a very simple specification where capital and labour are complements:

$$Q_i = L_i = K_i \big/ k \quad (2)$$

Where k is the constant capital/labor ratio.

The firm maximises its utility which depends positively on expected profit $E\boldsymbol{p}$, and negatively on its variance $Var\boldsymbol{p}$, with $\boldsymbol{f}$ being the risk aversion coefficient:

$$\underset{Q_1, Q_2}{Max} U = E\boldsymbol{p} - \boldsymbol{f} Var\boldsymbol{p} \quad (3)$$

[3] We assume standard iceberg transportation costs for tractability. This transportation cost is proportional to output. It does not affect the fixed cost which can be interpreted as a training cost. Hence, the fixed cost is more important compared to variable costs when the host country is close to the investing country.

[4] It is a mix between the world interest rate and the local interest rate, in order to take account of re-investing profits as a way of financing investment, in countries where repatriating benefits was often constrained in the past.

2.3 Resolution

The two first order conditions lead to the following reaction functions[5]:

$$\begin{cases} Q_1 = t_1^2 \dfrac{P-(W_1/t_1)ES_1^{'}-kr_1R_1S_1/t_1}{2fW_1^2VarS_1^{'}} - \dfrac{W_2}{W_1}\dfrac{t_1Cov(S_1,S_2)}{VarS_1^{'}}\left(\dfrac{Q_2}{t_2}+F\right)-t_1F \\ Q_2 = t_2^2 \dfrac{P-(W_2/t_2)ES_2^{'}-kr_2R_2S_2/t_2}{2fW_2^2VarS_2^{'}} - \dfrac{W_1}{W_2}\dfrac{t_2Cov(S_1,S_2)}{VarS_2^{'}}\left(\dfrac{Q_1}{t_1}+F\right)-t_2F \end{cases} \quad (4)$$

The production in country 1 depends on costs and uncertainty concerning country 1 (first term), but also on the outcome in country 2 (through the second term). Three cases can be distinguished.

1st case: $Cov(S_1,S_2)=0$. The productions carried out in the two countries are independent. Each one depends on the (positive) difference between the price of the good and the unit costs expected, and on the uncertainty surrounding these costs: a rise in $VarS'_i$ reduces Q_i, other things equal.

2nd case: $Cov(S_1,S_2)>0$. The productions in the two countries are substitutes. This is because when one currency appreciates (raising costs in this country), the other one also appreciates. Hence, diversifying locations is useless: costs generally grow in the two locations simultaneously. In this case, better conditions in one country lead to a transfer of FDI from the other country.

3rd case: $Cov(S_1,S_2)<0$. The productions in the two countries are complements: when costs rise in one country – because its currency appreciates – they generally decrease in the other one. However, in this case the firm raises (reduces) its production in both countries at the same time when costs are reduced (increased) in one of them. Diversifying its locations reduces the overall risk on its profit.

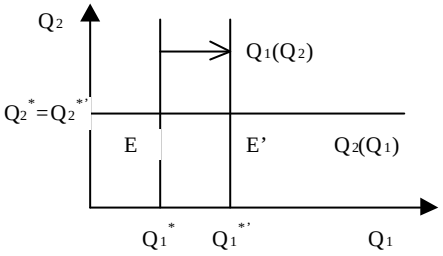
The three cases are represented in Chart 2, and the impact of reduced costs in country 1 (through a currency devaluation for instance) is studied. In the three cases, the shock increases output in country 1. But in the independence case, production is unaffected in country 2, whereas it declines in the substituability case and rises in the complementary case. Note that the smaller the transportation cost (the larger t), the larger the influence of the covariance term: the firm will arbitrate mainly between close locations.

[5] If the variance is zero (in the case of a currency board for instance), then the firm maximizes its expected profit. The first order condition then leads to $P = (W_1ES'_1+r_1R_1kS_1)/t_1$, which is a form of PPP.

