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## **GRAVITATY POTENTIAL FOR CURRENCY ALLIANCES' INTRARIGIONAL TRADE**

**Abstract.** The paper develops the concept of regional monetary integration, the framework of which includes three alternative exchange rate arrangements: currency board, full or parallel dollarization and currency union. Each of them has its own peculiarities of formation and development, its own advantages and disadvantages, but the common feature is unconditional exchange rate unification. The concept of currency proto-integration was introduced, which foresees the exchange of information on monetary initiatives between monetary authorities, consideration of counterparties' interests to minimize risks or maximize common benefits in the field of monetary relations.

In order to assess the effectiveness of monetary integration for the development of intra-regional trade flows, we use gravity modeling based on a sample of more than 105 thousand observations of bilateral trade flows within monetary integrational and proto-integrational alliances. Gravity model includes the parameters of the volumes of bilateral trade, gross domestic product, weighted distances between states and the system of dummy-variables for the determination of monetary associations, common language and borders between trading states. The applied gravity model demonstrates a fairly high level of certainty for South America, Europe, South and East Asia ( $R^2$  for them was 0.71, 0.63 and 0.54, respectively). It was established that among the monetary alliances, the integrational and proto-integrational structures of South America, Asia and Europe were most effective in the aspect of intensifying intraregional trade. Between the African monetary blocks, the regular growth of mutual trade was observed only in the West African Economic and Monetary Union, while the rest was characterized by reverse dependence.

**Keywords:** regional monetary integration, gravity modelling, currency union, intra-regional trade, dollarization, currency board, monetary policy.

**JEL Classification** F31, F45

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## ГРАВІТАЦІЙНИЙ ПОТЕНЦІАЛ ВНУТРІШНЬОРЕГІОНАЛЬНОЇ ТОРГІВЛІ ВАЛЮТНИХ АЛЬЯНСІВ

**Анотація.** Розвинуто концепцію регіональної валютної інтеграції, до каркасу якої включено три режими валютного курсу: валютну раду, повну або паралельну доларизацію та валютний союз. Для кожного із них характерні свої особливості розвитку, переваги і недоліки, однак їхньою спільною рисою є безумовна валютно-курсова уніфікація. Введено поняття валютної протоінтеграції, яка включає разом із практикою здійснення регулярних трансакцій з іноземною валютою та обміну інформації щодо монетарних ініціатив також урахування інтересів контрагентів для мінімізації ризиків чи максимізації спільних вигід у сфері валютних відносин.

Проведено аналіз ефективності валютної інтеграції для розвитку внутрішньорегіональних торговельних потоків. Дослідження базувалось на використанні методології гравітаційного моделювання торгівлі на основі вибірки із понад 105 тис. спостережень білатеральних торговельних потоків у рамках інтеграційних і протоінтеграційних валютних об'єднань. Гравітаційне моделювання враховувало параметри обсягів білатеральної торгівлі, валового внутрішнього продукту, зваженої відстані між державами і системи фіктивних змінних для врахування впливів членства у валютних об'єднаннях, наявності спільної мови та кордонів між торгуючими державами. Результати гравітаційного моделювання продемонстрували доволі високий рівень статистичної достовірності для Південної Америки, Європи, Південної та Східної Азії ( $R^2$  для них становить 0,71; 0,63 та 0,54 відповідно). Установлено, що серед валютних об'єднань найбільш ефективними в аспекті інтенсифікації внутрішньої торгівлі виявились інтеграційні та протоінтеграційні структури Південної Америки, Азії та Європи. В Африці регулярний приріст взаємної торгівлі спостерігався лише в Західно-Африканському економічному і валютному союзі, решта союзів характеризуються зворотною залежністю.

**Ключові слова:** регіональна валютна інтеграція, гравітаційне моделювання, валютний союз, внутрішньорегіональна торгівля, доларизація, валютна рада, валютна політика.

