

Do Currency Unions Solve the Border Effect Puzzle? Evidence from the CFA Franc Zone

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Abstract

This paper aims at conciliating two controversial issues in international economics: the border effect puzzle and the currency union impact on trade. Considering the case of the CFA Franc Zone in West and Central Africa, we propose first to assess the effect of monetary unions on trade, and second to measure the extent to which a common currency explains the border effect. We show that currency unions affect trade significantly, but do not explain much of the border effect: the border effect remains large even within the two currency unions.

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1 Introduction

This paper refers to two controversial issues in international economics. The first one relates to the so-called border effect, one of the six major puzzles in international macroeconomics [Obstfeld and Rogoff, 2000]. The border effect puzzle or home bias puzzle is first emphasized by McCallum (1995), who showed that a Canadian province trades about 20 times more with another province than with an American state of comparable size and distance. This finding has been confirmed afterwards [Helliwell, 1996; Hillberry, 1998] and for other regions of the world [Wei, 1996]. The second controversial issue concerns the relationship between trade and monetary unions. The “traditional” literature emphasizing that monetary unions¹ and fixed exchange rates should enhance trade has been recently questioned by Andrew Rose (2000). He highlighted that a fixed exchange rate has a negligible impact on trade, while a monetary union enhances trade by a factor of three. However, Rose’s result is subject to various bias and the most widely shared criticism concerns the heterogeneity of his sample².

The literature provides various explanations of the home bias puzzle: mis-specifications, formal and informal trade barriers as well as national preferences. Another consistent explanation stems from the existence of various currencies. Since a nation is by definition a monetary union, crossing borders implies the use of different currencies entailing transaction costs and therefore impeding international trade.

In this paper, we try to answer two essential questions. First, does a common currency have an effect on trade? And more importantly, does the existence of separate currencies explain part of the border effect?

To address these issues, we use the theoretical gravity model developed by Anderson and van Wincoop (2003). Based on this model and Rose (2000)’s sample, Rose and van Wincoop (2001) estimate that a monetary union increases trade by a factor of 2.3. However, as stated previously, their sample has been deeply criticized and they do not relate theoretically monetary unions and the border effect. In order to take into account both the effect of borders and the effect of currency unions, we redefine the trade cost factor.

The choice of West and Central Africa is relevant for our purpose. First, there is very little literature estimating the border effect for this particu-

¹A monetary union is defined by a single currency, a single central bank and a single monetary policy.

²For a review of the various potential bias affecting Rose’s result, see Lochard (2002).

lar zone and for less developed countries [Helliwell, 1998]. Second, until the creation of the European Monetary Union, the only reference in terms of currency unions consisted in the African countries of the Franc Zone. Moreover, this zone comprises two monetary unions: the West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CAEMC), and this particular feature allows us to compare intra-currency unions, inter-currency unions and extra-currency unions trade relationships.

Using bilateral trade data on 25 African and European countries from 1980 through 1999, we empirically test the relationship between currency unions and the border effect. We find a positive impact of currency unions on trade, but the national border effect remains large even after controlling for the currency union effect. Furthermore, integration between CFA countries and France seems much deeper despite the existence of different currencies.

These results are all the more important since other countries in this area contemplate to create a new currency union regrouping the WAEMU and other countries belonging to the Economic Community of West African States (ECOWAS).

We proceed as follows. In section 2, we present the historical and economical background of the CFA Franc Zone countries. Then, in the third section, we review the literature dealing with the empirics of the gravity equation and the border effect. In the fourth section, we describe the theoretical model. The fifth section is devoted to the presentation of our empirical results, and in the final section, we conclude.

2 The Franc Zone and its two currency unions

2.1 A short history

As to January 1st, 2003, the CFA Franc Zone comprises 14 Sub-Saharan African (SSA) countries of which 12 were French colonies³ (two Sub-Saharan countries which had no colonial relations with France joined more recently: Equatorial Guinea in 1985, Guinea-Bissau in 1997)⁴. Eight of these coun-

³Cameroon was indeed a French and British colony. Two French colonies, Mali and Guinea decided to create their own currency at the time of their independence (Mali finally returned to the Franc Zone in 1973), while Mauritania exit in 1972.

⁴Equatorial Guinea was a Spanish colony, while Guinea Bissau was Portuguese.

tries belong to the WAEMU (Benin, Burkina Faso, the Ivory Coast, Guinea-Bissau, Mali, Niger, Senegal, Togo) and six to the CAEMC (Cameroon, the Central African Republic, Chad, the Republic of Congo, Equatorial Guinea and Gabon) (see appendix A.1). The denomination “Franc Zone”⁵ exists since 1939, but its reality goes back to the 19th century. In 1840, a unified financial community has already gathered France’s SSA colonies. In 1850, the emission of bank notes is performed in the colonies by emission institutes. In the protectionist environment of the 1930’s, France tries to consolidate its commercial ties with its colonies, and delimits an area within which currencies are freely convertible and pegged to the French Franc.

The introduction of a single currency as a means of payment in the whole French colonial empire goes back to 1939⁶ and the creation of the CFA Franc⁷ dates from 1945, on the day when France ratified the Bretton Woods agreements. Nowadays, the use of the CFA Franc is limited to WAEMU and CAEMC countries. These two areas form two distinct monetary unions with two different currencies and two different central banks. The acronym designating both currencies is the same, CFA Franc, but the meaning is different: *Franc de la Communauté Financière d’Afrique* (Franc of the African Financial Community) for WAEMU countries, and *Franc de la Coopération Financière en Afrique Centrale* (Franc of Financial Cooperation in Central Africa) for CAEMC countries. The former is issued by the *Banque Centrale d’Afrique de l’Ouest* (BCEAO) located in Dakar (Senegal) and the latter, corresponding to the CAEMC countries is issued by the *Banque des Etats de l’Afrique Centrale* (BEAC) located in Yaoundé (Cameroon).

The Franc Zone is characterized by several institutional features [see for example Guillaumont and Guillaumont, 1984 and Semedo and Villieu, 1997]. Firstly, the two CFA Francs are pegged to the French Franc (nowadays the Euro) at the same rate⁸. Next, France guarantees the convertibility of the

⁵Besides the two monetary unions, the Franc Zone includes metropolitan France, its overseas departments, territories and the territorial communities of the French Republic (Mayotte and Saint-Pierre-et-Miquelon), the Principality of Monaco and the Comoros.

⁶The second World War led to a strict exchange control on the French franc, so that France decided to create an area (the Franc Zone) within which there was no restriction on the convertibility of the franc.