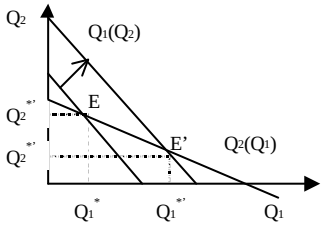
Chart 2: The Relationship between Production in the Two Locations

Impact of a reduction in country 1 costs

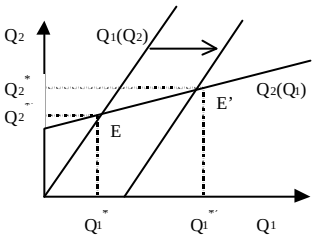
1a: independence



1b: substituability



1c: complementarity



Hence, the allocation of FDI is not necessarily a zero-sum game: in the case exchange rates are negatively correlated, both locations take advantage of a reduction of costs in one country. Conversely, in the substituability case, a devaluation in country 1 will reduce FDI to country 2 except if the latter also devaluates or reduces local costs (for instance through lowering capital prices or liberalizing the capital account so that the interest rate converges to the world level).

Solving the model leads to:

$$Q_i = \frac{1}{2\phi(1-\rho^2)}\left(\tau_i^2 \frac{C_i}{W_i^2 Var S_i'} - \rho C_j \frac{\tau_i}{W_i}\frac{\tau_j}{W_j}\right) - F\tau_i \qquad (5)$$

where ρ denotes the correlation between S_1' and S_2',

$C_i = P - \left(ES_i' \frac{W_i}{\boldsymbol{t}_i} \right) - kr_i R_i \frac{S_i}{\boldsymbol{t}_i}$ measures the competitiveness of country i,

The existence of fixed costs imply that the price of the goods must exceed the local costs in order for the firm to invest abroad[6]. In addition, we find the standard trade-off between fixed costs and transportation costs referred to above[7]: would the choice be between exporting and investing abroad, high specific fixed costs (*F*) would reduce the incentive to produce abroad. However, since we are interested in the choice between two foreign competing locations devoted to re-export, a rise in fixed costs reduces output in both locations, but especially in the host country facing low transportation costs with the investing country ($\partial Q_i / \partial F = -\boldsymbol{t}_i$). For distant locations, fixed costs are largely offset by transportation costs as a deterrent to foreign inward investment. In contrast, close or adjacent countries are highly sensitive to changes in fixed costs, transportation costs remaining negligible in any case. To put it differently, since relocating computer assembly for the US market is concerned, Mexico is more concerned by plant economies of scale than Beijing.

Turning to the arbitrage between the two locations according to expected costs and to the uncertainty pattern, the results can be summarized as follows:

- Lower expected costs in country 1 (higher C_1) induce more output in that country, especially if transportation costs are low ($\boldsymbol{t}_1$ high).
- Lower uncertainty in country 1 (lower $VarS'_1$) increases the sensitivity of output in country 1 to local costs.
- Lower expected costs in country 2 reduces, increases or leaves unchanged output in country 1 depending on whether the two exchange rates are positively, negatively or not correlated respectively.
- Output in country 1 is more sensitive to country 2 costs if transportation costs are low between both countries and the investing country (the product $\boldsymbol{t}_1 \boldsymbol{t}_2$ is high).

A preferential commercial scheme, allowing products exported from *i* to enter more liberally in the investing country, can be interpreted in the same way. Such discrimination would reduce transaction costs between *i* and the investing country, hence increase $\boldsymbol{t}_i$, and attract FDI detrimental to *j*.

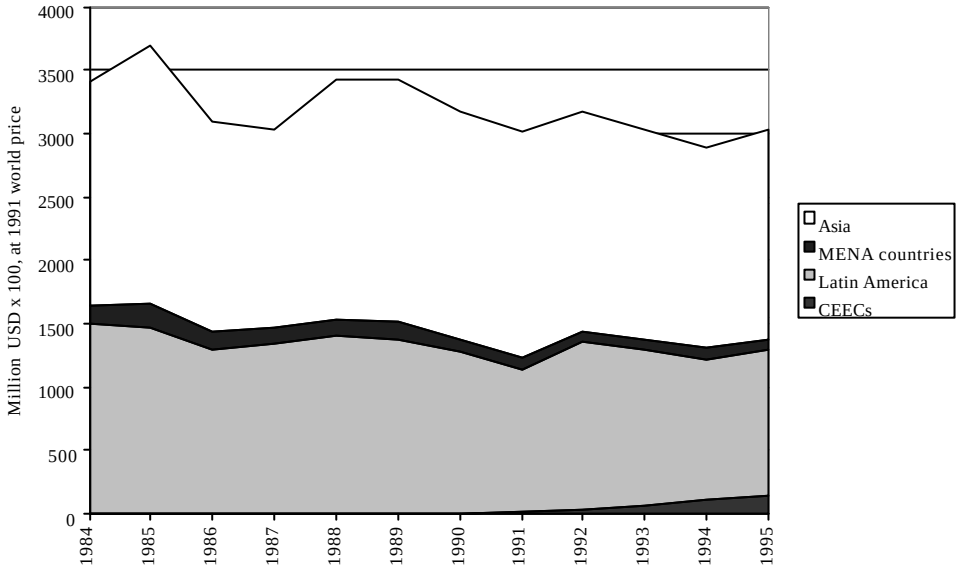
[6] Note that the lower bound of output is zero.
[7] It can be surprising that fixed costs enter the first order conditions: notice however that it is due to the calculation of the variance of the profit.

