WORKING PAPER / 2010.05

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Please contact the author at **<danny.cassimon@ua.ac.be>.**

I**nstitute of Development Policy and Management**
University of Antwerp

Postal address:	Visiting address:
Prinsstraat 13	Lange Sint Annastraat 7
B-2000 Antwerpen	B-2000 Antwerpen
Belgium	Belgium

tel: +32 (0)3 265 57 70
fax +32 (0)3 265 57 71
e-mail: dev@ua.ac.be
www.ua.ac.be/dev

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Policy making in asymmetric regional integrations: a methodology for allocating cohesion fund resources

G. Calfat.[a], R. G. Flôres.[b], A.Rivas.[a,] and M.Granato.[c]

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[a] *IOB, University of Antwerp,Belgium*

[b] *EPGE, Fundação, Getulio Vargas, Brazil*

[c] *FCE, Universidad. Nacional de Rio Cuarto, Argentina*

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ABSTRACT

We propose a combination of region- and product-identification procedures in order to map the potential of economic activities in areas with poor infrastructure in an asymmetric regional integration. After identifying spatial units with relative backwardness in terms of infrastructure, we detect the most competitive exports, estimate gravity models for each of them and perform simulations for an improvement of 20% in the value of the infrastructure index. In a final step, we identify goods/provinces where investment in infrastructure should be directed to. A thorough and data intensive application is made to the case of the Fondo de Convergencia Estructural del MERCOSUR (FOCEM), the recently created cohesion fund of one of the most asymmetric integration projects. Our main conclusion is that FOCEM resources, under the global objective of enhancing structural convergence among the members, should be totally directed to Paraguay instead of being dispersed among all backward regions in the bloc.

JEL: F15, H54, R58

Keywords: Regional Integration, Infrastructure, Allocation of Resources, MERCOSUR

1. INTRODUCTION

Asymmetries are a serious problem in regional integrations. The asymmetries rhetoric mixes however in the same bowl ingredients from distinct sources. Policies to deal with a given bloc's asymmetries should aim at those aspects of the problem related to the existence, functioning and deepening of the bloc itself, especially in what regards its strictest purpose; usually the building up of a customs union or a common market. Acceptance of this point allows for consideration of two kinds of asymmetries, relevant to the integration process: a) the ones related to public policies and b) structural asymmetries.

The mere announcement of common trade policies, for the future establishment of a unified market, for instance, is not immediately translated into benefits. Its realization requires the implementation of complementary measures to coordinate and harmonize individual, domestic public policies of member states. The implicit application of measures for the treatment of asymmetries, through the implementation of differentiated periods of convergence, lists of exceptions and the operation of different regimes of origin for the smaller partners does not usually achieve the expected results.

As known, MERCOSUR suffers from an original sin as regards asymmetries: from the Brazilian giant to the tiny Uruguay, size differences –from nearly every viewpoint– are impressive, making even more difficult the already slow and winding path of integration, and turning the bloc into a model example of the problem. If Paraguay and Uruguay are very small and, to a certain extent, poor economies, with respect to Brazil, they are not, on the other hand, the poorest spots in the integrated space. Continental Brazil, with its huge income disparities, is the country where the poorest areas of the bloc are found, the size and complexity of the Brazilian social problem largely overtaking those of its fellow members.

This has two important consequences. The first is that, though hoping that MERCOSUR will enhance growth and improve convergence prospects among its members, it is unwise to expect the bloc to solve internal, deep structural problems that existed before its creation. Poverty alleviation, as a national strategy, will have to continue to be a national issue, reasonably independent of the common policies. Secondly, the acute Brazilian problem renders senseless any global asymmetries' strategy focusing purely on income disparities.

In MERCOSUR, the implementation of common public policies aimed at reducing inequalities in the less developed partners, as a result of the creation of the customs union, has been treated implicitly, and constitutes an unsolved issue. Concerning structural asymmetries, one of the important tools is the recently created *Fondo de Convergencia Estructural del MERCOSUR* – FOCEM, which aims at alleviating somehow the discrepancies among the four members by way of target regional investments, projects and works that would improve the socio-economic conditions of those less-favoured areas. Once such a fund exists, a key problem is how

to allocate its (scarce, in the case) resources. The issue is less simple than one might think because, as said, the poorest areas are found in the biggest member, Brazil, and using this as a single criterion would amount to channelling (back) most of the funds to the richest (though extremely unequal) member. This naturally raises the question of internally versus externally induced structural policies. Moreover, policies may also bear a predominant micro or macro character. Flôres (2008) and Baruj *et al*. (2008) have addressed part of these issues from a predominantly micro perspective. In this paper, taking instead a *regional* perspective, we outline how external policies would help in reducing asymmetries.

It is for the above reasons that we have chosen to analyse the regional disparities in terms of physical infrastructure, in order to build a range of priorities at the sub-regional level, where the degree of impact of improvements in physical infrastructure would be measured by the enhancements in export performance. Our analysis focuses on a raking of spatial units with relative backwardness in terms of infrastructure, as well as the identification of sectors/products, which could improve their export position through an intervention or financial support investments programmes in specific infrastructure. Ideally, a combination of both identifications (units/product), based on an exercise of "mapping" the concentration of economic activities in disadvantaged areas in terms of infrastructure can set priorities for the efficient allocation of funds for structural convergence.

Several works have already studied the interaction between, on the one hand, the modifiable assets in the physical environment and in trade costs and, on the other hand, the levels and patterns of trade. Empirical papers, measuring the actual impact those features could provoke on bilateral flows, seem to have confirmed the various theoretical predictions. The present paper belongs to this strand of the literature. Its applied exercise addresses MERCOSUR regions' export performance, focusing on the role played by transport costs and regional infrastructure. Moreover, the paper contributes to understanding the MERCOSUR regional reality by answering the following questions: To what extent transport costs and regional infrastructure condition regional export performance? May infrastructure enhancement or the reduction of transport costs effectively help in changing regional competitiveness and market accessibility? And, under the event of solving bottlenecks to improve competitiveness, could regional common policies turn the otherwise irreversible destiny of less developed or disadvantaged MERCOSUR regions?

The methodology here developed is comprehensive enough and can be applied at different national and sub-national spaces. The application we present for the case of MERCOSUR should be taken as an illustration of how the proposed framework can be employed to derive useful policy suggestions.

The work is organized as follows. Section 2 presents a review of the relationship between export performance and infrastructure in its conceptual framework, followed by theoretical and empirical issues which are the mainstay of the gravity model used in the analyses following the selection of products. In section 3 the methodological

steps of the proposal are outlined. Regional data as well as methodological issues concerning the application of the principal component analysis, which is the basis for identifying MERCOSUR units with relatively less developed physical infrastructure, are the subject of section 4. The next one goes deep into the application; it details the selection and estimation of the gravity equations to model the export performance of a select number of products exported by Paraguay and Uruguay, the ensuing simulations and the guidelines for identifying products/sectors, as potential recipients of funds. Finally, section 6 presents some conclusions and a suggestion on further data initiatives.

2. EXPORT PERFORMANCE AND INFRASTRUCTURE: CONCEPTUAL FRAMEWORK

In the last twenty years, New Trade Theory (NTT) and New Economic Geography (NEG) have stressed the role played by market accessibility in determining the distribution of increasing returns to scale activities across regions. Further, recent theoretical extensions have proposed that regional export performance is driven by that basic force, which assumes a dual dimension when firms are vertically linked: the real access to purchasers for products local firms sell, and the real availability of suppliers for intermediates goods those firms use.[1]

Within this framework two elements appear as principal targets when attempting to shape destiny: trade costs and locally settled advantages. Broadly interpreted, the former comprises all those features that limit or even preclude trade flows –such as the level of search costs, transport costs and the level of trade barriers. The latter corresponds to those modifiable assets that make local agents particularly efficient, and thus more competitive, for producing and exporting certain goods. This is precisely the case of physical infrastructure, specially related to local transport, energy and communication. Needless to say, the lack of adequate physical infrastructure is at the origin of inefficient trade exchanges, affecting, consequently, the firms' competitive position.

A clear evidence of the popularity infrastructure issues have nowadays is given by the multiplication of studies on infrastructure impacts and the proliferation of regional initiatives intended to develop infrastructure projects. We mention, for instance, the contributions of Estache and Fay (2007) reviewing current debates on infrastructure policy, and of Mu and van de Walle (2007), Grigoriou (2007) and Limi and Smith (2007) assessing the impacts of infrastructure improvements in Asian and African countries. As regards those initiatives, we can refer to the World Bank's and the African Development Bank's projects (Buys *et al*., 2006) and the Initiative for the Integration of the South American Regional Infrastructure (Vega Alvear, 2002; IIRSA, 2007), among others.

[1] The adjective 'real' indicates that both concepts, demand and supply access, acknowledge for the fact that the mass of customers/suppliers improve access (market size effect), while the number of competitors (competition or market-crowding effect) and the level of trade costs across regions may worsen it.

Previously, though the importance of infrastructure for productivity and economic growth had been widely documented, very few studies explored the link between infrastructure and trade. One of those exceptions is Bougheas *et al*. (1999) who, within a Dornbusch-Fischer-Samuelson (1977) - Ricardian model, assume transport costs inversely depend on the level of infrastructure.