⁷At that time, the CFA Franc stood for *Franc des Colonies Françaises d’Afrique* (Franc of the French Colonies of Africa) and in 1958, it became *Franc de la Communauté Française d’Afrique* (Franc of the French Community of Africa).

⁸The rate defined in 1948 (0.5 CFA Franc per French Franc, then 50 CFA Franc per FF when the new franc replaced the old franc in 1958) remained unchanged until January 1994 where it was devaluated by 50%.

CFA Franc thanks to a so-called operation account open by each central bank with the French Treasury. Both central banks have in principle an unlimited overdraft facility, which allows them to acquire French Francs in case of a temporary deficit of the balance of payments. However several rules limit the amount that can be withdrawn. Each central bank must deposit 65% of its foreign assets in this operation account, can only make reimbursable loans to the treasuries of their member states within the limit of 20% of their tax revenue, and must maintain its foreign exchange assets within the limit of 20% of the currency issued. Finally, there is free movement of capital within the zone and with France (now the Euro area)⁹.

This institutional framework facilitates trade between France and the CFA zone. When France runs a commercial deficit with one of the CFA Zone countries, it can repay its debt by crediting the operation account. It also avoids foreign currency rationing since these countries can obtain foreign currencies without any limit [Semedo and Villieu, 1997].

2.2 Regional Integration

Hence, regional monetary integration in West and Central Africa is a long-lasting process. It may seem paradoxical that a group of independent countries share a common currency while having different trade policies. Indeed, the sequence of regional integration in Africa is inverse compared to Europe: monetary integration precede the creation of a common market¹⁰. In many respects, the 1994 reform is the main turning point in trade integration.

2.2.1 Institutional Integration

WAEMU. The monetary union between independent countries was first established by the WAMU treaty signed in 1962 and revised in 1973. Then, on January 10, 1994 a new treaty, founding the WAEMU, aimed at transforming the monetary union in an *economic* and monetary union with sovereignty transfers, as in the European Community. Four main lines have been defined: harmonization of the legal framework, creation of a common market, multi-lateral control of macroeconomic policies, coordination of national sectoral policy in the areas of agriculture, environment, transport, infrastructure,

⁹In practice, convertibility of the CFA Franc and free movement of capital are limited. Following a speculative attack in August 1993, the Central banks of WAEMU and CAEMC suspended the external convertibility of the CFA Franc bank notes. Since then, each Central bank refuse to buy CFA Franc bank notes coming from outside its own currency union, including those coming from the other currency union.

¹⁰However, this sequence seems to be more appropriate to African conditions [Guillaumont and Guillaumont, 2002]

telecommunications, human resources, energy, industry, mining and crafts. The integration process accelerated in 2000 with the implementation of a common trade policy and a customs union. On January 1, 2000 all member countries adopted a common external tariff with five tariff rates (0, 5, 10, 15, 20%), agreed on the dismantling of intraregional tariff barriers, and on the adoption of common rules for customs valuation of goods and common safeguard measures [IMF, 2001].

CAEMC. The treaty founding the CAEMC was signed on March 16, 1994. It extends the monetary union (BEAC) and the economic union of central Africa (UDEAC) in order to create a common market. A preferential tariff on intracommunity trade was adopted in 1994 with a uniform rate of 20%, lowered to 10% in 1996 and to 0% in 2000. However, its application across member states seems highly uneven, with most countries maintaining tariffs on regional trade. A common external tariff was also introduced in 1994 with four rates (5, 10, 20, 30%). But this reform is imperfectly enforced in particular because of the use of diverging nomenclatures or deviations from the rate structure [IMF, 2002].

Prospects for further integration. On April 20, 2000, six West African countries declared their intent to form a monetary union among the non-WAEMU countries of the ECOWAS (Nigeria, Ghana, Guinea, Liberia, Sierra Leone and Gambia, see appendix A.1) by January 2003. The second stage would be the formation of an even larger monetary union including all the countries belonging to the ECOWAS in 2004 [see Masson and Patillo, 2001].

2.2.2 Economic Integration

In broad terms, recorded intraregional trade among the CFA Franc zone is relatively low¹¹. For WAEMU countries, it represents less than 10% of their total trade (9.47% on average for the 1995-99 period) and for the CAEMC countries it is even lower (less than 3%). Trade is hampered by remaining tariff and non-tariff barriers coming from an inability and/or unwillingness to carry out trade liberalization measures. But the low level of intraregional trade is also explained by the existence of non-monetary barriers: a very poor

¹¹This section is devoted to official trade. However, there are also trade flows (mostly intraregional) which are not well recorded. While it is, by definition, difficult or even impossible to evaluate these flows, there seems to be a consensus on the importance of informal trade. The extent of informal activities is particularly manifest in the case of trade between Nigeria and its neighbors (Benin, Niger, Chad, and Cameroon).

transportation infrastructure, low economic potentials, extreme ethnic, cultural or linguistic diversity, and very high political instability [Guillaumont and Guillaumont, 1994; Foroutan and Pritchett, 1993].

Intraregional trade has been increasing in the WAEMU (the share of intraregional trade in total trade was 8.5% in 1981, and is about 11% in 1999). But this global increase has taken place in quite an erratic way (see appendix A.3 table 4). For CAEMC countries, the tendency is even more confused: the share of intraregional trade globally increased during the 80's, decreased during the pre-devaluation crisis and increased overall in recent years (see appendix A.3 table 5). This leads Yeats (1998) to argue that African regional trade agreements have not contributed to the increase in intraregional trade.

In intra-WAEMU trade, the Ivory Coast and Senegal are the main regional exporters (in 1999, nearly 14% of their total exports are intraregional) and the landlocked Sahel countries the main importers (Burkina Faso, Mali and Niger import between 20% and 25% from their intraregional neighbors in 1999). The principal product categories traded are hydrocarbons, fertilizers and cements and salts. In intra-CAEMC trade, the main importer countries are the Central African Republic and Chad (which export respectively 15% and 22% to the other member states in 1999) and the main exporter is Cameroon with a share of intraregional exports of only 6%. Note that in the CAEMC, the share of intraregional imports in total imports is higher than the share of intraregional exports in total exports, whereas in the WAEMU, the situation is opposite (in 1999, intraregional imports represent 8.18% of total imports and intraregional exports 11.16% of total exports). This difference probably reflects the composition of CAEMC exports, highly biased toward oil products. In Gabon, oil products represent 75% of total exports in 1999. Cameroon is the most diversified exporter with one third of its exports consisting of oil, another third consisting of wood, and the last third consisting of various crops like cafe, cocoa or cotton.