3. ECONOMETRIC ANALYSIS

3.1 Methodology

We test the theoretical model on a panel of 42 developing countries receiving FDI from 17 investing countries over 1984-1996. The dependent variable is the logarithm of the stock of FDI received by country *i* from country *k*. It is expressed in US dollars at constant world price. The declarations of the OECD reporting countries are used. Hence, we consider mirror data. This variable is highly unstable, and it does not exhibit a trend (Chart 3). Besides, it should be noted that, due to missing values, the cross-section dimension of the sample is much more important than the time series dimension.

Chart 3: The Real FDI Stock in Various Emerging Areas



Note: MENA = Middle East and North African.
CEECs= Central and Eastern European Countries
Years 1996 to 1998 were removed from the graph due to missing data in some countries.
Source: OECD.

We aggregate emerging countries in an emerging zone indexed *j* in order to get an alternative location for each country *i* (for simplicity, we assume that each emerging country considered in the estimation is small in the aggregate). The equation to be estimated is:

$$\log FDI_{it}^{k} = a_0 + a_1 \log C_{it}^{k} + a_2 Vol\ S_{it}^{k} + a_3\, r_{it}^{k} \times \log C_{jt}^{k} + a_4 \log DIST_{i}^{k} + a_5 OPEN_i + OIL_i \left(a_6 \log C_{it}^{k} + a_7 Vol\ S_{it}^{k} + a_8 \log DIST_{i}^{k}\right) + e^{k} + e_t + u_{it}^{k} \quad (6)$$

The competitiveness of country *i* (C_i in the theoretical model) is proxied by the uncertain-priced real exchange rate of *i* against each investing country *k* (C_i^k), calculated with

consumer price indexes. Consistently, the competitiveness of the alternative location (C_j in the theoretical model) is the real exchange rate of the emerging countries aggregate j against each investor k (noted C_j^k).[8]

The uncertainty on the nominal exchange rate is given by the quarterly volatility of country i nominal exchange rate against k, defined as the coefficient of variation of the nominal exchange rate over the past three years ($Vol\ S_{it}^k$). The correlation between i/k and j/k exchange rates is calculated over the same period (ρ_{it}^k).[9]

Transportation costs are proxied by a measure of distance between i and k ($DIST_i^k$).[10] The distance between alternative locations and the investing country is assumed constant on average throughout the sample.

In addition to the theoretical model referred to above, we introduce an openness variable ($OPEN_i$), which is designed to control for the nature of foreign direct investment: if FDI aims at re-export, then it should translate into a large openness ratio (the ratio of exports plus imports to GDP), since entering the small domestic markets of host economies can hardly be the investor's motivation.[11]

A dummy (OIL_i) is also introduced to control for the particular behavior of oil exporting countries. In these countries, FDI is mostly related to the energy sector, which is itself linked to the real exchange rate through a Dutch disease effect: when the energy sector booms, the real exchange rate tends to appreciate, but at the same time FDI is attracted because its profitability in this sector is increased. Hence, we should expect a positive link between real appreciation and FDI, in contradiction with the theoretical model, which mainly describes manufacturing FDI. Along the same line, the effect of exchange rate volatility is likely to be important in oil exporting countries, since the law of one price applies to oil exports: a large volatility in the nominal exchange rate means a large uncertainty on local operating costs and thus on profits. Lastly, transportation costs are expected having little role in the location strategy since the location of primary commodities is determined by the nature. This contrasts with the aim of our model that is interested in footloose industries.

