ECLAC
Economic Commission for Latin America and the Caribbean

MODELING REGIONAL MACROECONOMIC INTERACTIONS:
SITUATION AND PERSPECTIVES FOR MACROECONOMIC COORDINATION
IN LATIN AMERICA
Background paper prepared for the REDIMA workshop on "Modeling Macroeconomic
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1. Introduction

The early 1990s opened a new era for the analysis of economic interactions between Latin America and Caribbean (LAC) countries. Two channels, real and financial, conveyed the transmission of shocks. Intra-regional trade recuperated strongly in the wave of trade liberalization and the resumption of economic growth after the "lost decade" that marked the 1980s. The first year of the 1990s decade coincided also with the large scale introduction of new financial instruments that allowed operators to trade riskier papers, opening the door to an active market of financial titles emitted by the so called "emerging economies". As a result of this innovation, and the settlement of the old debt problem through the Brady agreement, and an increasing flow of foreign direct investment, the net transfer of resources to the region became once again positive, and growth resumed.

But growth resumption was accompanied by higher volatility, due to the nature of the new international financial market, where contagion and herding have become a prominent reality. As a result, shocks initiating in one country will have direct impacts upon trade and other real variables, financial spreads and exchange rates in its neighbouring geographical area, as well as upon the international business climate if the troubled country is large enough (e.g., Argentina, Brazil or Mexico). This common destiny, in spite of differences in policies or fundamentals from one country to another, is a clear symptom of the emergence of a subregional dimension as a result of trade integration and financial globalization. (Studart, 2002)

Indeed, because of this common component, national macroeconomic stability (including real aspects) should now be treated as a regional public good. The existence of such externalities calls for more coordination of national economic policies in the region. Despite these interdependencies and notwithstanding major initiatives in promoting macroeconomic coordination in several LAC subregions, cooperation does not always emerge naturally, even when it would be optimal to do so. Reflecting on this situation, Escaith, Ghymers and Studarts (2002) states that "it is striking that there is no systematic, operational regional or subregional scheme to deal with these regional or subregional spillovers… Indeed, economic policies are still totally uncoordinated and all the decisions continue to be taken in close-knit national circles without considering any spillovers at all. The clearest symptom of this is the choice of exchange-rate regimes based on strictly national considerations."

2. Economic convergence, integration and policy coordination in Latin America

Despite their limitations, Mundell's OCA criteria are a good starting point to look a the feasibility of initiating a dynamic process of policy coordination in a regional framework. The issue depends not only on national considerations, but also on externalities linked to the regional dimension of the transmission of shocks.

The evolution of the LAC economies since the mid-1980s shows a convergence in terms of macroeconomic policies and achievement. Confronting the negative shock of the debt crisis of 1982, the necessary adjustment following the reversal of net financial resource transfers from the rest of the world and episodes of high to hyperinflation, most countries embarked upon stabilization programmes. These programmes shared a nuclear set of common objectives, strategies and instruments. The increased dependence on external finance during the 1990s also led to a reduction in the discretion of domestic policy makers to diverge from orthodox policies.

The trend not only affected macroeconomic policies *stricto sensu*, but also brought a deeper transformation of the institutional framework via structural reforms. The evolution of reform indexes (Paunovic in CEPAL, 2001), shows that most Latin American and Caribbean countries had achieved by the end of the 1990s convergence in terms of trade, financial and capital liberalization reforms.

As a result of these trends, most LAC countries entered the decade of the 2000s with many shared characteristics, not only in their way of thinking about making economic policies, but also in the results –both positive and negative– of these policies. Sharing common objectives, institutional frameworks and instruments provides a rather fertile ground for macroeconomic policy co-ordination. Whether it is optimal to integrate this dimension into the national strategies depends in part on the comparative review of their exposure to external shocks. The first aspect to be analyzed is trade integration.

1. Commercial integration

One of the central factors in macroeconomic policy co-ordination and OCA is the degree of trade interrelationship between potential partner countries throughout the trade sector. This is traditionally analyzed in terms of trade flows and symmetry of external shocks.