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## **ГРАВИТАЦИОННЫЙ ПОТЕНЦИАЛ ВНУТРИРЕГИОНАЛЬНОЙ ТОРГОВЛИ ВАЛЮТНЫХ АЛЬЯНСОВ**

**Аннотация.** Развивается концепция региональной валютной интеграции, к каркасу которой включены три режима валютного курса: валютный совет, полную или параллельную долларизацию и валютный союз. С целью оценки эффективности валютной интеграции для развития внутрирегиональных торговых потоков использовано гравитационное моделирование. Модель продемонстрировала достаточно высокий уровень достоверности для Южной Америки, Европы, Южной и Восточной Азии. Установлено, что среди валютных объединений наиболее эффективными в аспекте интенсификации внутренней торговли оказались интеграционные и протоинтеграционные структуры Южной Америки, Азии и Европы. Среди африканских валютных союзов регулярный прирост взаимной торговли наблюдался только в Западно-Африканском экономическом и валютном союзе.

**Ключевые слова:** региональная валютная интеграция, гравитационное моделирование, валютный союз, внутрирегиональная торговля, долларизация, валютный совет, валютная политика.

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**Introduction.** Monetary integration became the global trend of the second half of the XX century. It manifested in the formation of new forms of currency cooperation, the most developed of which is the creation of regional currency alliances. As of the beginning of 2018, 11 states and 2 dependent territories support the currency board regime; the official regime of currency dollarization is used in 37 states and territories with a total population of less than 50 million people; 4 monetary and 3 currency unions operate. The European Economic and Monetary Union (EMU) was a kind of benchmark for deep economic integration, which currently has no analogues in the world. Successful introduction of the euro has had a «demonstration effect» for other regions of the world and serves as a catalyst for the processes of currency integration. However, not all

unions are so effective in the process of their monetary integration, in particular, due to the fact that it significantly limits the possibilities of the most simple methods of regulating the country's financial policy.

**Research analysis and statement of objectives.** Known scholars have made significant contributions to the development of scientific foundations for the formation of currency unions and areas: A. Rose, B. Eichengreen, J. Frankel, A. Alesina, J. Ingram, R. Baldwin, R. Mundell, and others.

Taking into account the dynamics of integration processes in the currency sphere, it became necessary to outline the development trends of currency integration in different regions of the world and to determine the effects of creating currency unions.

The purpose of the article is to identify the gravity potential of regional currency integration based on the study of the currency alliances' effectiveness in stimulating intra-regional trade.

To achieve this goal, methods of economic-mathematical modelling are used.

**Research results.** The concept of monetary integration is characterized by the lack of a unified approach from both the point of view of ontology and the epistemology of the study. At present, there is a lack of scientific consensus on what processes, phenomena and / or currency arrangements should be considered monetary integration, and therefore the very definition of the term is in question. In the traditional Ukrainian and post-Soviet scientific literature, monetary integration is generally defined in two ways:

- narrowly — as «... purposeful process of gradual convergence and unification of the monetary policy and currency relations of the participating countries within the limits of regional economic unions» [1];

- widely — as «... the process of currency policy coordination, the formation of a supranational mechanism of currency regulation, the creation of inter-state monetary and financial institutions» [2].

In western scientific literature, the conceptual apparatus of currency integration is paid insignificant attention. By default, as in national practice, researchers, when considering currency integration, use the narrow approach and investigate the specifics, implications and prospects of common currency areas and their «optimality».

In this paper, we will consider such disparate processes based on specific exchange rate regimes as part of the monetary integration:

1. Formation of currency (monetary) unions as a collective decision of two or more states on the use of a common currency.

2. Official dollarization as a unilateral decision by the state on the full or partial use of foreign currency in parallel with or instead of domestic currency.

3. The creation of currency / monetary boards or, in other words, currency bureaus or monetary authorities as the strict fixing of the national currency rate, which is established at the legislative level of the state and is supplemented by significant reserves in foreign currency (100% + of money base).

Some researchers [3] believe payment unions (interstate clearing unions for counteraction to problems with balance of payments of states, conclusion of swap agreements with the consolidation of reserves, creation of liquidity funds, etc.) should be included among the forms of currency integration. We propose to use the term «currency proto-integration» for these alliances. Currency proto-integration not only envisages regular practice of economic agents in the implementation of foreign currency transactions and the exchange of information regarding monetary initiatives, but also takes into account the interests of counterparties to minimize risks or maximize the common benefits in the area of currency relations.

Among the main advantages of regional monetary integration is the growth of mutual trade. The most well-known empirical confirmation of such dependence is found in the study by A. Rose, who, using gravitational modelling, has shown that the volume of bilateral trade between the two countries that are part of the monetary union is on average 3,35 times higher than trade between the

other countries [4]. Although later refinements of the model (including ones by A. Rose himself) demonstrated a reduction of the effect by 100% [5] and more [6]. In this regard, it should also be noted that the study on the dependence of the trade turnover intensity on the type of exchange rate (fixed or floating) generally showed a not very strong connection [7; 8].