Finally, we add fixed effects for time (e_t) and for investing countries (e^h). The latter control inter alia for the size of the investing country, whereas the former catch trends in the world economy such as deregulation.

We cannot a priori exclude that the real exchange rate be influenced by FDI inflows as one component of capital inflows. However Artus (1999) shows that there is little correlation between the average net FDI flows (as a percentage of GDP) and the average growth of the

[8] This synthetic measure of competitiveness encompasses variables impacting on productivity, including human capital. The definition of variables and data sources are detailed in Appendix.

[9] The use of past volatilities and correlations can be justified by the auto-regressive nature of the volatility: except for institutional breaks like the settlement of a currency board, looking at past volatility helps to forecast future volatility.

[10] We are grateful to Michaël. Pajot for kindly providing this measure.

[11] It could be argued that some host countries of our sample are large enough to attract FDI aiming at serving the local market, which would lead to a somewhat different impact of competitiveness and exchange rate volatility in these countries. However these countries also receive re-export FDI for which their contribution is large given the fact that we did not introduce dummies for recipient countries.

real exchange rate, for a set of 18 developing countries over the 1992-1996 period. Hence, we can rule out reverse causality.

3.2. Results

The result of the econometric estimation is reported below.

$$\begin{aligned}\log FDI_{it}^{k} = & \underset{(2.729)}{0.231}\log C_{it}^{k} - \underset{(-3.384)}{0.630} Vol\ S_{it}^{k} - \underset{(-2.256)}{0.034}\, r_{it}^{k} \times \log C_{jt}^{k} - \underset{(-7.174)}{0.347}\log DIST_{i}^{k} \\ & + \underset{(16.563)}{0.910} OPEN_{i} + OIL_{i}\left(\underset{(-3.819)}{-0.463}\log C_{it}^{k} - \underset{(-1.996)}{0.007} Vol\ S_{it}^{k} + \underset{(7.174)}{0.357}\log DIST_{i}^{k} \right)\end{aligned} \quad (7)$$

Nb obs. = 1749; $\overline{R}^{2} = 0.619$

The Student statistics are given in parentheses. All the coefficients are significant at 1%, except that on exchange rate volatility in the oil exporting countries which is significant at 5%.

As expected, a depreciation (rise in the real exchange rate) of *i* against the investing country increases FDI inflows (*competitiveness effect*), whereas an increase in the nominal exchange rate volatility tends to reduce FDI (*volatility effect*). The coefficient associated to the multiplicative variable $r_{it}^{k} \times C_{jt}^{k}$ (*interdependence effect* thereafter) also bears the negative, expected sign: when the exchange rate of other emerging countries is positively correlated to that of country *i*, an improved competitiveness in other emerging countries reduces FDI inflows to country *i* (through a substitution effect); conversely, in case of a negative correlation, an improved competition in other emerging countries raises FDI to country *i* (through a diversification effect).

Geographic distance (which proxies transportation costs) accounts for a significant part of the investing behavior of industrialized countries, consistently with the literature on economic geography. Moreover, openness has a significant impact on FDI, which highlights that these countries receive a large proportion of FDI aiming at re-exporting at least partially their output.

The effect of a real appreciation is opposite in oil producing countries compared to other emerging countries: it raises FDI inflows. This is consistent with the Dutch disease referred to above.[12] The impact of volatility is reinforced compared to other countries, whereas the coefficient on economic distance is almost zero (0.357-0.347=0.010). The latter outcome can firstly be explained by the fact that oil producing countries are all far from potential investors (mainly the United States). In addition, as already noticed, the location of primary commodities is determined by the nature and location strategies are consequently highly constrained.

[12] See Corden and Neary (1982) for theoretical developments on the Dutch disease.

4. POLICY IMPLICATIONS

Our estimations highlight the trade-off to be made between price competitiveness and nominal exchange rate stability. More precisely, it is shown that a 1% appreciation in the real exchange rate reduces the FDI stock by 0.23%, whereas a 1 point increase in exchange rate volatility reduces it by 0.63%. The trade-off arises because an emerging country typically suffers from a positive inflation differential with investing countries. Hence, preventing the real exchange rate to appreciate means allowing the nominal exchange rate to depreciate periodically, which induces some volatility.