Martin and Rogers (1995) pioneered introducing public infrastructure in a NEG setting, where infrastructure is assumed to impose higher costs on trade and to comprise "*any facility, good, or institution provided by the state which facilitates the juncture between production and consumption*" (page 336). The authors, who examine the impact of infrastructure on industrial location when trade integration takes place, find that firms tend to locate in countries with better domestic infrastructure; in addition, they uncover high levels of international infrastructure and strong increasing returns to scale magnify industrial relocation. Within a multi-country NTT set up, Behrens *et al*. (2007) explicitly model a transport-cost function that acknowledges for the fact that firms choose among roads minimising transport costs. The authors conclude that improvements in transportation infrastructure, which reduce trade costs, have spatially limited impacts.

Baldwin *et al*. (2003, ch. 17) present a growth model that assumes infrastructure can affect both domestic and international trade costs. They find results for relocation, which are in line with those of Martin and Rogers, though exacerbated due to market-size endogeneity. In the same vein, with a NEG linear model that allows for domestic inequalities and labour mobility, Behrens (2004) concludes that whereas trade combined with poor domestic infrastructure may exacerbate spatial inequalities, better local infrastructure may favour a more balanced development.

More recently, Combes and Lafourcade (2008) and Lafourcade and Paluzie (2008) have developed novel settings for addressing these issues. The former estimates a structural linear specification for France, in order to assess the impact of further intra-national integration on location. Theirs is a more sophisticated measure of transport costs instead of the standard proxies[2], and they conclude that decreasing intra-national transport costs entail changes in inequality and that Paris should attract an increasingly large number of firms. A fall in France's inter-regional trade costs tends to foster domestic agglomeration, as well as intra-regional inequality. In the latter, the authors investigate whether the European integration process has changed the geography of trade within France. By studying French regions between 1978 and 2000, they find that French border regions trade on average 72% more with neighbour countries than do interior regions, perform better if they have good cross-border transport connections, and are not so benefited with respect to other border regions if they are located in the periphery (western and southern) of Europe. Their innovative approach highlights the importance of cross-border transport infrastructure. It is assumed that trade costs are composed of two elements: transport costs and specific cross-border costs; and that transport costs between any two regions depend on the

[2] Indeed, the database they use provides the cost for a truck to connect any pair of EAs through the cheapest route on the real road transport network in 1993.

existence (or not) of cross-border infrastructures, while specific cross-border costs include both tariffs and informal barriers.

To sum up, these models assume –implicitly or explicitly– infrastructure improvements are trade-cost reducing, and thus affect location, export performance and disparities across regions. They disregard, however, the role infrastructure may also play like an incentive (or a constraint) to the production process itself. For instance, Arrow and Kurz (1970) and Barro (1990) stressed the substitutability of public infrastructure and private capital in the production function. The authors consider some public capital generate a flow of services which are comparable to productive services, such as transportation, water, electric power, etc. Other studies, like Holtz-Eakin and Lovely (1996), Bougheas *et al*. (2000), Justman *et al*. (2005), Brakman *et al*. (2002) and Egger and Falkinger (2006), acknowledging that public infrastructure is an important aspect of competitive location policy, sustain that it directly affects firms' production costs.

Within the empirical arena, during the last decade many studies have addressed the role played by infrastructure and trade costs as determinants of bilateral trade. Bougheas *et al*. (1999), using an augmented gravity model and data from European countries, find their two alternative infrastructure variables –i.e., the stock of public capital and the length of the motorway network– have a positive impact on the volume of trade. Based on stylised facts, Limão and Venables (2001) propose a transport-cost specification that relies on transport and communication infrastructure inside both trade partners and transit countries together with other country characteristics. The authors regress a gravity equation for bilateral trade where transport costs take that form, finding international support for the importance of infrastructure quality as a determinant of trade flows, especially for landlocked countries.

Nordås and Piermartini (2004) follow a similar approach, but extend it to acknowledge for bilateral tariff rates, multilateral resistance indices and remoteness à la Anderson-van Wincoop (2003). They find that the quality of infrastructure has a significant impact on bilateral flows, and that bilateral tariffs have a large and negative impact on them. In another interesting contribution, Shepherd and Wilson (2006) following Buys *et al*. (2006) examine the quality of the road network across a group of neighbouring countries.

As regards articles that specifically address intra-country location, namely across domestic regions, beyond the two already mentioned studies on France, Overman and Winters (2005, 2006) use employment data by establishment and international trade data by port to assess the trade effects of UK's accession to the European Economic Community on the location of manufacturing activities within the UK. The authors find that the change operated across ports –through which trade entered and exited the country– modifies market access and external competition across regions, hence asymmetrically affecting regional employment. Using Combes and Lafourcade (2008)'s structural framework for Portuguese regions, Teixeira (2006)

finds that the expansion of the road network has not resulted in greater spatial equity; nonetheless a further expansion is likely to foster manufacturing dispersion.

Summarising, every study finds infrastructure –in particular, transport infrastructure– has a significant role explaining location and trade performance. In addition, they highlight some infrastructure improvements could exacerbate historical agglomeration instead of fostering greater spatial equity. Albeit the relevance this empirical literature seems to have, many studies have some weak points which deserve attention. For instance, some tend to rely on ad-hoc instead of 'model-based' equations, and to use proxy variables which identification with the 'true' variable is rather imperfect. Further, as it is highlighted by Shepherd and Wilson (2006), most studies do not take into account alternative modes of transport and the interactions among them. The present paper tries to contribute to this strand of the literature.

Reviewing applied studies carried out for Latin American countries, one finds they are scarce and pretty recent. Martinez-Zarzoso and Nowak-Lehmann (2003), who run a gravity equation including infrastructure indices, find support for the importance of the importer's infrastructure in trade between the EU and MERCOSUR. Applying a similar approach, Acosta *et al.* (2006) conclude that the infrastructure stock of the countries in the Andean Community of Nations (CAN) is decisive in determining their trade performance. Mesquita Moreira (2007), in a full-of-data descriptive (non-gravitational) work, discusses the relative importance of infrastructure and policy-related trade costs in South America and their potential impacts on regional disparities and growth.

Benedictis *et al.* (2006) go beyond their predecessors and accomplish a gravitational study where sub-national regions are explicitly considered, namely the Ecuadorian provinces. Infrastructure emerges as an important determinant of provincial export performance. Also addressing intra-country location, Ferraz and Haddad (2008) applies an interstate CGE model for Brazil running simulations to examine how the distribution of the economic activity may change as the country opens up to international trade. The authors, who explicitly model regional transport sectors, maritime transport costs and regional port costs, find that reductions in maritime transport costs and improvements in port efficiency are both important for regional trade performance, although import tariffs are yet the most important determinant of trade. Further, those infrastructure improvements seem to reinforce the centrality of the main industrial core in the country, the city of São Paulo. Finally, Castro and Saslavsky (2009, ch. 3) and Granato (2008) study how provincial trade performance in Argentina has been affected with MERCOSUR enactment and which could have been the role played by regional infrastructure.

In the macroeconomic literature, numerous studies have individually assessed the impact a particular type of infrastructure has on economic growth. For example, Röller and Waverman (2001) analysed the impact of telecommunications in economic development. Fernald (1999), found a positive effect on productivity due to changes in road infrastructure. Similarly, other authors have combined different

indicators of infrastructure to investigate its impact on economic development –see Hulten (1997), Limão and Venables (2001), Acosta *et al.* (2006).

The study of Calderon and Serven (2004) pointed out, however, the high degree of correlation between various types of infrastructure (e.g. roads, electricity and telephones), making almost impossible the identification of the degree of contribution each type of infrastructure might have in the econometric estimation. The authors adopted a different methodology based on principal component analysis for the purpose of capturing in a single index the likely effect of each infrastructure variable on growth.

Lastly, those empirical studies that have examined the impact of the use of European cohesion funds (the only respectable example given the time intervals for the analysis) conclude that the cohesion funds have been influential in its goal of helping to convergence between nations, but agree they have not achieved one of its main objectives: reducing intraregional disparities. In this regard, a review of the literature on the topic of the effectiveness of European regional policies –see, among others, Molle (2007), Bijvoet and Koopmans (2004), Rodriguez-Pose and Fratesi (2004) and Ederveen *et al*. (2002)– seem to indicate that the implementation of cohesion policy has failed to diminish, in a significant manner, the asymmetries within the European regions.

The explanations advanced by the literature on this topic suggest that regional policies designed to attract economic activity in so-called peripheries, in order to reduce the circularity of agglomeration effects –as it follows from the NGE– to break in this manner, regional disparities, are a complex process and in many cases are marked by failure. The reason given is that the peripheral regions lack a critical mass capable of retaining economic activities. Within this context, the improvement of infrastructure in remote regions might facilitate trade between the periphery and a centre next door, making it the first to lose competitiveness and inducing a reorientation of economic activity towards the centre. Examples of these developments relating to the impact of investment in infrastructure (inter-regional and intra-regional) at the expense of the periphery have been noted, among others, by Puga (2002) and Forslid (2004).