1.1 Intraregional trade

Since 1991, with the recovery from the 1982 debt crisis, trade with other LAC countries, especially within integration subregions (Andean Community, CARICOM, Central American Common Market, Mercosur), has increased much faster than trade with other countries, at least up to 1998. Indeed, intraregional trade, that represented 13% of total exports in 1990, raised to 20% in 1998, an implicit growth rate of almost 15% annual in real term. Due to the crisis in the Mercosur and a decline in the Andean group, this share has decreased to 16% in 2002, reducing the annual growth over the 1991-2002 period to 9%. (see table 1) This growth is particularly significant from our perspective, because trade has grown much more rapidly than domestic product, increasing its contribution to the level of economic activity.

Table 1
TRENDS IN TRADE AND DOMESTIC PRODUCT, 1991-2002

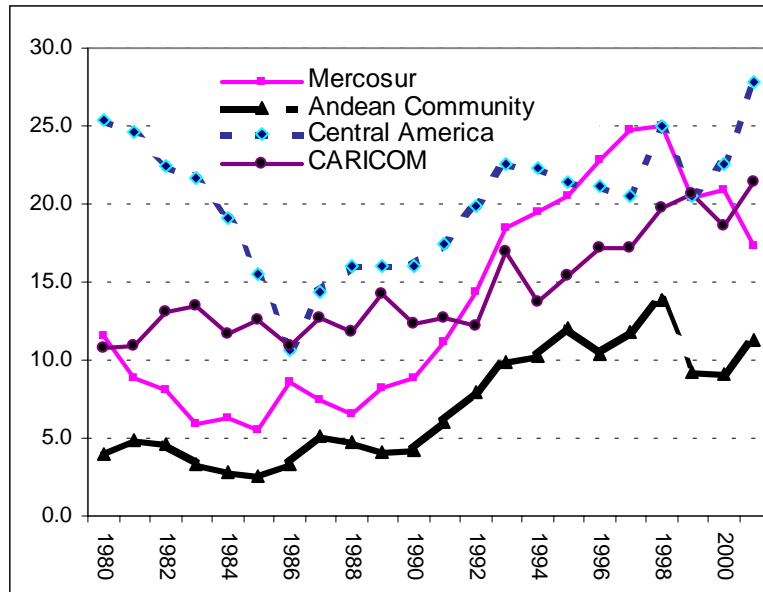| Latin America and the Caribbean (LAC)	Average annual growth rate a/	
	1991-1998	1991-2002
1. Total supply	4.5	3.3
Of which:		
- GDP	3.3	2.5
- Imports of goods and services	12.0	8.0
2. Exports of goods and services	8.5	7.3
Of which:		
- Exports to other LAC countries b/	14.8	9.2

Source: Based on ECLAC data.

Note: a/ Percent, from data at constant 1995 prices; b/ Estimated from data at current prices.

Economic transactions within each subregional integration schemes have been taking an increasingly role (see graph 1). This is important not only in quantitative, but also and especially in qualitative terms: while extraregional trade is composed of traditional products (commodities or processed primary products) in South America, intraregional trade is based on manufactured products, allowing national economies to diversify their export base (see Benavente, 2001).

Mexico, Central American and Caribbean countries, on the other hand, have diversified their exports thanks to their privileged access to the United States market (the "maquiladora" industries) or their natural advantages for tourism.

Figure 1
INTRAREGIONAL TRADE IN RELATION TO TOTAL EXPORTS
(%)