Another implication of our estimates concerns the choice of a specific anchor: since potential anchor currencies fluctuate to a large extent among themselves, it is not possible to monitor price competitiveness and reduce exchange rate volatility against all of them at the same time. Hence a second trade-off must be considered across possible anchors.

Finally, the trade-off is made more complex by the fact that it must take the behavior of other emerging countries into account. Namely, it is important for a recipient country to differentiate its exchange rate regime from those of other emerging countries in order to benefit from the diversification of investments from risk adverse multinational firms. This last feature is captured by the negative coefficient on the correlation variable. Because all real exchange rates are taken as an index (on a 100 basis), the order of magnitude of their decimal logarithm is 2. Hence, a drop in the correlation between i/k and j/k (k being the investor's currency) from 1 to zero increases FDI to country i by 6.8%, which is equivalent to a 30% depreciation (in country i) or a 10 point drop in volatility.

In this Section, we successively illustrate these three main implications through simulating and comparing various exchange rate arrangements. Switching from one regime to another entails some political as well as economic costs in the short run, which are not taken into account in our static framework. Considering a relatively long term horizon, however, we can ignore these costs.

4.1. The choice of an exchange rate regime

In a first step, we assume there is a single investor country and a single recipient country which suffers from a 10% inflation differential with the investing country. For simplicity, we take the case of a country which is not an oil exporter. We also assume that it keeps the same exchange rate regime during three years. We compare four stylized exchange rate regimes for the recipient country.

In the "successful currency board", the nominal exchange rate is held constant, and inflation drops after a short term adjustment to the level of the anchor country. The fixed exchange rate regime is assumed identical to the currency board except that the inflation differential remains positive. In the crawling peg or managed floating regime, nominal devaluations compensate for inflation differentials. Finally, in a hypothetical "successful free floating", exchange rate volatility would be higher (20% in our simulation), the real exchange rate remaining constant.

By construction, the "successful currency board" appears the best regime for attracting FDI, because the real exchange rate stays constant without any nominal exchange rate volatility. This "credibility in a bottle" (cf. Frankel, 1999) regime is taken as a benchmark, and other regimes are compared to it in Table 1. Of course, there may be other ways of reaching the

benchmark level, for instance through a credible fixed peg or a credible inflation target. Conversely, some inflation differential can remain in a currency board.[13] In a similar way, the impact of intermediate and floating regimes on inflation can be discussed. The various regimes studied here are stylized, our goal being to compare contrasted regimes. If inflation was to be reduced in the fixed exchange rate regime, then the loss in competitiveness would be smaller, and this regime would be closer to the benchmark. Conversely, a fixed exchange rate regime would unlikely survive inflation differentials well above 10%.

As expected, FDI inflows are lower in our rather unsuccessful fixed peg regime than with the successful currency board. This is due to the loss of competitiveness. The crawling peg and the managed floating regime have an intermediate impact on FDI: because they keep competitiveness constant with limited volatility, they appear better than both a fixed peg or a "successful free floating". The evaluation of the latter crucially depends on the assumption concerning volatility. Should volatility be smaller, then this scenario would look like a crawling peg or managed floating regime.

Hence, our very simple, two-country framework shows that the exchange rate volatility induced by a free floating regime is detrimental to FDI inflows, even if it prevents the real exchange rate to appreciate. By construction, a "successful" currency board is the best way of attracting FDI. This is not to say that currency boards should be adopted everywhere (as underscored by Frankel, 1999). But, in evaluating each exchange rate regime, it should be stressed that exchange rate stability has a sizable impact on FDI which compares to the impact of price competitiveness.

Table 1: Impact of Various Exchange Rate Regimes after three years on the Stock of FDI

Exchange rate regime	**Successful currency board (benchmark)**	**Fixed peg**	**Crawling peg or managed floating**	**Successful free floating**
Related assumptions				
- inflation differential p.a.	0	10%	10%	10%
- nominal exchange rate after 3 years	100	100	133	133
- exchange rate volatility during the previous 3 years	0	0	8%	20%
- price competitiveness after 3 years	100	73	100	100
FDI	100	93.8	95.0	87.4

Source: simulations based on Equation (7) with OIL held to zero.

[13] However, the remaining inflation in a currency board may reflect a Balassa effect which does not affect external competitiveness.