An interesting feature is that CAEMC and WAEMU countries trade a lot with Europe: an average of more than 50% of their trade is with European countries. This share has been decreasing since the 80's, especially in the WAEMU countries where it shrank to 40% of total trade in 1999 (see appendix A.3 table 4). France of course represents their main (European) exporter, with a very pronounced dependence for CAEMC countries like Gabon or Chad (where imports from France account for 40% and 50% respectively of total imports in 1999) and a less clear dependence for WAEMU countries like Mali or Togo (where imports from France represent respectively

18% and 11% of total imports in 1999). Naturally, Equatorial Guinea and Guinea-Bissau do not trade much with France, as they have not been French colonies.

We next turn to the gravity model which explains more formally bilateral trade flows in terms of their underlying determinants.

3 The Gravity Equation and the Border Effect Methodology

3.1 African trade and the gravity model

The gravity equation is a well-known empirical model which basically relates the volume of trade between two countries to their economic size and distance. Its classical formulation is:

$$X_{ij} = kY_i^\alpha Y_j^\mu D_{ij}^\lambda \quad (1)$$

where X_{ij} is the value of bilateral trade between i and j , Y is the real GDP and D_{ij} is the distance between them. Elasticities α and μ are expected to be positive, while λ is expected to be negative.

The gravity model has been used to measure the impact of various policy issues and computed for nearly every region of the world. But curiously its application to Sub-Saharan countries and more specifically to the Franc Zone is quite limited. Why is it so useful?

First, it allows to test whether trade among Sub-Saharan African countries is higher or lower than one would expect [Foroutan and Pritchett, 1993]. Two different methods are possible. The first one consists in estimating a gravity model without African countries, to use the estimated coefficients to predict intra-SSA trade and finally to compare these predictions with actual flows. The second method consists in introducing different dummies to capture the specific effect of Sub-Saharan Africa on trade. The result of both approach is that, contrary to the common view, intra-SSA trade is not “too little” [Foroutan and Pritchett, 1993].

Second, the gravity model can also be used to estimate the effect of regional agreements on trade. Out of the three existing Sub-Saharan regional groupings present in Foroutan and Pritchett’s sample, the only one to have a noticeable effect on trade is the CEAO (*Communauté Economique*

de l'Afrique de l'Ouest, now WAEMU). Carrère (2002) extends the analysis for the period 1962-1996 and a sample including 153 countries. She advocates the use of panel-data techniques which account for further elements (historical, political or cultural) that possibly affect the level of trade. By including a variable for imports from the rest of the world, it is also possible, for each trade agreement, to test if the estimated effect is a trade creation effect or a trade diversion effect¹². Five African trade agreements are considered here (WAEMU, CAEMC, ECOWAS, SADC, COMESA, see appendix A.1), and on the whole period 1962-96, all entail trade creation. For example an average CAEMC country trades 3.25 times more with another member state than one would expect, given their GDP, populations, infrastructures etc. For WAEMU countries, the effect is slightly lower (3.13). But in both cases, the extra trade comes from trade diversion (imports from the rest of the world are respectively 38% and 43% lower than they should be)¹³.

Finally, Rose (2000) opened another area of application for the gravity model in measuring the effect of currency unions on trade. When applied to the CFA Franc Zone, this methodology gives significant results: countries within the CFA zone are found to trade 1.9 times more with each other than with other countries in West and Central Africa [Nitsch, 2002]¹⁴. This effect is quite large but it is still slightly smaller than having the same coloniser and much smaller than having a common border. However, these results appear biased by the large number of missing data. Filling in missing trade observations with the average trade values (computed for the years for which data are available) lowers the estimated effect to 58% [Nitsch, 2002].

3.2 The border effect methodology

Another promising field of application for the gravity model has been initiated with the work of McCallum (1995). It aims at measuring the impact of national borders in international trade by relating *international* trade flows to *intranational* ones. This approach is very helpful for our concern because

¹²Trade creation is characterized by a rise in intra-trade concomitant to a stability in imports from the rest of the world; trade diversion occurs when a rise in intra-trade is totally balanced by a drop in imports from the rest of the world; and net trade creation arises when intra-trade increases more than imports from the rest of the world.

¹³Indeed, there seems to be a net trade creation for WAEMU countries in the latter period (the beginning of the 90's) while for CAEMC countries, the increasing gross trade creation is still accompanied by an important trade diversion, leading to no net trade creation.

¹⁴The estimation is run on a sample including the 14 African countries of the CFA Franc Zone and 9 other SSA countries for the period 1970 to 1995 at five-year-interval.

it allows us to measure more precisely the effect of currency unions on trade.

The principle of the border effect approach is the following. Let's consider two countries. If their *bilateral* flows are smaller than their *intranational* ones after taking into account all other factors affecting trade (distance among others), one can conclude that the border matters i.e. crossing the border impedes trade. This methodology has been first applied to measure the effect of borders between Canada and the US. Comparing trade flows between two Canadian provinces on one hand, and trade flows between a province and a comparable American state on the other, yields a particularly impressive result: trade within Canada is found to be more than 20 times larger than trade between Canada and the US [McCallum, 1995].

The extension of this methodology to measure border effects for other countries generates two major problems [Wei, 1996]. First, while we do have inter-states (provincial) trade flows for the US (Canada), equivalent data are not available for other countries. A solution to measure intranational trade consists in subtracting total exports from total output [Wei, 1996] (see appendix A.2). The second problem lies in the measurement of intranational distance. Many approaches have been suggested. Wei (1996) proposes to measure intranational distance as one quarter of the distance to the nearest neighbor. Estimated in this way, the border effect for OECD countries is around 10. If one adds additional variables for remoteness, linguistic ties and adjacency, the average border effect even falls to a factor of 2.6 [Wei, 1996].

As far as we know, the border effect methodology has never been estimated in the specific case of the CFA countries and nearly never in the case of less developed countries. The only consensus on this issue concerns the negative correlation between the border effect and GDP per capita [Helliwell, 1998]. Border's size is nearly 8 times larger for less developed countries than for OECD countries in 1988. For example, Zimbabwe is found to trade around two hundred times more with itself than with other countries, while in the case of South Korea, the same ratio is between 15 and 20 [Helliwell, 1998]. The existence of a negative correlation is supported by empirical evidence and can be explained by several arguments. First of all, it seems that an increase in per capita income alter preferences towards foreign goods. More indirectly, higher levels of development may constitute political support for policies promoting trade. Moreover, in the case of developing countries, we expect a large border effect, reflecting their supply structure. For example, the specialization of the CFA countries in primary goods (which are mostly non-traded intraregionally) will probably be translated into a high border effect.

These results give some clues to understand the causes of a home bias in international trade. However, much work is still needed on this front. Many questions remain largely unanswered: is the border effect real or is it an illusion? Is it really due to the existence of borders (which may involve large costs for traders), or is it independent, related to other factors themselves correlated with borders? We now turn to the possible explanations of the border effect.