This trend has two important (and potentially conflicting) consequences for the purposes of the present paper. First, it increases the transmission of shocks through trade, in the traditional OCA perspective, and thus is a factor of greater interdependence between countries. Second, it increases the potential for conflict between national exchange rate policies, as these exports consist of consumer and intermediary products that are sensitive to relative prices. Thus, devaluation by one of the regional trading partners could have a strong impact on regional trade flows, triggering regional tensions (as occurred in Mercosur after devaluations in Brazil or Argentina) or competitive devaluations (as in Europe in the late 1970s). Obviously, these cross-effects are directly relevant to both the choice of national exchange rate regime and the potential gains for regional coordination (see CEI, 2003, for a review of the cooperation issues from a Mercosur perspective).
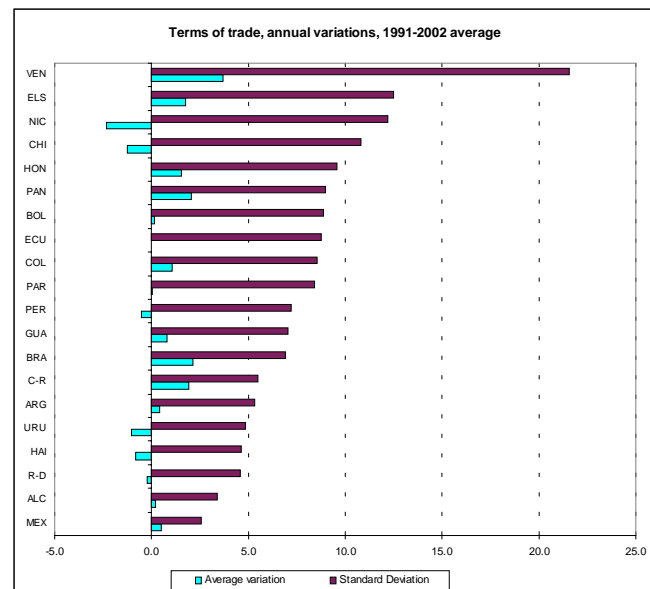
1.2   Terms of trade

In small open developing economies, terms of trade fluctuations (variations in the prices of a country's exports relative to those of its imports) are a major source of instability. Structural characteristics make export prices very volatile because of the high proportion of commodities and there is little capacity for substituting imports internally (because of their higher technological content), even when their relative prices increase. Non-transitory shifts in relative prices, as exemplified by structural trends in terms of trade is an issue that has been receiving attention for quite a long time (see Ocampo and Parra, 2003).

Short-term fluctuations in relative prices are perhaps more damaging on investment than long term trends, as volatility increases systemic uncertainty and diminish the capacity for sound decision-making. The latter are also more relevant when it comes to macroeconomic policy coordination, especially when the explicit objective of the macroeconomic policy is to stabilize nominal and real variables, i.e., to smooth out high frequency fluctuations.

As shown in graph 2.a, the dynamics of terms of trade has been quite different across countries over the past ten years in terms of trends[1] and volatility. As an annual average over the 1991-2002 period, six countries out of nineteen suffered negative shocks and eleven positive ones. This resulted in a small positive annual average of 0.2% for the region as a whole (0.6% for a simple average of individual countries), the extreme ranging from –2.4% (Nicaragua) to 3.7% (Venezuela).

Volatility is very different from country to country, with standard deviations ranging from a low 2.6 in Mexico, which has the advantage of a diversified export structure, to as high as 21.6 in Venezuela, a mono-exporter of oil. The volatility for consolidated exports is low for the region as a whole, 3.4 when all exports are consolidated, but reaches 8.1 if computed as a country average.

Figure 2
TERMS OF TRADE, 1991-2001
a: ANNUAL VARIATIONS

Terms of trade, annual variations, 1991-2002 average

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[1] The term "trends" is used here in the sense of tendency, and does not refer to what statisticians may understand by deterministic trends (e.g., in contrast to random movements).