3. THE METHODOLOGICAL PROPOSAL

Trying to make a synthesis of the above positions, the present paper draws on the NEG setting proposed by Granato (2008) which makes a theoretical distinction among the infrastructure effects, dividing them between those concerning the firms' production functions and those directly connected with interregional trade. The basic model –an extension of Robert-Nicoud (2002, 2006)'s – deals with the location of both final goods and intermediate input producers. Thus, it assumes monopolistic firms are vertically linked and the productive factor entering fixed costs is inter-regionally mobile; Herscker-Ohlin comparative advantage is allowed across regions and a transport-cost function à la Behrens *et al*. (2007) is introduced. The model displays the two

mechanisms for profit equalisation across regions that characterised alternative NEG models: re-localisation of firms *and* adjustments through production costs.[3]

In the inevitable comparison with the European reality, the experience of the MERCOSUR integration presents potential risks of desertification, a phenomenon clearly due to the Brazilian asymmetries and the existence of a limited number of powerful centripetal agglomerations - mainly São Paulo, and less so Porto Alegre, Rio de Janeiro and Buenos Aires (the only agglomeration of magnitude, outside Brazil). This disparity in terms of concentration of economic activity has no parallel in Europe, with a more equal distribution of economic activities. It renders impractical the application of criteria for the allocation of funds for individual eligible regions exhibiting, for instance, development indicators below 75% of the average MERCOSUR values. In such event, it would take several FOCEMs to meet the needs of the poorer regions. Moreover, the difficulties of establishing selection criteria are magnified. Since most indicators use a blurred combination of the concept of development based both on social and economic indexes, a region rich in economic terms could present weak indicators of access to health and education, and vice versa. An alternative solution would be the use of synthetic indices, able to condense economic, infrastructure or social indicators.

This is precisely the idea implemented in this work, where a characterization of the spatial units builds on an infrastructure index, summarizing in a single indicator the total economic-physical infrastructure endowment. The rationality of focusing on traditional indicators of physical infrastructure is based on the fact that these are directly linked to what might be recognized as an integration effect: enhanced exports. The inclusion of other types of capital would have provided a valuable input in the analysis, making however the judgment of the cause-effect links an extremely complex exercise.

The first step then is a ranking of regions in the bloc, according to the values of the synthetic infrastructure index. The bottom regions are the potential candidates for help. This result is combined with information on export potential at the product level (5-digits), in order to provide additional information to be used as a valid criterion for allocating the integration resources. The starting point now is to select a range of sustainable products[4] with export potential (for Paraguay and Uruguay, in our example), and next to estimate a gravity model, for each of the correspondingly chosen exports. Finally, each models' coefficients are used to predict the increase in exports of these very products as a result of improved physical infrastructure or a reduction in transport costs.

[3] That is, the distribution of production across the space is endogenously determined by two simultaneous processes: firms relocate into those regions with higher operating profits while production costs increase in more agglomerated areas.

[4] The criteria applied to select products with export potential for Uruguay and Paraguay is as follows: In a first step, we used trade data for both countries and their major trade partners (MERCOSUR partners, Mexico, USA, China and members of the EU-15) to construct a trade complementarity index (TCI) . Trade data used in this step was collected from COMTRADE -2005 --coded up to five digits of the SITC, rev.3 classification-- extracted through the WITS-system. In a second step, products having a TCI>1 and a representative share within the total exports of the respective country were selected. Additionally to complement these criteria, selected products were analyzed by stage of production to evaluate their dynamism into global chains of production. (See Calfat et al 2008b)

We use an extended gravity equation along the lines of Anderson and van Wincoop (2003), considering as well the methodological hints raised by Baldwin and Taglioni (2006). In this vein, and relying on a complete and careful data scrutiny of the MERCOSUR regions, the paper studies whether transport costs and regional infrastructure are relevant determinants of export performance at the regional level.

The estimation of our extended gravity model is undertaken at a product level using panel data from 2003-2005. For the case of Argentina and Brazil trade data was available at a provincial and state level. This was not the case for Uruguay and Paraguay for which trade flows are recorded at a national level only. Nevertheless, since both countries are relatively small, with industrial activity highly concentrated into their capital cities and considering that most of their trade is shipped through specific gateways, we have attempted to circumvent these data constraints by considering them as big regions of MERCOSUR. Hence, observations of 53 MERCOSUR's regions and their main trading partners (21) were taken into account for the selected samples at product level. It is worth to notice that sample size for each product varies as not all MERCOSUR's regions exhibit the same trade pattern. Moreover, even though a total of 30 products were selected, estimations were only performed for those cases in which the number of observations was representative.

Furthermore for estimation purposes and to account for changes on the stocks of infrastructure through time, new infrastructure indices were computed for each of the 53 units of MERCOSUR. In this respect, annual observations for each one of the stocks of infrastructure considered (paved roads, electricity consumption per capita and phone lines) jointly with the coefficients obtained from the Principal Component analysis (see equation 1) were used.

The estimation of gravity models allows to arrive at a kind of counterfactual result to figure out what would had been the export performance of a 'without asymmetries'-integration, had no changes occurred in the physical infrastructure or in transportation costs. The results of the simulations thus set an indicative ranking of products able to further expand exports as a result of a 20% improvement in the physical infrastructure of the exporting region.

The simultaneous identification of regions and products with export potential provides the input for determining the final allocations.

4. DATA AND BACKGROUND RESULTS

4.1. Regional Data

The establishment of a database of spatial/regional statistics within the MERCOSUR, similar to the NUTS system (Nomenclature of Territorial Units for Statistics) used by EUROSTAT, is still a dream to come through. Because of this 'statistical' reality, data collection of comparable indicators of infrastructure for cross-regions is a daunting, frustrating and sometimes tortuous endeavour.

In an attempt to fix this "bug" in the official statistical landscape, we have compiled a systematic and fairly comprehensive collection of provincial, state or departmental level–information at the regional level[5], in the hope to set up the basis for further work on the subject.

4.2. Measurement of Infrastructure

On the threshold of the creation of the FOCEM, Hoste (2003), analysed the likelihood of applying similar criteria to assist the less developed members in MERCOSUR, drawing a parallel with the criteria for assistance to disadvantaged regions implemented by the European Cohesion Fund. In his attempt to classify regions in MERCOSUR based on their level of development, the author focuses on the identification of three kinds of gaps in development indicators based on economic and social infrastructure. The author ends up computing twenty possible indicators in his analysis with the aim of establishing a ranking of regions according to their degree of development.

This effort, worthy and valuable in its parts, lends itself to complex interpretation as a whole due to methodological difficulties, as well as to the nature of the reality of MERCOSUR and its peculiar differences with the European experience.

Based on the approach of Serven and Calderon (2003) and following Sanchez-Robles (1998), we construct an index of infrastructure for each of the regional units (provinces, states, departments) of MERCOSUR making use of principal components analysis.

Adopting the definition to characterise physical infrastructure cited by the MERCOSUR Secretariat (2005), as being related to transport, energy and communications, and depending on the availability of statistics for the countries studied, three have been the variables used in constructing the index: electricity consumption per capita (MW), number of telephones (fixed + mobile) per 1000 inhabitants and the length of paved roads (KM) normalized by total surface (km²) in the region.

Data availability obliged us to work with 87 regions, which roughly correspond to the Brazilian states (27 regions), the Argentine provinces (24 regions), and 17 and 19 spatial divisions in Paraguay and Uruguay, respectively. The observations refer to average indicators (2003-2005) for each infrastructure variables described above.

[5] For detailed information on the sources and data used in the construction of our regional infrastructure data base, we refer the reader to the annexes of the report prepared for the MERCOSUR Secretariat (Calfat *et al.*, 2008a).

The results of the principal component analysis show that two components of our three measures of infrastructure in telecommunications, roads and electricity account for 80% of the variation in these indicators. Furthermore, the three measures enter in the principal component analysis with similar weights.

$$PC(Z)_{it}=0{,}53 \text{ x } proad + 0{,}56 \text{ x } elecper + 0{,}64 \text{ x } phones \qquad (1)$$

where $PC(Z)_{it}$ represents the first principal component; *proad* stands for the length of paved roads (kms) normalized by total surface (km²) of the region; *elecper* corresponds to electricity consumption per capita (Megawatts); and *phones* symbolises number of telephones (fixed + mobile) per 1000 inhabitants.

After carrying out the calculation of the infrastructure index, and in order to establish a comparative analysis of the existing asymmetries between the various regions, a ranking was prepared. Tables in Annex A.1 give the overall result, where the regions that occupy the top places are those which, in addition to improved physical infrastructure, have a relatively high per capita income.

The outcome of the ranking is compelling and offers a rather fair representation of the regional state of physical infrastructure in MERCOSUR. The Brazilian states of the Southern and Southeast regions, characterised with relatively high income levels, are represented in the upper section of the ranking. In Argentina, the top positions, as expected, include the Autonomous City of Buenos Aires and the provinces of Southern Patagonia, Chubut, Santa Cruz, Neuquén and Tierra del Fuego, characterized by production structures based on intensive use of natural non-renewable resources. Interestingly, the heading group also includes Catamarca, which along with San Luis, located in an overall twenty-second place, are typical cases of new economic developments with the support of provincial policies aimed at attracting investments in the region.

The southern provinces of Uruguay, which concentrate the highest levels of economic activity, belong to the top ten of the MERCOSUR regions (with the exception of Colonia, which lies at the nineteenth position.). The highest Paraguayan region in terms of the infrastructure index is represented by Asunción and the Central Department (which were merged as one region for the purposes of calculating the index). Furthermore, it is interesting to observe the location of the province of Buenos Aires in Argentina, which appears relatively far from the top. Two main reasons explain this position in the ranking: a) a clear abandonment of the physical infrastructure in the last twenty years, b) the heterogeneity of this province, characterised by a wide geographical discrepancy in terms of basic infrastructure. The latter points out the direction of further improvements in the regional data base for MERCOSUR, similar to the European NUTS system.