3.3 Explaining the border effect

3.3.1 An estimation bias?

One way to explain the existence of a large border effect is to suspect a potential bias in the estimation. The main source of bias can be related to omitted variables. The gravity model is above all an empirical model¹⁵ and its functional form is not always well defined. Some authors argue for the inclusion of relative price terms. A first attempt to approximate these price terms consists in including GDP deflators in the estimated equation [Bergstrand, 1985]. A second possible approach is to account for these price terms by estimating the gravity equation with non-linear least squares [Anderson and van Wincoop, 2003]. Estimated in this way, the border effect is quite reduced compared to McCallum's order of magnitude: the border between the US and Canada is found to impede trade by 44%, while among other industrialized countries the effect is even smaller (29%). Finally, a third possible approach consists in introducing fixed effects [Harrigan, 1996; Hummels, 1999] (see section 5).

The omitted variable bias can also stem from an heterogeneity bias related to differences in historical, political, and cultural ties between countries that may explain their different propensity to trade. For example, it has been argued convincingly that history plays a great role in shaping the direction of international trade [Eichengreen and Irwin, 1998]. The problem with this interpretation is that it is usually difficult to quantify (and even to observe) these differences. A first solution is to control for such factors using a fixed effect model [Cheng and Wall, 2002; Wall, 2000]. When accounting for heterogeneity by including bilateral fixed effects¹⁶, the impact of borders is found to be larger, of nearly 40% compared to McCallum's initial estimate [Wall, 2000].

¹⁵Theoretical foundations have been developed in recent years (see section 4).

¹⁶In this case, fixed effects are trading-pair intercepts which are allowed to differ according to the direction of trade.

This procedure should also solve the problem of misspecified variables. This potential bias in early estimations has been emphasized particularly in the case of intranational distance. Head and Mayer (2002) argue for example that “because distances are always mismeasured in the existing literature, the border effects may have been mismeasured in a way that leads to a systematic overstatement” (p.4) [see also Wei, 1996]. However, in any case, even if its size can be reduced, the border effect remains.

3.3.2 Large costs in crossing borders?

The most exploited way to explain border effects is to suppose that crossing a border entails a significant cost. Borders are characterized by the fact that they separate different nations with different languages, different cultures or preferences [Head and Mayer, 2000], different legal systems [Turrini and Van Ypersele, 2002; De Sousa and Disdier, 2002] and different currencies. We will focus more specifically on assessing the part that currencies play in explaining the border effect.

Indeed, many authors argued that the existence of various currencies and exchange rate uncertainty help explain the magnitude of the border effect. Various papers have first tried to measure the impact of exchange rate variability. Wei (1996) introduces several variables for exchange rate volatility to test whether exchange rate uncertainty can cause a home bias. However, he obtains a wrong sign for these variables and finds that the estimated home bias coefficient is not much affected by the inclusion of volatility. In another contribution, Parsley and Wei (2001) conclude that exchange rate variability together with distance and unit-shipping costs explain a substantial part of the border effect between the US and Japan¹⁷. Taglioni (2001) also obtains a positive result, showing that the border effect among European countries is largely explained by exchange rate volatility¹⁸.

Hence, the evidence appears rather mixed concerning the explanatory power of exchange rate volatility. But after all, a nation is characterized more specifically by a single currency, and sharing a common currency is a much more serious and durable commitment than having a fixed exchange rate. This raises the question of how these two exchange rate regimes affect trade. Most of the “traditional” literature has considered that a monetary union

¹⁷Parsley and Wei identify the border effect through the dispersion in prices between cities located in different countries (here, the US and Japan).

¹⁸Using disaggregated data at 3-digit industry level for the period 1976-95, Taglioni (2001) argues that exchange rate volatility explains half of the overall border effect.

should enhance trade by eliminating exchange rate volatility, thus considering implicitly that these two regimes are equivalent. But the debate has been largely reopened since the publication of Rose's (2000) controversial paper. Rose shows that the effect of a currency union on trade is different from the effect of a fixed exchange rate regime. Using an augmented gravity equation and a large sample including more than 180 countries, he highlights that fixing the exchange rate by eliminating its volatility has a negligible impact on the volume of trade, while a currency union enhances trade by a factor of three.

However, Rose's paper has been deeply criticized. The most widely shared criticism stems from the heterogeneity in the monetary unions selected by Rose. Firstly, Rose's sample includes both multilateral and unilateral currency unions. This heterogeneity yields an over-estimation of the estimated coefficients because the *Rose effect* is highly dependent on the second group of currency unions, which consists mainly of "small subnational entities with strong institutional and political ties with the issuer of the common currency" [Levy Yeyati, 2001]. Secondly, since there are few existing monetary unions in the world, Rose's sample includes typically small countries (Caribbean islands for example) and all kind of monetary relations which look like currency unions (for instance little dependencies and their former coloniser, like Guadeloupe and France). Moreover, the largest and most lasting monetary union present in Rose's sample is the CFA Franc Zone, but it is considered by Rose as a single monetary union, whereas there are indeed *two* monetary unions (the WAEMU and the CAEMC, see section 2). To take into account the risk of an heterogeneity bias, we choose to focus more specifically on these two currency unions.

Implementing the theoretical model proposed by Anderson and van Wincoop (2003) on Rose's original sample¹⁹, Rose and van Wincoop (2001) obtain that the effect of common currencies on trade is reduced to a factor of 2.3. They conclude arguing that "national currency seems to be a significant barrier to trade". This interpretation is challenging: why not draw a parallel between the currency union effect (stating that countries sharing the same currency trade much more with each other than with other countries) and the border effect puzzle (stating that countries trade much more with themselves than with other countries)?

Work is needed to clarify the border effect issue. It seems highly likely that

¹⁹This methodology consists in introducing country-fixed effects (dummies for each country) to proxy the multilateral resistance terms that stem from the theoretical model (see section 4).

there are numerous possibly interacting explanations for the border effect. In this paper we try to answer two essential questions. Firstly, does a common currency have an effect on trade? Secondly, are these two issues connected? I.e. does the existence of separate currencies explain part of the border effect? A positive answer to this question would strongly reinforce the case for a single currency. Conversely, a negative answer would probably call the whole debate into question. We address this issue, showing that currency unions do have an effect on trade, but that they do not explain much of the border effect.

4 Theoretical foundations

4.1 Existing literature

The first attempts to derive a gravity equation from theoretical models date back to Anderson (1979) and Bergstrand (1985). Subsequently, various models stemming from different general frameworks have been developed²⁰. Following Deardoff (1998) and Anderson and van Wincoop (2003), we will assume in our model that each country is specialized in a single good.