Terms of Trade, 1991-2002
Principal Component, axes F1 and F2
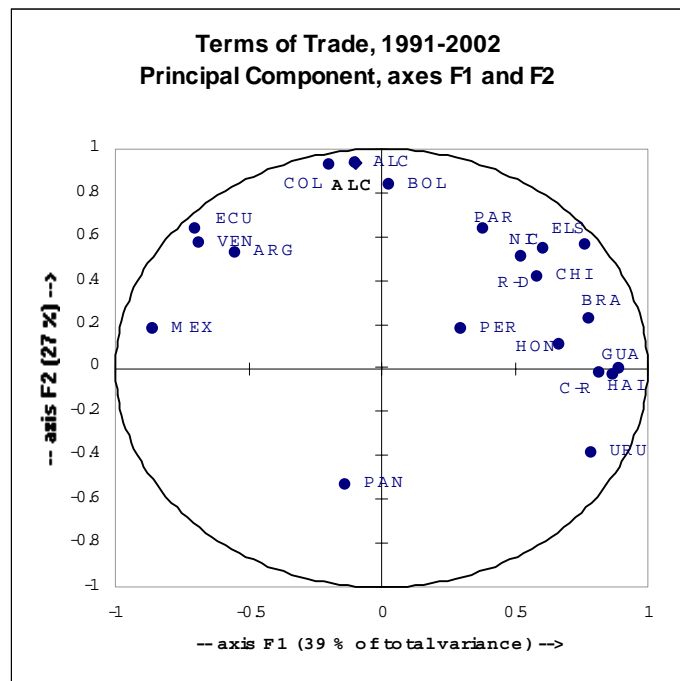
Source: Authors' construct, based on ECLAC data.

Looking at the correlation between countries, one notes that most countries in the region share a common positive interdependence, while a small group evidences diverging behaviour. This is best seen from graph 2.b that shows the clustering of LAC countries according to a breakdown of the principal components of their terms of trade variations. On the first two axes, that explain jointly 65% of total variance, one may note a first cluster of countries in the N-W quadrant, composed of Ecuador, Venezuela, Argentina and, to a lesser degree, Colombia and Mexico. These are oil-exporting countries. Panama is isolated because of its specificity as a processing and transit zone.

Except for Bolivia, all other LAC countries are clustered into a compact group on the West part of the graph. This cluster includes all countries in the Central American Common Market and almost all countries from Mercosur, with the exception of Argentina. This means that the countries from these two integration areas share the same (short-term) trends for terms-of-trade variations, which is an important basis for coordinating a regional response to common external shocks. The situation of the Andean countries is more diversified from this point of view, because of their respective specializations in oil exports (Ecuador and Venezuela, but also Colombia) or in other minerals (Bolivia, Peru).

1.3   Effective Exchange Rates

Exposure to common terms of trade shocks and stronger intraregional trade should lead to greater co-variation of effective real exchange rates (ERERs). Their calculation takes into account the evolution of its bilateral exchange rates in relation to each trading partners, correcting for differences in the respective domestic rates of inflation and weighting for the relative importance of the trading partner in a country's total trade.

The ERER is a widely accepted measure of short-term macroeconomic competitiveness. As such, it is an important indicator to monitor in any trade integration scheme: when the ERER rises (decreases), the reporting country gains (loses) competitiveness with regard to its (weighted) average trade partner. Obviously, when regional partners account for a significant share of external trade, variations in neighbouring countries' exchange rates (or internal prices) will greatly affect the overall trade competitiveness of each country.

This merely quantitative and mechanical effect is compounded by the potentially greater price elasticity of intraregional trade. Because intraregional trade in Latin America is more intensive in manufactured goods, demand is potentially more sensitive to changes in relative prices than the goods exported to the rest of world. In the case of Latin America (especially in South America), exports to the rest of the world are mainly primary products, whose prices are set internationally. Firms participating in intraregional commerce are in general smaller than those trading with the rest of the world and more sensitive to transitory changes in relative prices.

Correlation coefficients between LAC exchange rates were calculated from 1992 up to the first semester of 2003 for the quarterly variations of four categories of real exchange rates: (i) bilateral with the United States economy, (ii) effective with regional trading partners (a weighting average of bilateral exchange rate adjusted by the differential of rate of inflation), effective with non-regional trading partners (excluding the United States of America) and the effective exchange rate for all (regional and non regional) trading partners. Contemporary correlation coefficients were calculated, thus capturing only the direct and most observable effects. Trading partners are weighted by their exports to the reporting country.