The contrasting situation of Uruguay and Paraguay in terms of physical infrastructure leaves little doubt in the event of identifying less favourable regions. A fragmentation of the global ranking into five sections would result in the inclusion of 11

Paraguayan departments, representing 60% of all its departments. In other words, 60% of all its departments, excluding the zone of Asuncion, come out as the MERCOSUR regions with the most limited physical infrastructure.

The analysis of the Paraguayan departments in the bottom of the ranking does not allow a clear-cut distinction between border and interior regions. It is only the Alto Paraná department –known for its great dynamism and as a major producer of soybeans, corn, wheat and other oilseeds– as well as Misiones, which escape from the border regions of the latter group –the central department was already mentioned as among the top regions. In general, based on the rates of infrastructure for Paraguay, it may be inferred, unequivocally, that most of their departments suffer from inadequate physical infrastructure in relation to its MERCOSUR partners.

This statistical finding is consistent with the Paraguayan official perception on the asymmetries in MERCOSUR.[6] In this document Paraguay argues for the implementation of "aggressive and sustainable common market policies" as the only way out to resolve, in their opinion, their most important structural hindrance: "being a land lock nation", ending its status as relatively less developed country. Clearly, a weak physical infrastructure can only further exacerbate the cost of being landlocked. The high toll resulting from the absence of coastline is further aggravated as a result of poor land routes connections from centres of economic activity to gateways to foreign markets. Paraguay exports are mainly carried by truck to Argentina (66%) and Brazil (95%), while transportation to Uruguay is mainly made by waterway (88%) and the rest by road (Sánchez and Cipoletta Tomassian, 2003).

Compared with the Paraguayan situation, and based on our principal component analysis, physical infrastructure in Uruguay does not appear as a crucial disadvantage in their perception of the notion of asymmetry. Indeed, and as it is observed in the ranking, Uruguay counts only two departments (Cerro Largo and Rivera), in the group of regions with the most underprivileged physical infrastructure.

Moreover, from a national perspective, in no one of the cases the indicators of infrastructure of the two sub-regions described for Paraguay as Border and Interior outperform their less developed peers in each of the other members –the North-western sub-region for Argentina, the sub-regions of North and Northeast for Brazil, and the lowest relative economic developed region in Uruguay. Building upon the results revealed by the principal component analysis, everything thus seems to indicate that the vast majority of regions in Paraguay would be in a condition to qualify for financial aid from the FOCEM, while a less developed criterion in terms of physical infrastructure, in view of the same results, can be regarded as a fragile argument to address the issue of asymmetries in the Uruguayan case.

This preliminary conclusion is, to a certain extent, confirmed in the light of an official document produced by the Uruguayan government under the name "Uruguay

[6] "Las Asimetrías en el MERCOSUR desde la Perspectiva de Paraguay", MERCOSUR/LXIV GMC/DT N° 16/06.

and MERCOSUR"[7]. In this document, Uruguay unveils its interpretation and proposals to address the asymmetries and smooth market access. With the exception of only one point of coincidence with the Paraguayan document, which stresses the small size of the domestic market as a major source of asymmetry, the Uruguayan perception of the notion of asymmetry outlines other causes of weight and it is in essence quite distant from the Paraguayan vision.

In a small economy like Uruguay, the achievement of efficient scales of production is closely linked to access to export markets, in other words, any sustainable growth strategy for Uruguay is doomed to failure if not accompanied, at the same time, by a competitive insertion in both intra and extra MERCOSUR markets.

In the Uruguayan view the main cause of its asymmetry is not fuelled by the classic shortcomings of the physical infrastructure but come, above all, from the high degree of uncertainty that characterises MERCOSUR policies. Uruguayan aspirations do not go beyond merely requiring compliance with agreed targets and measures to address the institutional deficit, to deal with the problem of non-tariff restrictions, to eliminate policies that distort trade and investment location, the coordination of financial and macroeconomic policies and the develop of an agenda of productive complementarities among MERCOSUR partners.

Returning to asymmetries based on physical infrastructure inequalities, the identification of regions in Paraguay, with a clear deficit in this aspect, should be dealt with even greater refinement. In this regard, and because of the dual economies existing in various Paraguayan departments, it would be possible to identify departments within sub-regions with distinct development characteristics. For example, the Alto Paraná region, characterised by a disintegrated development, has both agricultural areas that produce commodities and subsistence crops. At the same time, re-export activities can be observed, as well as parallel economies without production chains. This dualism is a structural feature of the society and the Paraguayan economy, almost equally divided in terms of inhabitants between the rural and urban areas.

Finally, the analysis in this section enables to advance some major ideas regarding the criteria to apply for the allocation of funds:

a) The amount (annual) of net transfers established by FOCEM for Paraguay (48 million) and Uruguay (32 million), does not seem to find support in the principal component analysis for the physical infrastructure. The balance should be tilted sharply toward the Paraguayan side.

b) Since the allocation criteria of the European Cohesion Funds are not immediately applicable to the MERCOSUR framework, in the case of Paraguay it would not be reasonable to allocate funds to the most backward regions, with reduced levels of economic activity and without export potential. This would be a mere "ugliness

[7] "Uruguay y el MERCOSUR", MERCOSUR/LXV GMC/DI Nº 16/06.

contest" to attract funds and produce a negligible return. Rather, the objective of a sound regional development policy should be to help the regional development of wealth-creating areas (*e.g*. the most dynamic areas in the Paraguayan border) and not to divert economic activity from a relatively prosperous region to another less developed, isolated and with a tiny chance of generating sustainable exports.

4.3 Helping the Poor, Supporting the Advanced Regions?

The preceding statement seems, at first glance, to contradict the widely held view regarding the expected destination of the funds for convergence between regions. This theme, related to increased channelling of funds to regions that concentrate more economic activity ('local cores') in relation to those with less advanced economic development ('local peripheries') has been subject to treatment in the literature and do not contradict, in any way, the principal objective of the fund, that is to say, to help to reduce imbalances between MERCOSUR regions.

This would indicate that the regions can not be interpreted as islands in itself but as belonging to a system of core and periphery. In this sense the location of activities in centres entails a trickle down effect as a result of so-called externalities of agglomeration, which could result in benefit of the areas adjacent to centres and located in the peripheries. In other words, the recognition of the existence of centre-periphery structures within regions is an important element in the decision to allocate funds to stimulate regional growth poles, while allowing, at the same time, an improvement in the development of poorer regions.

The logic of the exposed reasoning reinforces the choice of the methodology used in our attempt to arrive at objective criteria for the allocation of funds. The choice between equity and efficiency is addressed through an analysis in two stages: a) a first attempt which seeks to capture the notion of inequality, and focuses, thus, in a comparison of the MERCOSUR regional inequalities based on a summary measure of the degree of development in infrastructure, and b) a second one, in order to capture elements from efficiency (competitiveness), which aims to identify products/sectors with export potential.

Having identified priority regions, the next step is the identification of sectors/products with opportunities within each region. The main idea is to select products exported by Paraguay and Uruguay with sustainable opportunities and determine the extent to which interventions with a direct impact on competitiveness – in the case, improvements in physical infrastructure, or a reduction in transport costs - would be able to improve their export position and thus contribute to the development of the region to which they belong.

5. PRODCUCTS: EXPORT POTENTIAL

Using the latest available data, we study the export performance of MERCOSUR regions between 2003 and 2005, a period for which most of relevant variables have statistical coverage.[8]Consider a dynamic version of the following expression as a starting point to describe the variables analyzed:

$$\ln X_{rst}^{j} = b_0 + b_1 \ln G_{rt}^{j} + b_2 t_{rst}^{j} + b_3 \ln \delta_{rst}^{j} + b_4 \sum_{h} \varphi_h \lambda_{rs}^{h} + b_5 \ln v_{rt} + b_6 \ln E_{st}^{j} + b_7 \ln P_{st} + \varepsilon_{rst}^{j} \qquad (2)$$

The description of the variables in gravity model (2) is as follows:

X_{rst}^{j} is the logarithm of value of exports of commodity *j* shipped from the region *r* to partner *s* in year *t*. Bilateral exports were obtained from various sources. In the case of Argentina, the data was provided by the National Institute of Statistics and Censuses (INDEC) of Argentina, in the case of Brazil the database is from the Secretary of Foreign Trade (SECEX) of the Ministério do Desenvolvimento, Indústria e Comércio (MDIC) of Brazil.[9]

Aggregate exports from COMTRADE were used for the case of Paraguay and Uruguay. However, since it was not possible to obtain detailed information of regional exports, by departments, both Paraguay and Uruguay are considered as regional units in the gravity equation. In this context, countries/regions considered as 'reporting units' in estimating our gravity model amounted to 53 (24 provinces in Argentina, 27 states in Brazil, Paraguay and Uruguay).

$\ln G_{rt}^{j}$ is the logarithm of the Gross Domestic Product (GDP) of each regional exporting unit (province, state, country) considered in this study. The data was provided by the Ministry of Economy in the case of Argentina; The Brazilian Institute of Geography and Statistics (IBGE) in the case of Brazil. For Paraguay and Uruguay, the data was gathered from international statistics published by the World Bank.