4.2 The model

Our model starts from the utility of a representative consumer in country i , which is assumed to be:

$$U_i = \left(\sum_j \beta_j^{\frac{1-\sigma}{\sigma}} c_{ij}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \quad (2)$$

where c_{ij} is the consumption by country i consumers of goods from country j , and $\sigma > 1$ the elasticity of substitution between goods. The consumers in country i maximize their utility subject to the budget constraint:

$$Y_i = \sum_j p_{ij} c_{ij} \quad (3)$$

with Y_i the income of country i and p_{ij} the price of good j for consumers in i ²¹. Assuming that trade costs are borne by sellers and take the “iceberg”

²⁰These frameworks include monopolistic competition models as well as product differentiation models.

²¹Recall that i and j can be countries as well as goods since we assume that each country is specialized in a single good.

form, the price received by sellers in j will be:

$$p_j = \frac{p_{ij}}{t_{ij}} \quad (4)$$

where t_{ij} is the trade cost factor (see below). Assuming an iceberg form for trade costs amounts to suppose that for each good transported from country j to country i , a proportion $(t_{ij} - 1)$ “melts” in transit.

The result of the consumers utility maximization problem is:

$$c_{ij} = \frac{1}{p_{ij}} Y_i \left(\frac{\beta_j p_{ij}}{P_i} \right)^{1-\sigma} \quad (5)$$

with:

$$P_i = \left(\sum_j (\beta_j p_{ij})^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \quad (6)$$

Therefore, the value of imports of country i from country j is given by:

$$M_{ij} = Y_i \left(\frac{\beta_j p_j t_{ij}}{P_i} \right)^{1-\sigma} \quad (7)$$

It is decreasing in t_{ij} if $\sigma > 1$. The market clearing condition implies that the exporter j income is equal to the importer i spending²²:

$$Y_j = \sum_i M_{ij} = \sum_i Y_i \left(\frac{\beta_j p_j t_{ij}}{P_i} \right)^{1-\sigma} \quad (8)$$

From this equation we obtain the equilibrium scaled prices:

$$(\beta_j p_j)^{1-\sigma} = \frac{Y_j}{\sum_i Y_i \left(\frac{t_{ij}}{P_i} \right)^{1-\sigma}} \quad (9)$$

Substituting this expression into (7) gives:

$$M_{ij} = \frac{Y_i Y_j}{Y_w} \left(\frac{t_{ij}}{P_i \Pi_j} \right)^{1-\sigma} \quad (10)$$

where:

$$\Pi_j = \left(\sum_i \theta_i \left(\frac{t_{ij}}{P_i} \right)^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \quad (11)$$

²²This condition is equivalent to the balanced trade assumption.

and $\theta_i = Y_i/Y_w$ country i 's share of world income Y_w . Then using (9) and (6) we obtain:

$$P_i = \left(\sum_j \theta_j \left(\frac{t_{ij}}{\Pi_j} \right)^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \quad (12)$$

If we assume symmetric trade costs, then comparing (11) with (12) yields $\Pi_j = P_j$.

Finally, we get:

$$M_{ij} = \frac{Y_i Y_j}{Y_w} \left(\frac{t_{ij}}{P_i P_j} \right)^{1-\sigma} \quad (13)$$

with

$$P_i^{1-\sigma} = \sum_j \theta_j \left(\frac{t_{ij}}{P_j} \right)^{1-\sigma} \quad (14)$$

As in traditional gravity equations, trade depends positively on the size of each country and negatively on a trade barrier factor. But here, trade is also affected by the price indices of both countries. Anderson and Van Wincoop (2003) interpret these price indices as “multilateral resistance” variables²³: higher multilateral resistance of one of the two countries raises its trade with the other one. The interpretation is quite intuitive: “the more resistant to trade with all others a region is, the more it is pushed to trade with a given bilateral partner” [Anderson and van Wincoop, 2003].

The next step is to model trade costs. We assume in our model that the trade cost factor consists of three terms corresponding to three different types of costs: non-border costs (d), national border effects (b) and “supra-national” border effects (m):

$$t_{ij} = d_{ij}^p b_{ij} m_{ij} \quad (15)$$

where $b_{ij} = b^{1-\delta_{ij}}$ with $\delta_{ij} = 1$ if $i = j$ and 0 otherwise, and $m_{ij} = m^{1-\gamma_{ij}}$ with $\gamma_{ij} = 1$ if i and j share the same currency and 0 otherwise.

The first term relates to non-border costs. It is usually proxied by the distance between the two countries. The two following terms concern border costs but the last one is related not to national borders but to currency unions borders. Hence, this specification allows us to measure not only the effect of national borders, but also the effect of currency unions on trade.

²³These variables cannot be approximated by consumer price indices since they involve the trade cost factor which includes also non-pecuniary costs.

4.3 A simple expression

Transforming (13) in log terms and replacing the trade cost factor with (15) yields:

$$\ln\left(\frac{M_{ij}}{Y_i Y_j}\right) = a_0 + a_1 \ln(d_{ij}) + a_2(1 - \delta_{ij}) + a_3(1 - \gamma_{ij}) - (1 - \sigma) \ln(P_i) - (1 - \sigma) \ln(P_j) \quad (16)$$

where the coefficients we estimate are: $a_1 = (1 - \sigma)\rho$, $a_2 = (1 - \sigma) \ln(b)$ and $a_3 = (1 - \sigma) \ln(m)$. Some authors suggest to proxy the price index terms with remoteness variables representing bilateral distance relative to distance with all trading partners²⁴. Anderson and van Wincoop (2003) for their part argue that the remoteness indexes that have been included in gravity equations are “atheoretic” and contribute to a disconnection between the theory and the functional form of the gravity model. They suggest instead to estimate the gravity equation with non-linear least squares, or alternatively, to replace multilateral resistance terms with country specific dummies. Both methods lead to consistent estimates, and while the former is more efficient, “this benefit seems to be relatively small compared to the computational simplicity of the fixed effect approach” [Feenstra, 2003]. Indeed, the second method is much more simple since the estimation can be performed with ordinary least squares. We will run our estimations using both a traditional measure of remoteness and country fixed effects.