The correlation coefficients obtained for the ERER with regional partners are the most interesting in the present case, as they reflect the intensity of the shocks passed from one LAC country to the others through the exchange rates, either by trade or by other causes. They cure clearly a prime indicator of macroeconomic integration. When there are close trade relationships within a subregional integration scheme, a positive impulse in one country (a gain in exchange rate competitiveness) should result in a negative one in the regional trading partners.

By construction, because of the symmetry of trade relationships, the sum of the correlation coefficients is close to zero when considering all the LAC countries that enter in the calculation of the regional ERER. The closer the intra-regional trade relationship, the higher positive and negative variations. But part of the interaction analyzed through the behaviour of regional ERERs may be due to a third, external, factor to which all countries in the region react simultaneously (an external shock of large magnitude, such as the Asian and Russian crises of 1997-1998, for example). To filter out this noise, the correlation coefficients obtained for real exchange rates with the US$ were subtracted from the results obtained with the regional ERER. An index was constructed using the sum of the absolute values of the results obtained for each country, normalized by the total across countries. (see figure 3)

Figure 3
REGIONAL EXCHANGE RATE INTEGRATION INDEX

Regional Exchange Rate Integration Index
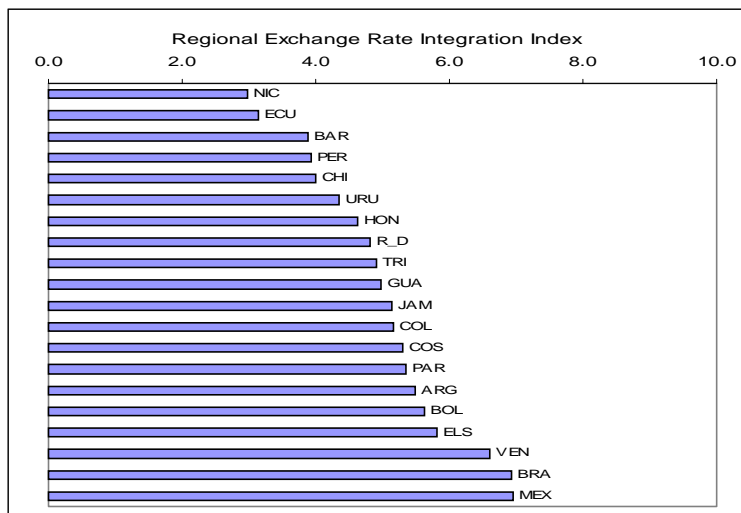
Source: Authors' construct (see text for methodology)<Figure 4>

As expected, the larger LAC countries (Argentina, Brazil and Mexico) are among those showing greater interaction with the rest of the LAC region. But great care should be taken not to draw definitive conclusions from this index. Despite the filtering process used, it remains subject to "spurious" correlation effects [2] affecting the results, Also, the index is better calculated on " normal years" because great asymmetrical shocks affecting a smaller economy may create noise in the indexing procedure. For example, Uruguay has been closely integrated into the Mercosur economy and ranked high in the index calculated from 1992 up to 2001 (6.6). The large devaluation of 2002 had no significant impact on the effective exchange rate of Uruguay' s trade partners due to the small size of its economy, and the resulting effect was a drop of more than two points in its integration index (4.4) when incorporating 2002 and 2003 periods.

Another conclusion may be drawn when looking at the ERER with non regional trading partners (excluding the USA). It is striking that (i) most elements of the correlation matrix are positive and (ii) many have a high value, in contrast with the regional ERER and the bilateral US$ tables. This intuition is confirmed when applying principal component analysis to the real exchange rate variations. In principal component, the higher the co-movement among original series, the fewer the common factors needed to "explain" the total variance of the sample. It is clear from table 2 than co-movements are higher when exchange rate variations are considered in relation with "other" trade partners than with the USA or regional partners. In the first case, the first factor explains 40% of the variance, approximately double the value encountered in the two other cases. The same difference persists when considering second (and, albeit less so, third) factors.