τ_{rst}^{j}, Accounts for policy barriers measures (e.g. tariff barriers, non-tariff and technical barriers). Nevertheless the lack of systematic information about domestic policies, together with the absence of a complete and updated time series of the commercial impediments levied by the partners, the inclusion of this variable for estimation purposes was impracticable.

δ_{rst}^{j} represents the transportation costs to ship the product *j* from region *r* in country *s* in year *t,* or 'transport infrastructure'. Trying to depart as little as possible from our model, and relying on some information about modes of transportation and border crossings in the country, we created an original proxy variable; We considered the construction of a variable representing transportation costs, δ_{rs}, or 'transport infrastructure', including both the notion of internal and external distance. This means

[8] This is not the case for previous years, for which a lot of statistical information is not available.

[9] The Secretariat of Foreign Trade has an integrated system called ALICEWEB http://aliceweb.desenvolvimento.gov.br, which allows querying detailed but limited exports for that reason it was necessary to request special access to information directly with the SECEX.

that, beyond the common distance from the export port to destination, the distance within the country, from the producing region to the export gateway was included. This is crucial not only for a landlocked member as Paraguay, but also for vast territories like Argentina and Brazil for which internal distances are not negligible at all.

To compute the internal distance we relied on the basis of information collected in identifying the point-to-point paths, till the exporting gateways, for different types of commodities. Accordingly, information on both latitude and longitude of the output nodes as well as the capital cities of the economic units under consideration was used. In the case of Brazil, the identification of gateways for product by destination did not posed many problems because the export databases containing such information was available. In the case of Argentina, we made use of a complementary database, which was provided by the Centre for Studies of Argentina's Production (CEP). Information on the exit gateways per product depending on destination was not available in the export datasets for the cases of Uruguay and Paraguay. To deal with this issue we made a thorough and detailed analysis to identify the exit points of the products selected for this study. In the case of Paraguay, we used an additional database provided by the Central Bank of Paraguay which facilitated the mapping of exports by product according to mode of transportation used. This information was combined with information from production areas, roads, airports and ports available from different sources. Similarly, in the case of Uruguay, we used basically export information from ports collected by the National Ports Administration (ANP). Moreover, for the purpose of correcting any biases in the calculation of the internal distance for the cases of Paraguay and Uruguay, only those departments concentrating most of the economic activity were considered

λ_{rs}^{h} are the other geographical and cultural determinants of bilateral trade, such as contiguity, common language and isolation. These variables are represented by dummy variables..

v_{rt} is the price of infrastructure services. As these prices are not available at the required level of geographical disaggregation, we adopt a "proxy" variable as suggested and implemented by Hanson and Xiang (2004), e.g. factorial supply of these resources in the region. It is further noted that this 'solution' is in line with those studies which have attempted to measure the impacts of infrastructure improvements on trade, reviewed in section 2.

E_{st}^{j} are expenditures on good *j* in region *s* during year *t*. Since it is not possible to find information on this variable for each partner and year, the national GDP is taken as proxy.Accordingly, GDP data from the international statistics published by the World Bank is used.

P_{st}^{j} is the price index of the commodity *j*. To represent this variable in gravity equation, several authors –Combes *et al*. (2006), Baldwin and Taglioni (2006) and Shepherd and Wilson (2006) among others– suggest the following alternatives: a) separately estimate the nonlinear price index, b) use direct measures of such an index,

which, however could differ crucially on its theoretical definition, and c) replace the Index by a dummy variable with temporal variation by country. In this work, however, we are forced to omit this variable because of lack of information.

To conclude, the computation of each variable, albeit many difficulties, tries to deviate as less as possible from the essence of model (2). In the event that the available information does not exactly match the theoretical definitions, we tried to select "proxy" variables for which a consensus has been reached in the literature. In the absence of any consistent or reliable information, the omission of the variable was decided. Thus, it should be noted that both the omission as well as the imprecise measurement of some variables, such as t_{rst}^{j} and P_{st}^{j}, may affect the obtained estimates, introducing some biases. The final specification estimated was:

$$\ln Exp\_ij = b_0 + b_1 \lg dp\_i + b_2 \lg dp\_j + b_3 \ln dist\_ii + b_4 \ln dist\_ij + b_5 INFRA + b_6 Bord + b_7 Locked\_i + \varepsilon_{rst} \quad (3)$$

5.2. Results of the Simulations

Table 1 shows the selected products with export potential for Paraguay and Uruguay. The regression results for ten of them are presented in Table A.2.1 in Annex A.2. The signs and the value of the coefficients, obtained by OLS and a classic pool and panel data with random errors, are generally acceptable, especially considering that these are not traditional gravity equations where export are aggregated in a total with no product distinction at all. The regressions by product imply a more refined construction of the variables where it is not always possible to collect information at compatible and uniform levels of classification and characteristics for products and industries, resulting in a complex interpretation of the results.

Table 1 List of selected products

Cod Prod	Description
01122	Meat of bovine animals, frozen....boneless
08131	Oilcake and other solid residues (except dregs), whether or not ground or i
01112	Meat of bovine animals, fresh or chilled....boneless
61142	Other bovine leather and equine leather, without hair on ....parchment-dres
42111	Crude oil, whether or not degummed
61141	Other bovine leather and equine leather, without hair on ...tanned or retan
04231	Rice, semi-milled or wholly milled, whether or not polished, glazed, parboi
89319	Articles for the conveyance or packing of goods, n.e.s.; stoppers, lids, ca
26873	Wool tops and other combed wool
02499	Other cheese
02222	Milk and cream, in solid form, of a fat content, by weight, exceeding 1.5%
65771	Wadding of textile materials and articles thereof; textile fibres not excee
06111	Cane sugar, raw
29193	Guts, bladders and stomachs of animals (other than fish), whole and pieces
82119	Parts of the seats of subgroup 821.1
01212	Meat of sheep, frozen
55421	Organic surface-active agents, whether or not put up for retail sale
42171	Crude oil of Rape, colza or mustard
63431	Plywood consisting solely of sheets of wood...with at least one outer ply o
28239	Ferrous waste and scrap, n.e.s.
24615	Wood in chips or particles....non-coniferous
03428	Other fish, frozen (excluding livers and roes)
62111	Compounded rubber, unvulcanized,....compounded with carbon black or silica
24752	wood....of other non-coniferous species
42151	Crude oil of Sunflower seed
55132	Other essential oils
05711	Oranges, fresh or dried
65422	Fabrics, woven, containing 85% or more..of combed wool or of combed fine a
78435	Drive-axles with differential, whether or not provided with other transmiss
24502	Wood charcoal (including shell or nut charcoal), whether or not agglomerate

Note: This list based on a selection criteria outlined by the authors

Product codes refer to SITC rev.3, COMTRADE-databases extracted from WITS system

As an example of the interpretation of the results, we select a particular product, sugar cane – 06111, and proceed with the comments on the coefficients to explain the degree of variability of exports (see Table A.2.1 (final)).

The variable that captures the purchasing power or market size of the trading partner (*lgdp_j*) has the expected sign and a high significance level. Sugar cane is an important input market in developed countries with temperate climates and is an alternative to the more traditional sugar beet, as in the case of Europe. The variable that captures the importance of the size of the producing region (*lgdp_i*) as a determinant of exports has a negative sign and a high significance. This result could indicate that the regions concentrating the exports of such products are often not the most economically developed, but those characterised by a weak level of economic activity, with a production mode typical of a rural setting. The same interpretation could be made of the

variable which captures the fact of being a landlocked exporting region, which seems to be a feature of exporting regions of sugar cane in our sample.

The variables which capture the importance of distance (the internal *ldist_ii* and external *ldist_ij*) as a proxy for transport costs, are significant and with the expected sign. This would indicate that poor access to export output gateways is equally important, when compared to the classical distances between the export gateway and the final destination, and acts as a brake on export potential.

Simulations where then performed, for each good selected for Paraguay and Uruguay, supposing an improvement in 20% in the value of the infrastructure index. The results of the simulations are presented in Tables 2 and 3, which contain a ranking of the most benefited exports as a result of the improvement in physical infrastructure.