However, it must be borne in mind that the effect of the currency union goes far beyond the usual fixation of the exchange rate. For example, the presence of historical and cultural interrelations between the states increases the tendency both to the formation of a monetary union and to the strengthening of trade relations between the states. Moreover, states that «have dared» to create a currency union are likely to stimulate parallel integration in other areas, including harmonizing standards and reducing trade barriers. Under such conditions, the net effect of increasing trade from currency integration is difficult to quantify.

In addition, in studies on the correlation of the trade effects and currency integration it is impossible (or difficult) to adequately assess the effect of the state leaving the currency union. Historically, a state leaving the currency union was often accompanied by an independence war against the metropolitan state, which at the same time was the issuer of the currency for the colony. It is clear that at the same time trade between the warring parties virtually ceased. A detailed study of this phenomenon is contained in the work of R. Thom and B. Walsh [9]. Even in the absence of hostilities, empirical models find it difficult to separate monetary and political disintegration. Attempts to assess the consequences of currency disintegration for the former Soviet Union and Yugoslavia showed somewhat differing results — from a sharp contraction of bilateral trade relations [10] to a more moderate decline [11].

The results of the currency union's influence on trade between its participants also depend on how it was created. In the case of using the so-called «client-anchor arrangements», the growth of mutual trade is observed at the level of 50% [12]. Whereas, when creating a «full» monetary union with a relatively even distribution of initiatives and commitments of participants, the effect on trade may even exceed the result of A. Rose [4] (see the study by A. Alesina et al. [13]).

The empirical confirmation of the currency union's role in the development of trade relations between the Member States of the EU is also rather ambiguous, given the high level of integration that existed before the introduction of the euro. The first study in this area was conducted by A. Micco et al. [14]. It showed an increase in trade by 8—16% compared to non-euro-EU members and by 4—10% relative to other developed countries. Later refinements of this model [15, 16] generally confirmed the positive effect of the creation of the European Economic and Social Committee on the development of mutual trade. The effect ranged from 2% in R. Baldwin [15] to over 70% in S. Gil-Pareja et al. [16]. One of the latest studies in this direction [17] has generally demonstrated a negative effect (albeit statistically not significant), which may indicate an excess of the convergence effect of the new EU members, many of which do not use the euro.

We evaluated the effectiveness of existing currency integration or proto-integration groups within the geographical regions using gravitational modelling.

We use the United Nations Standard M49 as a basis for the distribution of geographic regions, with some consolidations and minor modifications in line with current geopolitical realities.

In order to assess the effectiveness of regional monetary integration in terms of the development of intra-national trade flows, we use the gravitation equations in the style of A. Rose [4]:

$$\ln BT_{od} = \alpha_0 + \alpha_1 CU + \alpha_2 \ln(Y_o Y_d) + \alpha_3 \ln Dist_{od} + \alpha_4 Comlang_{od} + \alpha_5 Contig_{od} + \varepsilon \quad (1)$$

where  $BT_{od}$  — real bilateral trade flows between countries  $o$  and  $d$ ;

$Y_o Y_d$  — the total real GDP of the countries  $o$  and  $d$ ;

$Dist_{od}$  — weighted distance between countries (according to CEPII methodology [18]);

*CU* — dummy variable equal to 1 if countries *o* and *d* are using common currency (or rigid peg through a currency board regime);

*Comlang* — dummy variable equal to 1 if countries *o* and *d* are using common official language;

*Contig* — dummy variable equal to 1 if countries *o* and *d* share a common border.

Detailed implementation of the dummy variable *CU* is shown in Table 1.