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2   For example, higher international oil prices can affect the nominal exchange rate of oil exporting countries, such as Venezuela, and the internal rate of inflation of importers, thus affecting simultaneously the ERR of both exporters and importers even if they do not have close economic relations.

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Table 2
QUARTERLY REAL EXCHANG RATE VARIATIONS, 1992-2003: PRINCIPAL COMPONENT ANALISIS

(Results obtained for the first four components)

	Factor 1	Factor 2	Factor 3	Factor 4
1. LAC Partners				
Eigenvalue	4.4	3.5	2.7	2.3
% variance	22.2	17.5	13.4	11.5
% cumulative	22.2	39.8	53.2	64.7
2. Bilateral with USA				
Eigenvalue	3.9	2.1	2.0	1.8
% variance	19.3	10.5	10.1	8.8
% cumulative	19.3	29.8	40.0	48.7
3. Other trade partners				
Eigenvalue	8.0	2.6	1.6	1.3
% variance	40.0	12.9	8.0	6.3
% cumulative	40.0	52.9	60.9	67.2

Source: Author s' calculations.

It appears that most LAC countries share a common trend with respect to non-US$ monies (basically European and Asian currencies in our sample). This is easily explained considering that *de facto* or *de jure* these economies belong to the dollar area, and thus tend to share the same exchange rate fluctuations with other international currencies.

2. Internal economic cycles

In the previous sections, we looked at the transmission of shocks via terms-of-trade or exchange-rate channels. In view of the high external vulnerability of the region, these shocks would be expected to have an impact on short-term growth dynamics. In the present section, we will look into the coincidence of the "real cycles" within the region.[3]

Two set of indicators are used, one being the quarter-to-quarter seasonally adjusted GDP growth rate, and the other the size of the output gap. Those were calculated by reference to a medium-term tendency obtained by smoothing real GDP time series, applying the widely used Hodrick-Prescott (HP) filter to data. A standard value of 1600 was utilized to parameterize the filter, and the quarterly series were extrapolated at both ends of the sample, to reduce the well known end-point sensibility of the HP filter.

Tendencies for GDP growth using the filtered series capture the medium-term trends observed during the 1990s up to 2002. Figure 4 shows two different dynamics at the beginning of the present decade. The low-growth subset was composed of South American countries severely hit by the 1997-1999 crisis that affected many emerging economies. Particularly affected were the Southern Cone economies, especially so in the context of the Argentinean turmoil in 2001-2002. Mexico, Caribbean and Central American countries were able to escape the 1997-1999 turbulence thanks to their closer links to the booming United States economy and lesser dependence on exports based on primary products. When the USA, together with other industrialized economies, eventually entered recession in the second semester of 2001, this difference vanished.