Hence, we estimate alternately two equations:

$$\ln\left(\frac{M_{ij}}{Y_i Y_j}\right) = a_0 + a_1 \ln(d_{ij}) + a_2(1 - \delta_{ij}) + a_3(1 - \gamma_{ij}) + \ln(R_i) \quad (17)$$

with: $R_i = [\sum_k \frac{Y_k}{D_{ik}}]^{-1}$ the remoteness variable for country i , and

$$\ln\left(\frac{M_{ij}}{Y_i Y_j}\right) = a_0 + a_1 \ln(d_{ij}) + a_2(1 - \delta_{ij}) + a_3(1 - \gamma_{ij}) + \beta_1^i \phi_i + \beta_2^j \phi_j \quad (18)$$

where ϕ_i is a dummy variable indicating if country i is the importer and ϕ_j another dummy variable indicating if country j is the exporter. The coefficients β_1^i and β_2^j are supposed to estimate the multilateral resistance terms: $\beta_1^i = (1 - \sigma) \ln(P_i)$ and $\beta_2^j = (1 - \sigma) \ln(P_j)$.

²⁴These authors use different measures of remoteness and introduce generally two variables, one for the importer and the other for the exporter (see for example Wei, 1996 and Nitsch, 2000). However, it seems that we should introduce only one remoteness variable for the importer country [Head and Mayer, 2000: 9].

5 Results

Average border effect

Our study covers the period 1980-1999. Our data for WAEMU, CAEMC and EU countries include bilateral trade among twenty-five countries, for each year from 1980 through 1999. We focus more specifically on bilateral imports of WAEMU and CAEMC countries from all other countries. Data are pooled and estimations are carried out with ordinary least squares (OLS) regressions. In all estimations, heteroscedasticity is corrected with the White's method. Table 1 provides the results of several different specifications.

Equation (1) reports the results of estimating the basic gravity model constraining coefficients of GDP terms at unity. In this way, we control for a potential endogeneity of income. The coefficient on the "border effect" variable, in column (1) is negative, highly significant ($p < 0.01$) and is interpreted as the estimate of the average impact of border barriers on cross-border trade. More precisely, it means that intranational trade is on average about 63 [= $\exp(4.14)$] times larger than cross-border trade, after controlling for economic size and distance. This result suggests a large home bias in line with existing estimates on other developing countries [Helliwell, 1998: 55-56] (see section 3.2 for several theoretical arguments). The results in columns (1)-(3) also exhibit a negative and statistically significant impact of distance on trade.

In specification (2), we add a remoteness measure for importer countries. The coefficient is large and significant. It suggests that when the importer is economically remote from alternative markets, it imports more from a given partner. It is worth noting that adding the remoteness variables slightly decreases the border effect average.

In column (3), we include fixed effects to account for the difference in prices across countries, as in Harrigan (1996) and Hummels (1999). Comparing equations (1) and (3) shows that this theoretical modification increases the border effect-average.

Table 1: Average border effect on the CFA Franc Zone

Model	Dependent variable: $\ln(M_{ij}/Y_iY_j)$		
	Base Model	With remoteness	With fixed effects
	(1)	(2)	(3)
Border Effect-Average	-4.14^a (0.19)	-4.04^a (0.19)	-5.24^a (0.30)
Ln (Distance)	-1.52^a (0.04)	-1.55^a (0.04)	-1.16^a (0.10)
Ln (Remote _i)		0.92^a (0.08)	
R-sq	0.50	0.52	0.68
# of observations	4659	4659	4659

Notes: Dependent variable: Volume of imports divided by the GDP of importers and exporters. Standard errors in parentheses with ^a denoting significance at the 1% level. Column (1): Base model; Column (2): Base model with remoteness index for the importer. Column (3): Base model with fixed effects for source and destination countries. See text for more details.

The border effect and monetary unions

Despite the introduction of fixed effects and endogeneity corrections, the border effect of WAEMU and CAEMC countries remains large, as expected for developing countries. However, our main concern does not lie in finding the “true” border effect, but in relating it to the currency union effect. To what extent do currency unions explain the border effect? To address this question, we break up the average border effect into four border effects corresponding to each group of countries present in our sample. Results are reported in Table 2.

Hence we first calculate the average border effects within each monetary union, then the average border effect corresponding to trade between a WAEMU and a CAEMC member, and finally the average border effect corresponding to trade between a CFA country (WAEMU or CAEMC member) and a European country. Columns (1) and (2) report the results of estimating our base model, columns (3) and (4) include a remoteness index for the importer and columns (5) and (6) include fixed effects for source and destination countries.

Columns (1), (3) and (5) show that the border effects are smaller between countries sharing the same currency. This reflects a deeper integration between these countries and the effect of a common currency on trade. The inter-monetary unions border effect is much higher and the border effect related to trade with European countries is intermediate. However, these intra-monetary union border effects are still large. In the case of WAEMU (column 5), trade domestic intensity is 32 [= $\exp(3.47)$] times larger than cross-border trade between two WAEMU countries. To go further, let us calculate the tariff equivalence of the estimated border effect. Based on our theoretical model, the border effect coefficient is the product of the substitution elasticity and log of the tariff equivalent. As an example, suppose an intermediate degree of substitutability between goods ($\sigma = 10$), the estimated border effect of intra-WAEMU trade implies a tariff equivalent of about 47% [= $\exp(-3.47/(1-10)) - 1$]. The border effect of the intra-CAEMC trade appears larger. Consequently, currency unions affect trade positively, but do not explain much of the border effect which remains large.

This table also allows to compare the extent of regional integration with the special relationship between CFA countries and France. Therefore in columns (2), (4) and (6) we break up the average border effect corresponding to trade with European countries into two border effects: one related to trade with France, and the other related to trade with other European countries.

Table 2: Average border effects and monetary unions

Model	Dependent variable: $\ln(M_{ij}/Y_i Y_j)$					
	Base Model		With remoteness		With fixed effects	
	(1)	(2)	(3)	(4)	(5)	(6)
Ln (Distance)	-1.25 ^a (0.09)	-1.22 ^a (0.09)	-1.34 ^a (0.09)	-1.31 ^a (0.10)	-1.37 ^a (0.11)	-1.33 ^a (0.11)
Ln (Remote _i)			0.84 ^a (0.08)	0.83 ^a (0.08)		
Border Effect-Average						
Intra-WAEMU ^f	-3.40 ^a (0.29)	-3.46 ^a (0.30)	-3.10 ^a (0.30)	-3.17 ^a (0.30)	-3.47 ^a (0.32)	-3.55 ^a (0.33)
Intra-CAEMC ^g	-4.12 ^a (0.36)	-4.17 ^a (0.37)	-3.96 ^a (0.36)	-4.01 ^a (0.37)	-3.62 ^a (0.39)	-3.69 ^a (0.39)
Inter-currency unions ^h	-4.62 ^a (0.35)	-4.70 ^a (0.35)	-4.31 ^a (0.36)	-4.40 ^a (0.36)	-4.75 ^a (0.37)	-4.86 ^a (0.38)
CFA-Europe ⁱ	-4.57 ^a (0.43)		-4.20 ^a (0.44)		-3.67 ^a (0.52)	
CFA-France ^j		-2.44 ^a (0.42)		-2.09 ^a (0.43)		-1.60 ^a (0.52)
CFA-Other European countries ^k		-4.86 ^a (0.43)		-4.50 ^a (0.44)		-4.02 ^a (0.53)
R-sq	0.51	0.53	0.52	0.54	0.59	0.61
# of observations	4659	4659	4659	4659	4659	4659