Table 1

Current and potential regional currency unions  
(detailed implementation of the dummy variable *CU* in models)

<b>Collective currency integration and proto-integration unions</b>	<i>Dummy-variable CU</i>	<b>Member-states</b>
Organisation of Eastern Caribbean States (OECS)	-	Antigua and Barbuda, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Anguilla*, Montserrat*
Fondo Latinoamericano de Reservas (FLAR)	<i>CU_FLAR</i>	Bolivia, Colombia, Peru, Ecuador, Venezuela, Costa Rica, Uruguay and Paraguay
Local Currency Payment System (SML)	<i>CU_SML</i>	Brazil, Argentina, Uruguay
Cooperation Council for the Arab States of the Gulf (GCC)	-	Bahrain, Qatar, Kuwait and Saudi Arabia
West African Economic and Monetary Union (UEMOA)	<i>CU_UEMOA</i>	Benin, Burkina Faso, Guinea-Bissau, Côte d'Ivoire, Mali, Niger, Senegal, Togo
Economic and Monetary Community of Central Africa (CEMAC)	<i>CU_CEMAC</i>	Cameroon, Central African Republic, Chad, the Republic of Congo, Equatorial Guinea and Gabon
Common Monetary Area (CMA)	<i>CU_CMA</i>	Lesotho, South Africa, Swaziland
ASEAN+3	-	Philippines, Malaysia, Indonesia, Singapore, Thailand, Brunei Darussalam, Vietnam, Laos, Myanmar, Cambodia, China, South Korea and Japan
European Economic and Monetary Union	-	Austria, Belgium, Ireland, Spain, Italy, Luxembourg, Netherlands, Germany, Portugal, Finland, France, Greece, Cyprus, Malta, Slovenia, Slovakia, Estonia, Latvia, Lithuania
<b>Unilateral currency integration (dollarization, currency board)</b>		
The US dollar zone		Ecuador, El Salvador, Panama, Zimbabwe, Djibouti, Hong Kong
The Eurozone		Kosovo, Montenegro, Bosnia and Herzegovina, Bulgaria
Indian Rupee zone		India, Bangladesh, Nepal

\* Dependent territories.

For the estimation of gravity models, we select the indicators for the period from 1991 to 2016 according to the data of CEPII [18] and the author's determination of dummy variables reflecting regional monetary integration.

From the geo-economic point of view, the North American region (including Mexico) is a powerful trade integration block called the North American Free Trade Area. However, the prospects for currency integration of the region were considered only in the theoretical plane, so we will not carry out modelling in the region.

The analysis results of a sample of 11,363 observations of bilateral trade in the Central American and Caribbean region (Table 2) show rather low gravity of mutual trade flows of the states ( $R^2 = 0.33$ ), which may indicate non-regional orientation of export-import relations, and the low share of trade incomes in total GDP (for example, the domination of tourism revenues). Dummy-variable *CU* had the value of 1 when marking the bilateral trade of members of the OECS, as well as characterizing the trade pairs of officially dollarized states, in other cases, the variable was zero. Based on the obtained results it can be concluded that the effect of currency integration on

the development of intra-regional trade in Central America and the Caribbean was low (negative) ( $\alpha_1 = -0,408$ ). The indicators of economic size of countries, geographical distance and common language had a much greater influence. The impact of a shared border was statistically insignificant (which is expected for mostly island states of the region).

Table 2

Influence of currency integration on intra-regional trade flows in Central America and the Caribbean

	$\alpha$	t-Stat
Intercept	-3.443***	-4.3
CU	-0,408***	-2.6
$Y_o Y_d$	1,441***	45,4
$Dist_{od}$	-2,822***	-39.9
Comlang	3,417***	34.4
Contig	0,211	0.9
Normalised $R^2$	0,33	
$SE/(\pi_{max} - \pi_{min})$	4.7	
Nobs	11363	

Notes: \*, \*\*, \*\*\* indicate significance levels of 90, 95 and 99% respectively; Nobs — number of observations; SE — standard error;  $R^2$  — coefficient of determination; Intercept — coefficient  $\alpha_0$ ; CU,  $Y_o Y_d$ ,  $Dist_{od}$ , Comlang, Contig— variables given in model 1.  
Source: calculated by the authors

The gravity model for analysing the impact of currency proto-integration on intra-regional trade flows in South America (Table 3) has shown a fairly high level of predictive value ( $R^2 = 0.70$ ). Since there are no classical currency unions in the region, we gave the dummy variable CU the value of 1 for the characteristics of trade between members of currency proto-integration groups — FLAR and SML. All resulting variables are characterized by a level of statistical significance of over 99%. The analysis showed some positive effects from the creation of currency proto-integration unions ( $\alpha_1 = 0.685$ ). However, the impact of other factors, such as economic size, geographical distance, common language or borders, was stronger.