Figure 4
LATIN AMERICA: EVOLUTION OF POTENTIAL GDP, 1993-2002

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3   Real cycle in this purely descriptive context should be understood as GDP fluctuations around a trend, and does not refer to the source (monetary or real) of the observed fluctuation. For a more in-depth study on cycles co-movements in Latin America, see Cerro and Pineda (2002).
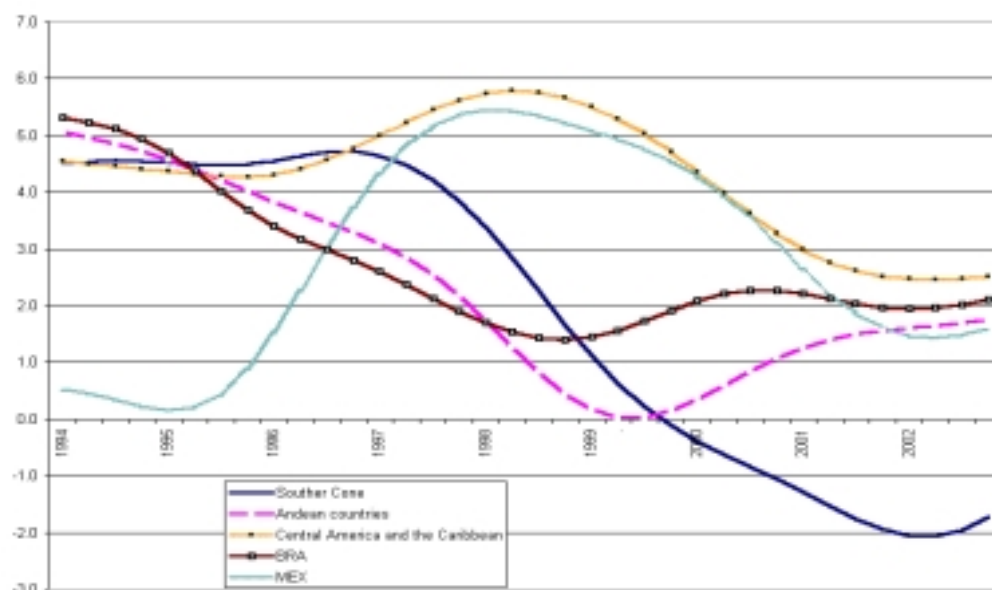
The analysis of short-term GDP fluctuations confirms this heterogeneity. The quarterly GDP, variations show little correlation across the region as a whole, confirming the results obtained by Cerro and Pindea (2002) and the conclusion of the VAR models on the Andean economies presented to this Seminar by Morales (2003). An interesting pattern emerges however when looking at (i) the evolution of the correlation over the 1993-2002 period and (ii) the situation within each of the subregions. Not only is the correlation higher when calculated within each subregion, but it is also increasing over time (see table 3).

Table 3

QUARTERLY GDP VARIATIONS: INTER-COUNTRY CORRELATION COEFFICIENTS

1993-2002

	Correlation within each subregion			Correlation within LAC region
	Average correlation within:			Average
	Mercosur	Andean Countries	MesoAmerica a/	
Period averages:				
Total 1993-2002	0.15	0.14	0.06	0.11
- 1993-1997	-0.01	0.07	-0.08	0.05
- 1998-2002	0.31	0.20	0.19	0.16

Note: a/ Mexico, Central America and Dominican Republic.

The review of the correlation coefficients obtained for output gaps (percentage difference between potential and observed GDP) shows that the co-variation of economic activity across the region is higher than the coincidence observed in output gaps. This is confirmed by the results of

the principal component analysis. As shown in table 4, the first factor has a greater representation power in the case of quarterly variation of total GDP, compared to the output gaps.

QUARTERLY GDP VARIATIONS AND OUTPUT GAPS: PRINCIPAL COMPONENTS
1993-2002

	Factor1	Factor 2	Factor 3	Factor4
Quarter to quarter variation				
Eigenvalue	4.8	2.5	1.7	1.3
% variance	34.2	17.9	12.5	9.1
% cumulative	34.2	52.2	64.6	73.8
Output Gap				
Eigenvalue	3.6	2.8	2.3	1.4
% variance	25.5	19.7	16.5	10.0
% cumulative	25.5	45.2	61.7	71.7

Source: Author s' calculations.

These results indicate that the co-variation of economic activity in the region is still diffuse, but has been increasing over the period and that LAC countries tended to cluster around common subregional patterns. This is quite an interesting feature considering that the correlation of business cycles across countries is an argument in favour of macroeconomic policy coordination and optimum currency areas. [4]

3. Model uncertainty

Because the application of the economic theory to real life situations is not unambiguous, there is always a probability of error when adopting a particular model specification. Parameter uncertainty and disagreement among coalition partners about the right economic model pose a real challenge for a cooperative economic policy. Policymakers may have different beliefs about how an economy actually works. Disagreement is obviously not an obstacle to cooperation, but because of the uncertainty about the "true model", negotiations may lead to a wrong model and result in a lower welfare than non-cooperation.