Notes: Dependent variable: Volume of imports divided by the GDP of importers and exporters. Standard errors in parentheses with ^a denoting significance at the 1% level. Columns (1) and (2) report the results of our base model; Columns (3) and (4): Base model with remoteness index for the importer. Columns (5) and (6): Base model with fixed effects for source and destination countries. ^f Average border effect between two WAEMU members (for example Ivory Coast-Senegal). ^g Average border effect between two CAEMC members (for example Cameroon-Congo). ^h Average border effect between one WAEMU member and one CAEMC member (for example Senegal-Cameroon). ⁱ Average border effect between one WAEMU or CAEMC member and a European country (for example Senegal-Germany). ^j Average border effect between one WAEMU or CAEMC member and France. ^k Average border effect between one WAEMU or CAEMC member and a European country excluding France.

Whatever the specification is, the average border effect related to CFA-France trade is much lower than the intra-currency union border effect. This result reflects the importance of historical and institutional relationships between CFA countries and France (see section 2).

Sensitivity tests related to informal trade

We perform some sensitivity tests in order to account for informal trade. Informal trade is commonly defined as transactions outside official channels. These unrecorded trade flows concern both legal and illegal goods. There seems to be a consensus on the importance of informal trade, while it is by definition difficult or even impossible to evaluate these flows. For example, Benin is known for being a platform of re-export. It legally imports merchandises from Europe or Asia and exports them fraudulently to neighboring countries, especially Nigeria.

Unrecorded trade flows are expected to modify the size of the border effect, as it can generate an underestimation of international trade flows within the CFA zone²⁵, and lead to an overestimation of intranational trade²⁶. Both mismeasurements are likely to decrease the border effect.

Accordingly, in table 3, we perform two kinds of tests. Firstly, we suppose that CAEMC exports are less underestimated than WAEMU exports, since they consist mainly in oil products (see section 2.2.2); thus we simply increase exports of WAEMU countries²⁷. This assumption is likely to affect the size of the border effect *via* the measure of intranational trade. Results for this first test are given in column (1). Secondly, various reports point out that effective trade flows within the CFA zone are at least twice the official flows. In order to deal with this issue, we multiply bilateral intra-CFA zone imports by 2 and then by 4. Columns (2) and (3) respectively report the results of this second assumption.

Our main findings do not appear to be sensitive to unrecorded trade. Yet, as expected, the border effect is smaller when accounting for informal trade flows. In the first case, the size of the average border effect is almost unchanged (column 1), while it decreases when modifying intraregional trade flows (columns 3 and 4 to be compared to column 6 in table 2). However,

²⁵We can reasonably assume that informal trade concerns mostly African countries and do not affect trade flows with Europe.

²⁶Recall that intranational trade is calculated taking production minus total exports. Hence, if total exports is underestimated and production is well-measured, intranational trade will be overestimated.

²⁷We multiply total exports of these countries by 1.5.

Table 3: Sensivity tests related to informal trade

Model	Dependent variable: $\ln(M_{ij}/Y_iY_j)$		
	Base Model with fixed effects		
	(1)	(2)	(3)
Ln (Distance)	-1.30^a (0.11)	-1.23^a (0.10)	-1.13^a (0.10)
Border Effect-Average			
Intra-WAEMU	-3.50^a (0.33)	-3.21^a (0.31)	-2.86^a (0.30)
Intra-CAEMC	-3.67^a (0.39)	-3.23^a (0.39)	-2.78^a (0.38)
inter-currency unions	-4.84^a (0.38)	-4.53^a (0.36)	-4.21^a (0.35)
CFA-France ^j	-1.61^a (0.52)	-2.12^a (0.50)	-2.64^a (0.48)
CFA-Other European countries ^k	-4.02^a (0.52)	-4.54^a (0.50)	-5.06^a (0.48)
R-sq	0.61	0.64	0.67
# of observations	4659	4659	4659

Notes: Standard errors in parentheses with ^a denoting significance at the 1% level. Columns (1)-(3) report the results of our base model, including fixed effects for source and destination countries and taking into account informal trade. In column (1), we multiply total exports of WAEMU countries by 1.5. In column (2), we multiply bilateral intra-CFA zone imports by 2. In column (3), we multiply bilateral intra-CFA zone imports by 4. ^{f g h j k}: See table 2.

the border effect among currency union members remains large and above the CFA-France border effect, even if the gap is reduced.

6 Concluding Remarks

The border effect methodology, which relates international flows to intranational ones, allows a better understanding of the relationship between tariff barriers, currency unions and trade. In this paper, we use a gravity model highlighting that the existence of separate currencies can be a factor impeding trade. We apply this theoretical model to measure the impact of national borders and “supra-national” (currency unions) borders on trade. We choose to focus on the CFA Franc Zone in West and Central Africa, as it exhibits particularly interesting features. First, the presence of two currency unions offers comparisons between intra-currency unions, inter-currency unions and extra-currency unions trade flows. Second, the close ties between these countries and France can be compared to the extent of regional integration.

Our results indicate that West and Central African currency unions affect trade, but the existence of a common currency explains only a small part of the border effect. For illustration, the intra-WAEMU border effect remains large and represents a tariff equivalent of about 47%. Moreover, the institutional framework relating CFA countries to France appears to have a somewhat larger influence on trade than any regional currency unions.

Our findings allow to draw some policy implications for emerging and developing countries contemplating to adopt a single currency (the ECOWAS members among others). A common currency reduces the border effect, but other factors including tariff and non-tariff barriers, heterogenous levels of development or informal institutions seem to matter much more. In this case, a single currency cannot help much in removing border barriers. Hence, our results provide evidence for promoting economic integration before the adoption of a single currency.