Table 3

Influence of currency integration on intra-regional trade flows in South America

	$\alpha$	t-Stat
Intercept	-39,262***	-32,4
CU	0,685***	4,79
$Y_o Y_d$	2,508***	56,2
$Dist_{od}$	-1,563***	-39.9
Comlang	5,251***	40,8
Contig	1,273***	7,87
Normalised $R^2$	0,70	
$SE/(\pi_{max} - \pi_{min})$	3,1	
Nobs	3143	

Notes: \*, \*\*, \*\*\* indicate significance levels of 90, 95 and 99% respectively; Nobs — number of observations; SE — standard error;  $R^2$  — coefficient of determination; Intercept — coefficient  $\alpha_0$ ; CU,  $Y_o Y_d$ ,  $Dist_{od}$ , Comlang, Contig— variables given in model 1.  
Source: calculated by the authors

Interestingly, the analysis conducted separately for two currency proto-integration unions (Table 4) showed a significantly greater positive impact on mutual trade from the existence of SML ( $\alpha_{CU\_SML} = 4,067$ ) than from FLAR ( $\alpha_{CU\_FLAR} = 0.266$ ). However, the level of statistical significance in the second case is slightly lower.

Table 4

## Influence of regional currency integration on intra-regional trade flows in South America

	$\alpha$	t-Stat
Intercept	-38,182***	-31,6
CU_FLAR	0,266*	1,8
CU_SML	4,067***	8,9
$Y_oY_d$	2,458***	55,0
$Dist_{od}$	-1,548***	-11,4
Comlang	5,530**	41,7
Contig	1,120***	6,94
Normalised $R^2$	0,71	
$SE/(\pi_{max} - \pi_{min})$	3,0	
Nobs	3143	

Noted: \*, \*\*, \*\*\* indicate significance levels of 90, 95 and 99% respectively;

Nobs — number of observations; SE — standard error;  $R^2$  — coefficient of determination; Intercept — coefficient  $\alpha_0$ ; CU,  $Y_oY_d$ ,  $Dist_{od}$ , Comlang, Contig— variables given in model 1.

Source: calculated by the authors

As the fourth region for the analysis, North Africa and Western Asia were selected, which in its totality is a geopolitical platform for Arab civilization. In accordance with the UN methodology, we excluded Israel (the traditional antagonist of the Arab world), Cyprus (to be considered in the European region), Georgia, Armenia and Azerbaijan (alternately considered in the regions of Europe and the conventional CIS) from the geographic framework of the region. We decided not to include Iran (ethnically populated by the Persians) even though it is geographically close to the region, since its relations with Arab states are not always clear (Islam was introduced by rather rigid methods instead of traditional Zoroastrianism).

In terms of regionalism, the territory is represented by the League of Arab States, a broad-based socio-economic organization, uniting Arab-speaking Muslim states, within which the Greater Arab Free Trade Area (GAFTA) has been established [19]. Political polarization between the states does not allow for the discussion of creating the Pan-Arab monetary union in modern conditions (although such an initiative was proposed by the Arabic Union of exporters and importers).

The prospects for the introduction of a common currency within the framework of a narrower regional association — Cooperation Council for the Arab States of the Gulf (GCC) are more realistic.

Internal trade in the region is not determined by a significant gravitational nature within the framework of model 1 ( $R^2 = 0.19$ ), and membership in the currency proto-integration alliance of GCC does not lead to an increase in mutual trade ( $\alpha_1 = -0.1114$  with a level of statistical significance of 90%) (Table 5).

Table 5

## Influence of currency integration on intra-regional trade flows in North Africa and West Asia

	$\alpha$	t-Stat
Intercept	-9,709***	-5,67
CU	-0,114*	-0,32
$Y_oY_d$	1,571***	24,67
$Dist_{od}$	-2,154***	-22,91
Comlang	2,503***	13,44
Contig	-0,758***	-4,08
Normalised $R^2$	0,19	
$SE/(\pi_{max} - \pi_{min})$	4,1	
Nobs	5180	

Noted: \*, \*\*, \*\*\* indicate significance levels of 90, 95 and 99% respectively;

Nobs — number of observations; SE — standard error;  $R^2$  — coefficient of determination; Intercept — coefficient  $\alpha_0$ ; CU,  $Y_oY_d$ ,  $Dist_{od}$ , Comlang, Contig— variables given in model 1.