4.2. The choice of an anchor currency

Here, we still take the case of a single host country. But now there are two investor countries: the United States and the euro zone.[14] If the euro/dollar exchange rate remains constant, then choosing the euro or the dollar as a monetary anchor is indifferent, and the two-country framework still applies. However emerging countries should not put too much hope on a possible coordination of G7 countries to reduce exchange rate fluctuations between their currencies. Hence the question is that of the resilience of exchange rate regimes in emerging countries to these fluctuations.

Here we consider the successful currency board against the dollar as a benchmark, and we assume the euro depreciates by 20% against the USD (progressively along three years).[15] Due to its peg to the dollar, currency *i* appreciates against the euro, which reduces the FDI stock coming from the euro zone by more than 8% (Table 2). In the case of a crawling peg against the dollar, FDI coming from the euro zone is slightly higher because volatility against the euro is smaller, but FDI coming from the United States declines by 5% due to the exchange rate volatility against the dollar. Finally, the crawling peg is superior when defined against a basket of the two currencies than against the dollar only. This is because then the currency depreciates against the dollar while appreciating to a lesser extent against the euro, without full compensation through higher volatility.

Of course, if the euro appreciates, then the results are reversed: a currency board against the dollar allows the competitiveness against the euro to rise with no change in the competitiveness against the dollar; a crawling peg against the USD also allows competitiveness to rise against the euro; finally, a crawling peg against a basket leads to a fall in the competitiveness in dollar terms but a rise in euro terms.

Hence, the best solution would be to choose the depreciating currency as an anchor. There is some evidence that Asian emerging countries had such a strategy in the past (Takagi, 1996). We can interpret the failure of the yen to become an anchor currency as a consequence of the "ever rising yen" (McKinnon and Ohno, 1997). However, pegging to a depreciating anchor should entail switching from one anchor to another over time, which is not possible in a pre-announced regime.

When changing the monetary anchor over time is not possible, then the objective should be to minimize the volatility of FDI inflows. Table 2 shows that this can be done through a currency board against the currency of the main investor country. When FDI comes from various countries in similar proportions, it is interesting to see that a basket peg does not perform much better than a peg to a single currency. This is because it introduces more volatility with a small gain in average competitiveness. In general, however, one origin is prominent in FDI (see Table 3). The case of MENA[16] countries is particular since the main source of FDI differs dramatically across them. Consequently, geography does not only determine FDI; according to our simulations, it also determines the choice of a monetary anchor.

[14] The same reasoning can be applied to Japan instead of the euro zone.
[15] For simplicity we assume no inflation differential between the United States and the euro zone.
[16] Middle East and North African.

Table 2: Impact of a 20% Depreciation of the Euro against the US dollar

Exchange rate regime	**Successful currency board against USD (benchmark)**		**Crawling peg against USD**		**Crawling peg against basket (50% $, 50% euro)**	
	US investor	Euro-zone investor	US investor	Euro-zone investor	US investor	Euro-zone investor
Related assumptions						
- inflation differential p.a.	0	0	10%	10%	10%	10%
- nominal exchange rate after 3 years	100	80	133	106	146	120
- exchange rate volatility during the previous 3 years	0	6%	8%	3%	10%	5%
- price competitiveness after 3 years	100	80	100	80	110	90
FDI	100	91.6	95.0	93.5	96.0	94.5
*- 50% US 50% euro zone**	95.8		94.3		95.3	

* assuming FDI comes from the two areas in equal weights.
Source: simulations based on Equation (7) with OIL held to zero.

As a whole, our analysis would advocates either managed floating regimes with changing anchors over time, or a polarization of exchange rate regimes consistently with economic geography. This is one first step towards monetary regionalism. The second step comes from interdependencies between emerging countries, which we study in Section 4.3.

Table 3: The Origin of FDI in Selected Emerging Areas (1995-1996 average)

FDI stock in	Stock (billions of USD at 1991 world price)	FDI stock from (in % of total stock)		
		The EU	North America	Japan
CEECs	14.6	83.1	15.6	1.3
Latin America	110.4	30.1	64.1	5.8
MENA countries	7.8	44.9	51.8	3.3
Asia	130.2	29.6	41.5	28.9
Total sample	263.0	33.2	49.9	16.9

Note: EU = Austria, Denmark, Germany, Finland, France, Great Britain, Italy, the Netherlands, Sweden
North America = The US, Canada
CEECs = Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovenia, the Slovak Republic.
Latin America = Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Panama, Venezuela.
MENA countries = Algeria, Egypt, Israel, Morocco, Turkey.
Asia = China, Hong Kong, Indonesia.
Source: OECD.