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A Appendix

A.1 Acronyms

Acronym	Description	Countries	Creation
BCEAO	Central Bank of West African States	See WAEMU	1962
BEAC	Bank of Central African State	See CAEMC	1972
CAEMC (CEMAC)	Central African Economic and Monetary Community	Cameroon, the Central African Republic, Chad, the Republic of Congo, Equatorial Guinea and Gabon.	1994
COMESA	Common Market for Eastern and Southern Africa.	Angola, Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia, Zimbabwe.	1984
ECOWAS (CEDEAO)	Economic Community of West African States	Nigeria, Ghana, Guinea, Liberia, Sierra Leone, The Gambia, Cape-Verde, Mauritania, and the eight WAEMU countries.	1975
FZ	Franc Zone.	France + 8 WAEMU countries + 6 CAEMC countries + Comoros	1939
SADC	Southern African Development Community.	Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe.	1992 (SADCC: 1980)
UDEAC	Central African Economic and Customs Union	Cameroon, the Central African Republic, Chad, the Republic of Congo, Equatorial-Guinea (1984) and Gabon.	1964- 1994
WAEMU (UEMOA)	West African Economic and Monetary Union	Benin, Burkina Faso, the Ivory Coast, Guinea-Bissau, Mali, Niger, Senegal, Togo.	1994
WAMU (UMOA)	West African Monetary Union	Benin, Burkina Faso, the Ivory Coast, Guinea-Bissau, Mali (1984), Niger, Senegal, Togo (1963), Mauritania (until 1973).	1962- 1994

As January 1st, 2003. Based on Carrère (2002).

A.2 The Data

The database includes 11 CFA countries (7 belonging to the WAEMU and 4 to the CAEMC) and 14 European countries²⁸. We drop the observations on Guinea-Bissau, Equatorial Guinea and Central African Republic because of too many missing observations for these countries. We consider here the imports of the CFA countries from all the other countries on the period 1980-1999. This represents a potential of $11 \times 25 \times 20 = 5500$ observations.

The import data in current US\$ come from the International Monetary Fund (IMF) Direction of Trade Statistics. This annual report provides trade flows (imports and exports) for every country with all other countries. It is the most complete database in terms of country coverage²⁹. Countries imports from themselves are calculated for the CFA countries as in Wei (1996). They are defined as the difference between total goods production on the one hand and total exports to the rest of the world on the other hand. Total exports are taken from the IMF Direction of Trade Statistics. Total goods production data are calculated using United Nations' National Accounts Statistics. This annual report allows us to calculate output-to-value added ratios for the countries and the years for which output data are available. For the other countries and years, we computed an average ratio. Finally, we obtain total goods production by multiplying this ratio by total value added in agriculture and in industry (taken from the World Development Indicators, WDI, World Bank 2002).

GDP in current US\$ come from the World Development Indicators (WDI), World Bank 2002.

Various measures of distance have been computed. For international distances, we calculated great circle distances between the major cities of the countries. For large countries, we divided each country in different regions and calculated great circle distance between the main cities of each region of both countries weighted by the population of the city. For example, to calculate the distance between Cameroon and France, we divided Cameroon in two areas (one centered on the capital: Yaoundé, the other around Douala) and France in eight regions corresponding to NUTS1 level (Bordeaux, Lille, Lyon, Marseille, Nantes, Paris, Rouen, Strasbourg). Bilateral distance between Cameroon and France is the average weighted distance between Yaoundé-Bordeaux, Yaoundé-Lille, . . . Yaoundé-Strasbourg, Douala- Bordeaux, . . . Douala- Strasbourg. Internal distances have been computed in three different ways. The first approach is based on Wei's method. Wei (1996) proposes to measure intranational distance as one quarter of the distance to the nearest neighbor. The second possible approach is to compute internal distance using great circle methodology [Wolf, 1997]. Therefore, we also calculated the internal distance as the distance between the two main cities in the country. Finally, we followed a third approach based on area measures. As in Leamer (1997), we approximated the economic geography of a country with a disk, assuming producers concentrated in the center and consumers randomly distributed throughout the rest of the area. The internal distance then cor-

²⁸Belgium and Luxembourg are considered together.

²⁹The other possible source for trade flows involving African countries is the COM-TRADE database compiled by the United Nations. This database is more precise since it contains trade flows by countries and by products, but its major drawback lies in the large amount of missing data.

responds to the radius of the disk: $\sqrt{area/\pi}$. We report only the results using Wei's measure, since the other methods yield a larger estimate of the border effect, but do not alter our main results.

Remoteness variable is calculated for the importer country as in Nitsch (2000). The remoteness of country i is defined as the inverse of the sum of the GDP of each trading partner divided by its bilateral distance with i : $R_i = 1/(\sum_k \frac{Y_k}{D_{ik}})$

A.3 Trade patterns

Table 4: WAEMU: Direction of Trade (1981-99)

	Total trade (millions US\$)	WAEMU (%)	CFA zone (%)	EU (%)
1981	9602.84	8.53	9.15	52.94
1982	8978.28	10.35	10.88	52.66
1983	7951.19	8.56	9.72	54.27
1984	8462.30	8.10	9.29	52.53
1985	8960.24	7.66	9.22	54.82
1986	10048.81	7.30	8.05	55.83
1987	10385.11	9.15	9.82	54.48
1988	9800.23	8.21	8.94	56.46
1989	10102.94	7.97	9.65	55.18
1990	10885.43	11.08	12.93	50.24
1991	10024.00	9.84	12.44	49.48
1992	11398.26	9.36	10.40	49.46
1993	10096.86	8.26	9.19	47.49
1994	9758.40	8.34	9.06	49.07
1995	13394.26	7.92	8.97	49.70
1996	15113.20	8.86	10.20	49.20
1997	13842.53	9.71	11.59	43.67
1998	15488.23	9.86	11.40	42.86
1999	15846.80	11.02	11.90	39.58

Sources: IMF, Direction of Trade Statistics.

Table 5: CAEMC: Direction of Trade (1981-99)

	Total (millions US\$)	CAEMC (%)	CFA zone (%)	EU (%)
1981	7126.55	2.47	3.23	55.53
1982	6929.29	1.58	2.11	55.96
1983	6208.60	1.64	2.11	60.01
1984	6943.11	1.29	2.01	58.42
1985	7382.88	2.07	3.58	60.28
1986	6358.90	2.39	3.64	66.83
1987	6085.15	3.17	4.43	69.85
1988	6843.83	3.51	4.66	64.48
1989	7102.15	3.21	4.93	59.73
1990	9578.66	2.73	3.96	58.97
1991	9176.02	2.38	4.45	61.19
1992	8703.11	0.90	1.99	57.09
1993	7549.92	1.95	3.22	50.49
1994	7087.85	1.44	2.39	49.80
1995	8572.96	2.70	3.92	49.32
1996	11400.24	2.82	3.96	50.84
1997	11633.00	2.89	4.94	40.80
1998	10783.97	2.99	4.71	46.32
1999	11755.10	2.17	3.34	44.09

Sources: IMF, Direction of Trade Statistics.