Source: calculated by the authors



In terms of regionalism, the West African sub-region is presented by the Economic Community of West African States (ECOWAS), within which the West African Clearing House was established and subsequently transformed into the West African Monetary Agency. In 1987, for the purposes of monetary unification, the ECOWAS Monetary Cooperation Programme was launched. Despite this, as of today, some of the member states of the community united into one fully functioning currency integration group — the West African CFA Zone. West African CFA Zone — predominantly French-speaking members of the West African Economic and Monetary Union: Benin, Burkina Faso, Guinea-Bissau, Côte d'Ivoire, Mali, Niger, Senegal, Togo. It should be noted that there is no unification of political interests within the framework of the WAEMU — some members of the alliance (Côte d'Ivoire, Niger and Togo), together with Ghana, have expressed a desire to withdraw from France's influence by creating a new currency union.

The sub-region of Central Africa is institutionalized by the functioning of the Economic Community of Central African Countries, most of whose members have joined the Economic Community of Central African States (formally alliances function independently of each other). The problematic aspect of the region is the presence of numerous internal and external political contradictions - the «conflict of the Great Lakes», the civil war in the CAR, and so on.

Economic regionalism of the southern sub-region is represented by the Southern African Customs Union, and the Common Currency Zone anchored to the Rand, consisting of South Africa, Namibia, Lesotho, Swaziland and, in part, Botswana (the rand is part of the national basket peg).

The internal bilateral trade in Sub-Saharan Africa is not too intense and cannot be accurately described using gravity ( $R^2 = 0.31$ ) in a sufficient manner (Table 6). Generally, membership in the currency union (the dummy variable CU has the value of 1 for trade between members of WAEMU, ECCAS and CMA) positively influences the intensity of intra-regional trade ( $\alpha_1 = 0.641$ ) (Table 7).

Table 6

Influence of currency integration on intra-regional trade flows in Sub-Saharan Africa

	$\alpha$	t-Stat
Intercept	-19,68***	-33,46
CU	0,641***	5,16
$Y_o Y_d$	1,955***	90,86
$Dist_{od}$	-2,376***	-52,70
Comlang	1,940***	35,45
Contig	2,680***	25,08
Normed $R^2$	0,31	
$SE/(\pi_{max} - \pi_{min})$	5,1	
Nobs	39416	

Noted: \*, \*\*, \*\*\* indicate significance levels of 90, 95 and 99% respectively;

Nobs — number of observations; SE — standard error;  $R^2$  — coefficient of determination; Intercept — coefficient  $a_0$ ; CU,  $Y_o Y_d$ ,  $Dist_{od}$ , Comlang, Contig— variables given in model 1.

Source: calculated by the authors

Table 7

Influence of participation in African currency unions on intra-regional trade flows

	$\alpha$	t-Stat
Intercept	-21,77***	37,25
CU_UEMOA	2,408***	16,42
CU_CEMAC	-1,065***	-5,18
CU_CMA	-13,993***	-27,02
$Y_o Y_d$	2,034***	95,03
$Dist_{od}$	-2,344***	-52,65
Comlang	1,956***	36,21
Contig	3,059***	28,79
Normed $R^2$	0,33	
$SE/(\pi_{max} - \pi_{min})$	5,07	
Nobs	39416	

Noted: \*, \*\*, \*\*\* indicate significance levels of 90, 95 and 99% respectively;

Nobs — number of observations; SE — standard error;  $R^2$  — coefficient of determination; Intercept — coefficient  $a_0$ ; CU,  $Y_o Y_d$ ,  $Dist_{od}$ , Comlang, Contig— variables given in model 1.

Source: calculated by the authors

At the same time, the formation of a model detailing currency unions (Table 7) shows quite contradictory results: only within the framework of the WAEMU there is an intensification of trade ( $\alpha = 2,408$ ), while in the framework of ECCAS, and especially the CMA, there are inverse trends (coefficients of 1,065 and 13,993 respectively).

Regional economic integration in Asia is marked by a much lower intensity compared to other continents. Numerous bilateral and multilateral trade agreements of low efficiency in the region have received the informal name «noodle-bowl effect». Among the currency integration unions, only the Currency Union of Singapore and Brunei and the Indian Rupee Zone (including Bangladesh and Nepal) can be singled out. They are local rather than regional. The dominant currency for payments and reserves in the region is the US dollar (the so-called East Asian dollar standard).