Table 2 Paraguay

Impact on exports derived from changes in the index of regional infrastructure

Exports of Paraguay - Main selected products

Cod.Prod	Product	Year	Trade Partnerl	Export. Est.[1]	Export.[2]	Incr. X.[3]	% Abs. Incr. X.[4]	Share X [5]	% Rel.Incr. X. [6]
*04231	Rice, semi-milled	2004	BRA	3,504.90	1,355.35	2,149.54	159%	100%	159%
*06111	Cane sugar, raw	2005	USA	29,700.23	13,899.11	15,801.12	114%	82%	93%
*55132	Other essential oils	2004	BRA	7,436.92	3,763.02	3,673.90	98%	79%	77%
*02499	Other cheese	2004	BOL	635.31	477.19	158.12	33%	100%	33%
*55132	Other essential oils	2004	FRA	785.42	396.52	388.90	98%	8%	8%
*55132	Other essential oils	2004	USA	551.74	278.25	273.49	98%	6%	6%
*06111	Cane sugar, raw	2005	ITA	1,666.39	778.90	887.50	114%	5%	5%
*06111	Cane sugar, raw	2005	BEL	1,483.32	693.22	790.10	114%	4%	5%
*06111	Cane sugar, raw	2005	NLD	1,121.69	523.97	597.72	114%	3%	4%
*06111	Cane sugar, raw	2005	DEU	1,100.36	513.99	586.37	114%	3%	3%
*55132	Other essential oils	2004	DEU	324.58	163.28	161.30	99%	3%	3%
*55132	Other essential oils	2004	BEL	324.18	163.08	161.10	99%	3%	3%
*06111	Cane sugar, raw	2005	GBR	847.51	395.65	451.86	114%	2%	3%
*06111	Cane sugar, raw	2005	DNK	288.45	134.00	154.45	115%	1%	1%

Elaboration: the authors

1. Estimated exports of the product per year and trading partners, due to improved infrastructure index by 20% (thousands U.S. $)
2. Eexports recorded by year and and trade partner, in thousands of U.S. dollars
3. Gross increase in exports by changes in the Infrastructure Index
4. Percentage increase in exports by changes in the Infrastructure Index
5. Percentage share of the product in the indicated indicated related to the sum of exports of this product in relation to the selected markets in the study
6. Relative increase in exports to the partner identified on the basis of their participation in the markets analysed

The difference observed between the results for Paraguay (Table 2) and Uruguay (Table 3) is due to a greater diversification, by country of destination, for the Uruguayan case and a less pronounced effect on the export increases (absolute and relative increases set out in columns 8 and 10) as a result of an improved infrastructure in the case of Uruguay. The latter would indicate that the largest relative increases in Paraguayan exports are explained by the existence of a weak infrastructure as compared to Uruguay.

In the case of Paraguay, the main products are: unrefined sugar cane (06111), semi-processed or prepared rice, polished or not, glazed (04231), other types of cheese (02499) and other essential oils (55132), among which we can find peppermint and the “Japanese” variety (being the Brazilian market the main destination). The largest Uruguayan export increments are observed in the following products: meat and frozen boneless bovine (01122), bovine meat not frozen, boneless (01112), other bovine and equine leather parchment (61142) and guts, bladders and stomachs of animals (except fish) (29193).

Further dealing with the example of the sugar cane, and due to the importance of this product among the list of sectors with greater export potential in the event of improvements in physical infrastructure investment, we proceed a deeper analysis on the characteristics of the sugar cane production in Paraguay. The basic idea is to determine a regional mapping as reliable as possible in order to match sectors/products with regions in MERCOSUR.

The emergence of sugar cane in a privileged position in our ranking is not accidental. The product is not the traditional sugar cane but the ecological variety of this product. Paraguay was the first nation in the industrial production of organic sugar and a leader in the worldwide market for this product. The organic sugar is exported to the major centres of global consumption, in North America and Europe, where its price is higher (a ton of organic sugar is priced at about $ 330, while $ 260 is the price paid for common sugar).

A glance back at the tables in Annex A.1 identifies the department of Guairá –heart of the production of sugar cane in Paraguay– as ranking in the 61st place out of a total of 87 regions. When compared to the whole of the MERCOSUR region, this department can be considered as relatively disadvantaged in terms of physical infrastructure. However, with the exception of the region that combines both the department of Asuncion Central and Misiones (near Guairá in the ranking), it comes out, within the context of Paraguay, as one of those enjoying a better position in term of physical infrastructure.

The department of Guairá, with a population of more than 180,000 inhabitants is part of the corridor that traverses the country from east to west, concentrating two-thirds of the Paraguayan population and considered as the most economically dynamic region of the country. It has been estimated that more than half the population of Guairá is related directly or indirectly to this sector. In addition, the acreage of sugar cane cultivation amounted to 23,000 hectares, with districts in which the area of cultivated land reached 60% or more, such as Mauricio Jose Troche, Borja, Itapé, Iturbe, Félix Pérez Cardozo and Mbocayaty.

The sugar cane mills not only receive and collect the raw material of its own department, but neighbouring or nearby departments too, as is the case of Paraguari, Caazapa, Caaguazú and Cordillera, which extend the benefits of improved export performance in the sector beyond the borders of Guairá.

In line with the above reasoning and following the recent evolution in terms of regional policies, the mapping ‘Guairá-organic sugar’ provides a valuable clue that achieves a balance between the concepts of fairness (equity) and efficiency (competitiveness). It is important to stress that though relatively well endowed in terms of infrastructure, Guairá exhibits relatively high poverty records (45% of its population considered poor).

In this regard, the strengthening of the agro-organic sugar cane system as a development strategy in the region (extended to neighbouring departments as mentioned above) deserves consideration. The last ten years have witnessed in Paraguay the shift from a traditional/marginal agricultural system and labour to an organic and sustainable system, comprising approximately 1200 “cañicultores”, internationally integrated, that is globalised and with established and solid international partnerships, a key element to guarantee access to markets and technology. In this

sense, the role that physical infrastructure plays in regional development and indirectly in improving the competitiveness of sectors with export potential is far beyond doubt.

Although everything seems to indicate that the boom of the sugar cane would naturally spill over all involved stakeholders in the sector, the analysis of the distributional impact of the potential benefits deserves special consideration. An agricultural sector such the sugar cane, located in Eastern Paraguay, is characterized by a rural population of very small production family units, with a significant share of subsistence production, within the framework of an agricultural economy using limited technological means and basically labour intensive. The transmission of international favourable international prices down to households will not materialise unless appropriate complementary measures are implemented.

That is why, having identified sector and region, and in light of a clear diagnosis of the situation, a criterion of convergence fund allocation should take into account an identification of bottlenecks in the price transmission mechanism, in order to encourage, through the implementation of complementary policies, improvements in physical infrastructure, provision of technical assistance and training to farmers, and upgrading of marketing systems, among others. This will smooth the pass-through of the positive shocks, allowing for a better distribution of the benefits of trade integration and liberalization, also to the most disadvantageous sectors of society.

Table 3 Uruguay

Impact on exports derived from changes in the index of regional infrastructure

Exports of Uruguay - Main selected products

Cod. Prod	Product	Year	Trade Partner	Export. Est.[1]	Export.[2]	Incr. X.[3]	% Incr. Abs. X.[4]	Share X [5]	% Rel.Incr. X. [6]
*01112	Meat of bovine animals	2004	USA	63,095.20	45,760.01	17,335.19	38%	37%	14%
*01122	Meat of bovine animals, frozen....boneless	2004	USA	324,100.85	316,066.20	8,034.65	3%	90%	2%
*01112	Meat of bovine animals	2004	BRA	11,595.84	9,113.73	2,482.12	27%	7%	2%
*61142	Other bovine leather	2004	DEU	41,972.08	39,835.45	2,136.63	5%	34%	2%
*61142	Other bovine leather	2004	USA	34,209.55	32,467.66	1,741.89	5%	28%	2%
*61142	Other bovine leather	2004	CHN	19,744.53	18,738.82	1,005.71	5%	16%	1%
*29193	Guts, bladders	2004	ITA	4,651.60	4,557.26	94.33	2%	35%	1%
*29193	Guts, bladders	2004	DEU	3,230.75	3,164.93	65.83	2%	24%	0%
*61142	Other bovine leather	2004	MEX	8,887.29	8,434.04	453.25	5%	7%	0%
*29193	Guts, bladders	2004	ESP	2,373.55	2,324.93	48.63	2%	18%	0%
*29193	Guts, bladders	2004	FRA	1,420.17	1,390.68	29.50	2%	11%	0%
*61142	Other bovine leather	2004	PRY	4,696.07	4,456.11	239.96	5%	4%	0%
*61142	Other bovine leather	2004	ARG	4,142.23	3,930.45	211.78	5%	3%	0%
*61142	Other bovine leather	2004	FRA	4,019.44	3,813.91	205.53	5%	3%	0%
*61142	Other bovine leather	2004	SWE	2,311.81	2,193.17	118.64	5%	2%	0%
*29193	Guts, bladders	2004	USA	551.78	539.71	12.07	2%	4%	0%
*29193	Guts, bladders	2004	CHN	481.63	470.97	10.66	2%	4%	0%
*01122	Meat of bovine animals, frozen....boneless	2004	ESP	11,420.04	11,136.01	284.03	3%	3%	0%
*29193	Guts, bladders	2004	ARG	360.04	351.82	8.22	2%	3%	0%
*61142	Other bovine leather	2004	ITA	1,369.03	1,298.37	70.66	5%	1%	0%
*29193	Guts, bladders	2004	CHL	287.19	280.43	6.76	2%	2%	0%
*01122	Meat of bovine animals, frozen....boneless	2004	DEU	5,718.34	5,575.62	142.72	3%	2%	0%
*01122	Meat of bovine animals, frozen....boneless	2004	NLD	4,337.68	4,229.18	108.50	3%	1%	0%
*61142	Other bovine leather	2004	BRA	574.24	544.02	30.22	6%	0%	0%
*01122	Meat of bovine animals, frozen....boneless	2004	GBR	3,569.65	3,480.18	89.47	3%	1%	0%
*29193	Guts, bladders	2004	PRT	103.04	99.98	3.07	3%	1%	0%
*01122	Meat of bovine animals, frozen....boneless	2004	BRA	2,908.93	2,835.84	73.09	3%	1%	0%
*01122	Meat of bovine animals, frozen....boneless	2004	PRT	2,837.69	2,766.37	71.33	3%	1%	0%
*01122	Meat of bovine animals, frozen....boneless	2004	FRA	2,762.27	2,692.81	69.46	3%	1%	0%
*01122	Meat of bovine animals, frozen....boneless	2004	SWE	2,423.00	2,361.95	61.05	3%	1%	0%
*01112	Meat of bovine animals	2004	DEU	12,266.83	12,247.63	19.20	0%	10%	0%

Elaboration: the authors

1. Estimated exports of the product per year and trading partners, due to improved infrastructure index by 20% (thousands U.S. $)
2. Eexports recorded by year and and trade partner, in thousands of U.S. dollars
3. Gross increase in exports by changes in the Infrastructure Index
4. Percentage increase in exports by changes in the Infrastructure Index
5. Percentage share of the product in the indicated indicated related to the sum of exports of this product in relation to the selected markets in the study
6. Relative increase in exports to the partner identified on the basis of their participation in the markets analysed

From this new angle, asymmetries derived by processes of deeper integration or trade liberalisation that result in less desired poverty effects, albeit the difficulties in establishing clear causalities, are certainly an important element to be considered at the time of allocating Fund resources[10].