4.3. Monetary regionalism

Here we study the impact of other emerging countries choosing their own exchange rate regimes independently. This has an influence on FDI received by each country through the correlation between *i/k* and *j/k* exchange rates, h being the investing country and *j* the group of other emerging countries. As seen in Section 4.2, several monetary anchors are available both for country *i* and for other emerging countries *j*. Hence the optimal arrangement for country *i* will depend on the choice made by the rest of the emerging world.

Here we take as a benchmark the extreme situation where all emerging countries (including country *i*) have a currency board against the USD.[17] Because all exchange rates against the USD are fixed, the correlation between *i/$* and *j/$* is zero, whereas the correlation between *i/euro* and *j/euro* is 1. If country *i* switches to a currency board against the euro, the correlation between *i/$* and *j/$* is still zero (because *j/$* is constant), but the correlation between *i/euro* and j/euro falls to zero (because i/euro is constant). The latter fall in correlation raises FDI from the euro zone by 6.8%, because *i* and *j* are no longer substitutes. Note that this rise in FDI also happens in the other host countries. Hence, there is a global gain in differentiating exchange rate policies across countries. However, complementarity effects can only occur if negative correlations appear among currencies[18], which implies that emerging countries choose between three monetary anchors (instead of only two in the previous case).

Assume now that other emerging countries (*j*) have a currency board against the yen.[19] If country *i* still has a currency board against the USD, then the correlation between i/$ and *j*/$ is zero (because *i/$* is constant), while the correlation between *i/euro* and *j/euro* is positive and set to 0.8 (in reference to the correlation between *$/ecu* and *yen/ecu* over the 1996-1998

[17] We take currency boards because in these regimes there is neither exchange rate volatility, nor real appreciation. Hence, it allows to concentrate on interdependence effects only.
[18] Diversification does not necessarily imply negative correlations: zero correlations among a large number of exchange rates would produce some diversification. But negative correlations offers even greater diversification.
[19] Pegging to the yen is not the only possibility of monetary regionalism in Asia. For instance, such a regionalism could come from a common currency between Hong Kong and Singapore, as suggested by the Hong Kong Treasury Secretary on October 22nd 1999 (AFP release).

period during which it was even higher). In this case, the stock of FDI is slightly increased in country *i* (by 1.4%) compared to the benchmark. Conversely, if country *i* has a currency board against the euro, the correlation between *i/$* and *j/*$ is negative and set to –0.8 (in reference to the correlation between ecu/$ and yen/$ over the 1996-1998 period), while the correlation between i/euro and *j*/euro falls to zero (because *i/euro* is constant). In this case, the stock of FDI coming from both the United States and the euro zone stands above the benchmark by 5-7%.

Of course, the latter case is unrealistic since many countries, especially in Latin America, will likely continue managing their currencies against the dollar. However it gives an idea of the benefits of monetary regionalism versus hegemony as far as FDI is concerned. A genuine monetary regionalism would include currency boards (or other forms of pegging) against three main currencies. Such an international monetary system would appear as a mixture of the cases described in Table 4. It is clear that FDI would increase compared to a situation of generalized dollarization (our benchmark) or even compared to a bipolar international monetary system (south-west of the Table).

Of course, the results of this last simulation are dependent on the negative correlation between ecu/$ and yen/$ over the 1996-1998 period. There is no guarantee of such a correlation over the future. However, should this correlation be positive in the future, emerging countries would not loose from monetary regionalism.

Hence, monetary regionalism could be a way of increasing FDI to emerging countries, since it would allow investors to diversify the exchange rate risk across various locations.