The gravitation equation of mutual trade in the Asian region demonstrated the average predictive ability ( $R^2 = 0.54$ ). Given the lack of full currency unions in the region, the dummy CU variable is denominating trade relations between the members of the ASEAN+3 proto-integration group, as well as between the members of the Indian Rupee zone. In general, participation in these currency unions has a positive effect on mutual trade ( $\alpha_1 = 0.947$ ) (Table 8).

Table 8

Influence of regional currency integration on intra-regional trade flows in East, South-East and South Asia

	$\alpha$	t-Stat
Intercept	-30,824***	-42,52
CU	0,947***	9,57
$Y_o Y_d$	2,461***	104,02
$Dist_{od}$	-2,292***	-32,95
Comlang	2,222***	21,18
Contig	-0,534***	-3,46
Normalised $R^2$	0,54	
$SE/(\pi_{max} - \pi_{min})$	4,47	
Nobs	12610	

Noted: \*, \*\*, \*\*\* indicate significance levels of 90, 95 and 99% respectively;

Nobs — number of observations; SE — standard error;  $R^2$  — coefficient of determination; Intercept — coefficient  $\alpha_0$ ; CU,  $Y_o Y_d$ ,  $Dist_{od}$ , Comlang, Contig— variables given in model 1.

Source: calculated by the authors

In general, researchers have largely come to a consensus on the inefficiency of the introduction of a common currency in Asia. Instead, two potential vectors for the development of currency coordination in Asia can be singled out. In the first scenario, a basket of currencies is formed, to which the national currencies of the countries of the region are bound [20]. The second scenario involves the introduction of a system of common parallel currencies [21] (Asian Development Bank proposed the name Asian Currency Unit (ACU), similar to the EC).

The gravity equation of the dependence of the bilateral intra-regional trade of European countries on participation in the currency union shows a high level of significance ( $R^2 = 0.63$ ), but though the effect of currency integration is positive, it is not particularly significant ( $\alpha_1 = 0.75$ ), which may be explained by a high degree of mutual trade even before the introduction of the euro (Table 9).

Taking into account the absence of currency integration processes, the article does not analyse trade effects in post-Soviet countries. In addition, the Oceania region was not considered separately, due to volatility and a small volume of trade flows.

**Conclusions.** The framework for regional monetary integration is proposed to include three alternative exchange rate regimes: currency board, dollarization and currency union. Each of them has its own peculiarities of formation and development, its own advantages and disadvantages, but the common feature is unconditional currency and exchange rate unification.

Table 9

## Influence of regional currency integration on intra-regional trade flows in Europe

	$\alpha$	t-Stat
Intercept	-9.97***	-30.05
CU	0.753***	15.26
$Y_o Y_d$	1.851***	188.22
$Dist_{od}$	-2.910***	-106.75
Comlang	0.323***	3.82
Contig	-0.144***	-2.13
Normalised $R^2$	0.63	
$SE/(\pi_{max} - \pi_{min})$	2.70	
Nobs	33997	

Noted: \*, \*\*, \*\*\* indicate significance levels of 90, 95 and 99% respectively;

Nobs — number of observations; SE — standard error;  $R^2$  — coefficient of determination; Intercept — coefficient  $\alpha_0$ ; CU,  $Y_o Y_d$ ,  $Dist_{od}$ , Comlang, Contig— variables given in model 1.

Source: calculated by the authors

The applied gravity model demonstrated a high significance level for South America, Europe, South and East Asia ( $R^2$  for them was 0.71, 0.63 and 0.54, respectively). For the rest of the regions, the relatively low gravitational pull of the mutual trade flows of the states is characteristic, which can testify to the non-regional orientation of export-import relations, and the low share of trade in total GDP (for example, the dominance of tourism revenues). Among the currency unions, the currency integration and proto-integration unions of South America (in particular for the SML Local Currency Payment System  $\alpha_1 = 4.077$ ), Asia (0.947) and Europe (0.753) turned out to be the most effective in terms of intensifying domestic trade. Among the African currency unions, the regular growth of mutual trade was observed only in the West African Economic and Monetary Union, while the rest were characterized by inverse dependence.

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