[10] Among the various authors who have developed the theme of the relationship between trade liberalization and poverty in the framework of MERCOSUR find: Porto (2003 and 2006), Barraud and Calfat (2008) and Castro and Saslavsky (2006).

Table 4 Paraguay

Effects on internal distance derived from changes in the index of regional infrastructure

Exports of Paraguay - Main Selected Products

Cod. Prod	Product	Trade Partner	% Decr. Int. Dist.[1]	Decrease Km Int. Dist.[2]	Export.[3]	Share X [4]	% Relat. Decr. Int. Dist.[5]	Year
*02499	Other cheese	BOL	-98%	-152	477,19	100%	-98%	2004
*55132	Other essential oils	BRA	-100%	-210	3.763,02	79%	-79%	2004
*06111	Cane sugar, raw	USA	-99%	-153	13.528,83	76%	-75%	2005
*61142	Other bovine leather	URY	-100%	-159	5.720,19	42%	-42%	2004
*01122	Meat of bovine animals, frozen....boneless	DEU	-27%	-41	2.469,03	36%	-10%	2004
*55132	Other essential oils	FRA	-100%	-155	396,52	8%	-8%	2004
*29193	Guts, bladders	DEU	-100%	-155	194,10	7%	-7%	2004
*29193	Guts, bladders	ITA	-100%	-155	184,26	7%	-7%	2004
*55132	Other essential oils	USA	-99%	-154	278,25	6%	-6%	2004
*29193	Guts, bladders	ESP	-100%	-155	123,17	5%	-5%	2004
*06111	Cane sugar, raw	BEL	-87%	-134	940,31	5%	-5%	2005
*06111	Cane sugar, raw	ITA	-72%	-112	976,53	6%	-4%	2005
*55132	Other essential oils	BEL	-100%	-154	163,08	3%	-3%	2004
*29193	Guts, bladders	USA	-100%	-155	62,65	2%	-2%	2004
*06111	Cane sugar, raw	NLD	-72%	-111	465,09	3%	-2%	2005
*01112	Meat of bovine animals	DEU	-100%	-151	396,48	1%	-1%	2004
*06111	Cane sugar, raw	DEU	-29%	-45	281,49	2%	0%	2005
*55132	Other essential oils	DEU	-7%	-11	163,28	3%	0%	2004
*01112	Meat of bovine animals	IRL	-100%	-151	15,50	0%	0%	2004

Elaboration: the authors

1 Percentage decrease of internal distance due to improved infrastructure index by 20% (thousands US $).

2. Decrease of internal distance expressed in kilometers

3. Exports recorded by year and trade partner, in thousands US dollars

4. Percentage share of the product in the indicated market related to the sum of exports of this product in realtion to the selected markets in the study

5. Relative decrease in internal distance identified on the basis of the volume of exports to the partner analysed

To complement the simulations on the effects derived from infrastructure improvements, an equivalent measure of this impact expressed in the form of a reduction of the internal distance in the transportation of the selected goods to its export gateways can be computed (Table 4). It should be noted that these results ought to be interpreted with caution because the calculation of internal distances for both the Paraguayan and Uruguayan case requires still refinement. The database for the export gateways has not yet been formalized, and in most cases is still missing. In this regard, although the work to identify the point-to-point paths was extremely dense, we believe that the assembly of these databases is crucial in the analysis of transportation costs, and constitute a research project in itself.

Having made this provision, the results for Paraguay, presented in Table 4, suggest the evidence of a significant volume effect in reducing the internal distance in response to changes in infrastructure. This confirms the importance that cargo volume has as a crucial determinant in the final transportation cost, considering the natural geographic barriers faced by the country for the shipping of goods.

In the case of Uruguay, due to greater diversification of their exports and increased availability of air cargo and sea port facilities, the effects of infrastructure improvements are less influenced by the size of the exports. The results in the case of Uruguay (not shown) tend to favour products whose main customers are in MERCOSUR, the U.S. and Germany.

5. CONCLUSIONS AND RECOMMENDATIONS

We have put forward a proposal with two well-defined steps. In the first one, and to produce a global idea of target sectors in the bloc at stake, spatial units are ranked according to an infrastructure index (encompassing, in the case study, data on roads, electricity consumption and telephone/telecoms network). Then, for one or two most disfavoured members – hosts to the greatest number of backwards units, based on a series of indicators, the most competitive exports (at the 5-digit level of the SITC-version 3 classification) are identified. Gravity models are estimated for each of the correspondingly chosen exports. In each regression, observations are composed by *all members in the bloc exporting the selected good*, acting as reporting units.

In a second step, simulations are performed, for each selected good, supposing an improvement in 20% in the value of the infrastructure index of the exporting regions/provinces in each country. This allows the identification of sectors/products where investment in the related infrastructure would be more rewarding, in terms of enhancing the country's exports revenues. Though exports data are not usually disaggregated by provinces, for the usually small members at stake, location of production centres for each key good can be made. This amounts in turn to identify provinces, whose infrastructure has been assessed in the first step. This closes the logic of the exercise, producing a set of goods/provinces where investment in infrastructure should be directed to.

In the early years of its existence, FOCEM, our case study, has been mainly focused in financing activities within the framework of a structural convergence notion, aimed at improving the physical infrastructure of MERCOSUR members, with less relative economic development. Our conclusions point to the added insight in combining regional information with trade performance parameters. Priorities become thus assigned not only in a more encompassing but also in a more realistic way.

The analysis of the infrastructure complex clearly showed that in 60% of Paraguayan 'departamentos', here included many (locally) considered as dynamic areas, the worst infrastructure conditions in MERCOSUR are found. Uruguay, on the other hand, presents a better overall situation in this aspect, more in the lines of the bigger members. This is indirectly confirmed by the simulations based on the gravity parameters, for products with sustainable export potential both in Paraguay and Uruguay, which indicate that improvements in infrastructure have much more impact on the export performance of the former rather than on that of the latter. Indeed the poor Paraguayan conditions seem to amplify the negative effect of its locked-in situation and related difficulties in reaching extra-bloc markets.

The applied policy conclusion is that FOCEM resources, under the global objective of fostering convergence of the members' physical infrastructure, should be directed, in their totality, to Paraguay, and not be dispersed among all backward regions in MERCOSUR. Behind this conclusion lies the belief that a regional development policy should aim at helping potential welfare-creating zones and not divert economic activities from prosperous or better areas to zones with no growth perspectives at all.

A side result of the work is the clear need to create spatial units similar to the NUTS system used by the EU, maintaining and regularly updating a socio-economic and physical infrastructure database at each unit's level.

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A.1. INDEX OF INFRASTRUCTURE: RANKING OF REGIONS WITHIN EACH MERCOSUR COUNTRY

Argentina

Cod	Region	Infrastruct. Index	Ranking
ACF	Ciudad Autonoma de Bs Aires	7.25	1
ACT	Chubut	3.92	2
ANE	Neuquen	1.24	3
ATF	Tierra del Fuego	0.79	4
ACA	Catamarca	0.65	5
AAZ	Santa Cruz	0.64	6
ASF	Santa Fe	0.61	7
AZA	Mendoza	0.44	8
ASL	San Luis	0.44	9
AOB	Cordoba	0.24	10
ALR	La Rioja	0.16	11
ARN	Rio Negro	0.06	12
ATN	Tucuman	0.04	13
ABA	Buenos Aires	-0.02	14
ALP	La Pampa	-0.03	15
ANN	San Juan	-0.05	16
AER	Entre Rios	-0.09	17
AMI	Misiones	-0.34	18
ARR	Corrientes	-0.59	19
AJU	Jujuy	-0.69	20
AHA	Chaco	-0.83	21
ASA	Salta	-0.85	22
AFO	Formosa	-0.91	23
ASE	Santiago del Estero	-0.96	24
PMP	Pampeana	8.05	1
PTG	Patagonia	6.64	2
CYO	Cuyo	0.82	3
NOA	NOA	-1.65	4
NEA	NEA	-2.75	5