Uncertainty may reduce the present value of the expected welfare benefits. A strategy to achieve cooperation is collectively stable if and only if the weight of future outcome in today's decisions is large enough. On the other hand, –as occurs with the OCAs welfare gains– part of this uncertainty is endogenously determined and changes with the number of time the "coordination game" is played. In this case, as we shall see, uncertainty is reduced through cooperation (while OCAs expected welfare gains are increased). When both policies and models are subject to choice, policy makers have four options: (i) They make neither an attempt to agree on the appropriate model, nor to coordinate their policies; (ii) they may exchange information or bargain over the model, but make no attempt to choose jointly their policies; (iii) they may not discuss which model should be used, but they coordinate their policy choices explicitly (they do not discuss the justification of their policies); lastly, (iv) they agree both on the choice of the model and to coordinate their policies. Hughes Hallet (1995) shows that disagreement over the model in the presence of uncertainty can still be beneficial for the policy makers if it causes the exchange of information, reducing with the passing of time, the risk of serious losses.

In practice, countries that enter into an active process of macroeconomic coordination do so after an extensive period of dialogue, exchange of information, mutual monitoring and convergence. The European Union is perhaps the best example of this process of uncertainty

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[4]   Albeit not a necessary one if one takes into consideration the endogeneity of these OCA criteria, as we already mentioned .

reduction through the sharing of information and mutual monitoring. In the Latin American region, there are several examples of similar processes, and in all sub-regional integration groups, national decision-makers are actively engaged in a dialogue to reduce uncertainty concerning the key parameters of their respective economies.

Usually, the first step is to establish convergence criteria for key indicators (as in the GMM in Mercosur, or as they were set in the Andean region, the Caribbean or the Central American Common Market).[5] This process of defining common concept for the monitoring of the respective economies from a regional perspective is an important step in promoting a regional dialogue on key variables, defining transparent criteria and building mutual trust among regional partners, all points whose importance cannot be underestimated. Model building is another important step in this strategy of promoting a regional dialogue, and helps gaining a better understanding of the potential for coordination in a particular context, as well as the theoretical and practical issues.

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5 See Chapter V in CEPAL (2002a)

4. CONCLUSIONS

On a technical basis, regional cooperation is the adequate forum when the regional partners' economic policies are themselves source of externalities, as is the case when instability and lack of credibility in one country cause contagion of neighbouring economies. Thus, providing the regional institutional arrangement is well functioning, regional co-operative solutions are at least comparable --if not superior-- to individual national solutions on both technical and institutional grounds.

Translating these theoretical conclusions into practical regional economics, it means that countries that have commercial and financial relations, that interact frequently and cannot escape from the consequences their decisions have on their partners, have a strong probability of entering into a cooperative dynamic which will be beneficial for all cooperative participants and will be stable, at least within the original cluster. All these argument points in the direction of a sub-regional arrangement, at least in the early phase of policy coordination.

From a more political perspective, the commitment-cum-monitoring technology derived from a sub-regional negotiation among peers is also easier to legitimate than extra-regional supervision. From a larger perspective, regional cooperation in the face of large external financial shocks is also the most appropriate step to face the asymmetries build in the new international financial system, where purely national answers are notably insufficient. (Ocampo, 2001)

These processes are still at an initial stage, and more efforts should be made to define in a more precise way the models underlying the national economies and their interactions. This implies specifying the key parameters of each national economy constituting the subregional group, and modelling the interdependence between them. As shown, this helps not only in measuring the potential gains from cooperation (or, conversely, the loss incurred by not cooperating), but also is a very powerful tool for reducing systemic uncertainty and helping decision makers not only to understand better their neighbours 'economies, but also to have a better grasp of how their own national behaviour may affect them, through "boomerang" effects such as those identified in the CAN region.[6]

In addition, unlike the countries of the European Union, those constituting the Latin American and Caribbean regions are developing economies, i.e., economies where the key parameters and the systemic response to impulses are prone to rapid and substantial change. Thus, it is even more important in the Latin American context than in the European Union to maintain a close monitoring of the key indicators and foster a common programme of analysis of reaction functions to external and policy impulses.

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6 See REDIMA Conference papers for a reference to an estimation made by the CAN Secretariat of the boomerang effect through trade channels in the CAN subregion.

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