The similarity in specialization of developing countries within a given region acts however as an opposite force. As demonstrated by our model, countries competing to attract FDI in the same industry benefit from being in opposite phasing with the investor's currency. Conversely, following similar exchange rate policies is not detrimental if they are not close competitors on foreign markets. This mechanism contradicts the usual optimum currency area argument which highlights the role of common shocks (i.e. similar specializations) when weighting the pros and cons of a currency union. The small GDP weight of developing countries justifies an external trade concentrated on relationships with developed countries rather than between the formers. Hence, intra-regional openness is lower for developing regions, and the traditional OCA argument in terms of similar specialization does not hold. On the contrary, *monetary regionalism is easier in our framework if the various countries of the region do not exhibit the same specialization pattern.*

Table 4: The Impact of Interdependencies between Host Countries

	Currency board against the USD in country *i*		**Currency board against the euro in country *i***	
	k = $	**k = euro**	**k = $**	**k = euro**
Currency board against the USD in other host countries				
- Correlation between i/k and j/k	0	1	0	0
- FDI	100	100	100	106.8
Currency board against the yen in other host countries				
- Correlation between i/k and j/k	0	0.8	-0.8	0
- FDI	100	101.4	105.4	106.8

Source: simulations based on Equation (7) with OIL held to zero.

CONCLUSION

The financial crises of 1997-1998 have given birth to a debate on the reform of the so called international financial architecture. Exchange rate regimes in emerging countries constitute one pillar of this new architecture, as testified by the creation of the G20 which gathers ministers from the G7 and from a set of large emerging countries to cooperate on monetary and financial affairs.

Our contribution can be viewed as a demonstration that exchange rate volatility does matter for foreign direct investment, and hence for a stable financing of growth in emerging countries. In addition, we show that exchange rate regimes in emerging countries should be defined in a global framework given the large externalities they encompass. More precisely, our analysis shows that monetary regionalism can be a way of increasing FDI to emerging countries as a whole. The frontiers of monetary areas would then be strongly influenced by geography, as FDI is.

Accordingly, we point out two complementary patterns of the future financial architecture: the building of currency blocks and the organization of the world economy in regions, which are shown here to be beneficial, as far as inward FDI and the related benefits of it for emerging countries (stability, technological progress) are concerned.

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APPENDIX: THE DATA

1 – ***FDI stock*** data come from the OECD and are tabulated using mirror data statistics. Real FDI stocks series are constructed as follows, with the world consumer price index coming from IMF, *International Financial Statistics*, line 64 (100 in 1991):

$$log\ FDI = log\left(\frac{\text{FDI stock in millions USD}}{\text{World consumer price index}}\right)$$

2 – ***The competitiveness indicator*** C_{it}^{h} is the real exchange rate of country *i* against country *k* (number of units of currency *k* needed to buy a unit of currency *i*). It is taken from the CHELEM data-base (CEPII).

3 – ***The volatility*** $VolS_{it}^{k}$ is the coefficient of variation (in %) of the quarterly nominal exchange rate of country *i* against country *k*, during the three years preceding year *t*. Source: IMF, *International Financial Statistics*, line rf.

4 – ***The coefficient of correlation*** between *i*/*k* and the rest of emerging countries/*k* exchange rates. The exchange rate between the emerging countries (*j*) and the investing country *k* is an effective, quarterly, nominal exchange rate of *j* against *k*, where each emerging country exchange rate is weighted by the GDP of this country in the total GDP of emerging countries (source : IMF, *International financial statistics*, line rf for nominal exchange rates and line 99 for GDPs).

5 – ***The competitiveness of emerging countries*** against *k* is computed using the CHELEM data-base on real exchange rates. It is a real, effective, annual exchange rate, where each emerging country exchange rate is weighted by the GDP of this country in the total GDP of emerging countries. GDP data come from IMF, *International Financial Statistics*, line 99.

6 – ***Distance data*** are constructed as follows : $DIST_{i}^{k}$ is the distance between *i* and *k* when *i* and *k* have no common border. $DIST_{i}^{k}$ is set to one when *i* and *k* share a common border. Data were provided by M. Pajot.

7 – ***Openness***. Openness relates the sum of total exports and imports of country *i*, to the GDP of country *i* (source : IMF, *International Financial Statistics* for the GDP, *Direction of Trade* for exports and imports).

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"La diversité des marchés du travail en Europe : Quelles conséquences pour l'Union Monétaire", première partie : La diversité des marchés du travail dans les pays de l'Union Européenne, Loïc Cadiou, Stéphanie Guichard, *document de travail n°99-10,* juin.

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