Brasil

Cod	Region	Infrastruct. Index	Ranking
BDF	Distrito Federal	2.68	1
BRJ	Rio de Janeiro	1.87	2
BSP	Sao Paulo	1.63	3
BSC	Santa Catarina	1.16	4
BPR	Parana	1.04	5
BRS	Rio Grande do Sul	0.74	6
BES	Espirito Santo	0.53	7
BMG	Minas Gerais	0.21	8
BPE	Pernambuco	0.21	9
BMA	Maranhao	0.10	10
BGO	Goias	0.07	11
BRN	Rio Grande do Norte	0.05	12
BSE	Sergipe	0.05	13
BMS	Mato Grosso do Sul	0.03	14
BMT	Mato Grosso	-0.22	15
BAL	Alagoas	-0.30	16
BPB	Paraiba	-0.41	17
BCE	Ceara	-0.56	18
BRO	Rondonia	-0.62	19
BAM	Amazonas	-0.65	20
BPA	Para	-0.68	21
BRR	Roraima	-0.69	22
BAP	Amapa	-0.71	23
BAC	Acre	-0.84	24
BBA	Bahia	-0.90	25
BTO	Tocantins	-1.00	26
BPI	Piaui	-1.24	27
BSE	SUDESTE	4.24	1
BSU	SUL	2.94	2
BCE	CENTRO-OESTE	2.56	3
BNE	NORDESTE	-3.00	4
BNT	NORTE	-5.18	5

Paraguay

Cod	Region	Infrastruct. Index	Ranking
PAC	Asuncion_central	1.12	1
PMI	Misiones	-0.74	2
PGI	Guaira	-0.79	3
PPR	Alto Paranß	-0.80	4
PPH	Pdte. Hayes	-0.82	5
PCD	Cordillera	-0.86	6
PIT	Itapua	-0.95	7
PPG	Paraguari	-0.95	8
PCG	Caaguazu	-0.95	9
PNM	Neembucu	-1.03	10
PCP	Concepcion	-1.03	11
PAM	Amambay	-1.10	12
PSP	San Pedro	-1.22	13
PCI	Canindeyu	-1.22	14
PCZ	Caazapa	-1.35	15
PAP	Alto Paraguay	-1.36	16
PBQ	Boqueron	-1.41	17
PYF	Py_frontier	-5.67	1
PYI	Py_inter	-9.79	2

Uruguay

Cod	Region	Infrastruct. Index	Ranking
UCA	Canelones	2.51	1
UMO	Montevideo	2.38	2
UMA	Maldonado	1.98	3
USJ	San Jose	1.64	4
UCO	Colonia	0.60	5
ULA	Lavalleja	0.32	6
URO	Rocha	0.08	7
UFS	Flores	-0.03	8
UTT	Treinta y Tres	-0.19	9
USO	Soriano	-0.28	10
UPA	Paysandu	-0.35	11
UFD	Florida	-0.35	12
URN	Rφo Negro	-0.56	13
UDU	Durazno	-0.68	14
USA	Salto	-0.75	15
UAR	Artigas	-0.80	16
UTA	Tacuarembo	-0.86	17
URV	Rivera	-0.93	18
UCL	Cerro Largo	-0.97	19
UR1	U region 1	9.11	1
UR2	U region 2	-2.23	2
UR3	U region 3	-4.10	3

A.2. REGRESSION RESULTS FOR TEN SELECTED PRODUCTS WITH EXPORT POTENTIAL

Table A.2.1 Estimations by product (cont.)

Variable	01112 Carne de bovinos sin		01122 Carne de bovinos		61142 Otros cueros de bovino		04231 Arroz semielaborado o		02499 Otros tipos de queso	
	OLS	GLS Random	OLS	GLS Random	OLS	GLS Random	OLS	GLS Random	OLS	GLS Random
lgdp_i	0.65 ***	0.93 ***	0.19 *	0.19	0.13	0.14	-1.35 ***	-1.31 ***	-0.52 **	-0.40
	(8.56)	(8.01)	(1.91)	(1.48)	(1.43)	(1.18)	(-4.52)	(-2.65)	(-2.41)	(-1.29)
lgdp_j	0.72 ***	0.97 ***	0.40 ***	0.35 ***	0.28 ***	0.20 **	0.36 ***	0.16	0.57 ***	0.42 ***
	(9.31)	(9.79)	(3.47)	(3.18)	(4.31)	(2.24)	(2.8)	(0.88)	(9.97)	(3.55)
ldist_ii	0.06	0.22 ***	0.05	0.05	-0.07	-0.01	0.05	0.39 *	-0.26	-0.16
	(0.79)	(3.64)	(0.77)	(1.48)	(-1.29)	(-0.34)	(0.2)	(1.65)	(-1.42)	(-0.92)
ldist_ij	-0.69 ***	-0.60 ***	-0.30 **	-0.17	-0.21 *	-0.09	-0.23 *	0.16	-0.38 ***	-0.18
	(-6.9)	(-5.11)	(-2.15)	(-0.98)	(-1.92)	(-0.67)	(-1.78)	(0.6)	(-3.75)	(-1.51)
Infra	-0.12 *	0.19 ***	0.29 **	0.40 ***	0.06	0.05	1.35 ***	1.67 ***	0.09	0.54 **
	(-1.77)	(2.73)	(2.33)	(2.92)	(1.05)	(0.58)	(2.66)	(4.05)	(0.27)	(2.15)
Bord	0.20	1.12	-0.36	0.16	-0.46	-0.19	2.02 ***	2.07 ***	0.55	1.15
	(0.28)	(1.35)	(-1.19)	(0.22)	(-1.49)	(-0.29)	(3.99)	(2.65)	(1.66)	(1.37)
Locked_i	0.18	0.56	-0.19	-0.04	0.09	-0.04	-0.87	-0.87	-0.12	0.25
	(0.71)	(1.56)	(-0.94)	(-0.14)	(0.38)	(-0.14)	(-1.51)	(-0.86)	(-0.28)	(0.44)
Cons	-7.25 ***	-11.08 ***	3.33 **	2.38	5.51 ***	4.88 ***	14.88 ***	11.76 **	8.71 ***	6.69 **
	(-4.3)	(-7.78)	(0.98)	(1.2)	(4.72)	(3.11)	(4.49)	(2.15)	(3.55)	(1.98)
R^2	0.23	0.20	0.21	0.21	0.10	0.09	0.40	0.32	0.34	0.29
N. obs	557	557	206	206	274	274	73	73	97	97
N groups		227		88		113		32		43
Rho		0.86		0.84		0.89		0.85		0.87

Nota : t-estadístico en paréntesis,: * p-value <.1; ** p-value <.05; *** p-value <.01

Table A.2.1: Estimations by product final)

Variable	02222 Leche y crema, en esta		06111 Azúcar de caña, sin		29193 Tripas,vejigas y estóm		82119: Partes y piezas de los		55132 Otros aceites esencia	
	OLS	GLS Random	OLS	GLS Random	OLS	GLS Random	OLS	GLS Random	OLS	GLS Random
lgdp_i	-1.41 ***	-1.10 ***	-0.41 **	-0.14 ***	0.28 **	0.26	0.29 **	0.37 **	-0.34	-0.27
	(-5.48)	(-3.07)	(-2.14)	(-0.72)	(2.2)	(1.61)	(2.44)	(2.15)	(-0.98)	(-1.16)
lgdp_j	0.01	-0.10	0.35 ***	0.32 ***	0.21 ***	0.24 **	0.70 ***	0.62 ***	0.18 *	0.17
	(0.1)	(-0.7)	(4.78)	(3.15)	(2.66)	(2.19)	(8.51)	(5.04)	(1.91)	(1.31)
ldist_ii	0.17	-0.15	-0.57 ***	-0.51 ***	0.02	-0.08	-0.11	-0.10	-0.07	-0.10
	(0.73)	(-0.69)	(-5.5)	(-4.35)	(0.28)	(-1.49)	(-1.43)	(-1.04)	(-0.86)	(-1.28)
ldist_ij	-0.45 ***	-0.46 **	-1.29 ***	-0.95 *	-0.14	-0.17	-0.49 ***	-0.39 **	0.23	0.21
	(-4.48)	(-2.44)	(-3.92)	(-3.11)	(-1.37)	(-0.98)	(-4.85)	(-2.26)	(0.82)	(0.75)
Infra	1.21 ***	0.87 **	1.16 **	0.69 *	0.13	0.11	-0.38 ***	-0.29 **	0.90	0.80 *
	(2.85)	(2.11)	(2.61)	(1.93)	(0.82)	(0.7)	(-4.04)	(-2.26)	(1.54)	(1.9)
Bord	-2.44 ***	-2.63 **			0.12	0.10	0.65	0.67	3.08 ***	2.85 ***
	(-3.51)	(-2.49)			(0.28)	(0.15)	(1.17)	(0.98)	(3.96)	(2.98)
Locked_i	-0.70	-0.51	1.56 **	1.22 *	0.05	0.11	-0.98 ***	-0.48	1.52 ***	1.53 ***
	(-1.23)	(-0.66)	(2.33)	(1.93)	(0.2)	(0.31)	(-3.01)	(-1.07)	(2.89)	(2.6)
Cons	19.71 ***	19.87 ***	19.46 ***	14.18 ***	1.53	0.12	-3.80	-5.41	3.46 *	3.27
	(8.52)	(5.11)	(5.51)	(5.65)	(0.94)	(0.04)	(-1.57)	(-1.57)	(1.69)	(1.52)
R^2	0.36	0.34	0.50	0.47	0.13	0.12	0.30	0.30	0.49	0.48
N. obs	129	129	96	96	220	220	245	245	52	52
N groups		69		48		95		118		25
Rho		0.75		0.79		0.87		0.78		0.51

Nota : t-estadístico en paréntesis,: * p-value <.1; ** p-value <.05; *** p-value <.01

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