

# III Export Potential and Basis of Trade of Climate Smart Goods and Specialized Products of Ecuador Using Gravity Analysis

## III.1 Gravity Analysis

We use the gravity analysis to explain the basis of trade of CSG between Ecuador and countries in MERCOSUR (nine excluding Ecuador), EU27, NAFTA (03 countries), East Asia (11) and India in 2010. We do this regression exercise on cross sectional data for 2010. Gravity Analysis helps us to explain basis of trade of merchandize and services. Gravity model examines the role of tariff barriers, inter country dispersion of income, prices, trade costs, preferential trading arrangements, trade resistance terms, inflations, economic size and endowments, general policy environment and overall infrastructure, distance between trading partner, membership of multilateral agreement, foreign direct investments, common language and borders, common colony, among others on trade of merchandize and services. For Example Gravity Model can explain what is the basis of trade in Climate Smart Goods (64 goods list defined by the UNESCAP). CSG are defined as components, products and technologies which tend to have relatively less adverse impact on the environment. CSGs constitute low carbon technologies such as solar photovoltaic systems, wind power generation, clean coal technologies and energy-efficient lighting.

We use variant of the Baier and Bergstrand (2001) Gravity formulation. The theoretical justification of using the present gravity formulation is given in Appendix Table X. This study uses gravity analysis which explains log of imports as a function of log of sum of GDPs of the trading partner, log of distance( capturing trade cost in the form of transportation cost, maybe language barriers ,common border and common preferential trading arrangement), log of inter-country dispersion(log of  $s_i \cdot s_j$ ), log of tariffs-weighted applied tariffs  $\log(1 + \text{tariffs})$  and log of prices in reporting(importer country) and log of prices in partner(exporter country)

We consider 62 trading partners in 2010 .

### DATA AND DATA REQUIREMENTS FOR GRAVITY ANALYSIS

Import data to and from Ecuador of CSG goods-one category made of the list of 64 goods (under 6 Digit HS Combined) is taken from WITS data base for 2010

GDP data of trading partners is expressed in billions of US dollars and the basic source of data is the IMF, World Economic Outlook (April 2011 edition)

Distance data is taken from the dist\_cepil.xls file of CEPII data base([www.cepii.fr](http://www.cepii.fr))

Tariff data is applied weighted tariff (%) on CSG goods for each country available from the TRAINS data (within WITS data base)

Inter country dispersion is product of two terms  $s_i * s_j$  where  $s_i = \text{GDP}_i / (\text{GDP}_i + \text{GDP}_j)$  and  $s_j = \text{GDP}_j / (\text{GDP}_i + \text{GDP}_j)$ .  $S_i$  and  $S_j$  is constructed from GDP data of trading partners. The product has an inverse relationship with variance of country's share of income in total group income. Variance of country's share of income in total group income is inversely related to volume of trade between countries. Please see appendix Table X for understanding the relationship between volume of trade and inter country dispersion of income.

Prices data of reporter (importer) and partner (exporter) from the GDP deflators available from the World Bank World Development Indicators available at the World Bank website for 2010 (Index Numbers)

### Hypotheses

- Sum of GDPs (sizes) matter for imports of country. Positive sign is hypothesized
- Distance is negatively related to imports. Greater distance means larger transportation cost, maybe higher language barriers, no common borders and limited access to each other's goods because of limited open regionalism.
- Lower is the inter country dispersion of income ( $s_i * s_j$ ) higher is the trade between countries (Helpman and Krugman, 1985). See Appendix Table X for understanding the relationship between equality of income and volume of trade.
- Larger are the tariffs, lower will be the imports as tariffs are trade costs



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- Higher prices in reporter country increases imports while lower prices in partner country lowers imports. Higher the price in the exporter's country more is the incentive to supply CSG goods abroad.
- All variables are in logs(natural) so the estimates of parameters will capture elasticity of explanatory variables with respect to imports

## Regression Results

Dependent Variable: SER01		log of imports		
Method: Least Squares				
Date: 01/27/12	Time: 02:38			
Sample: 1 62				
Included observations: 62				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
constant	-1.36185	5.740469	-0.23724	0.8134
Intariffs	-0.06713	0.325049	-0.20652	0.8371
InsumofGDPs	4.581373	0.814848	5.622365	0
Indistance	-1.60284	0.26348	-6.08335	0
Insisj	4.025633	0.982838	4.095925	0.0001
Inpriceimporter	1.617518	0.605196	2.67272	0.0099
Inpriceexporter	-1.12037	0.367492	-3.04869	0.0035
R-squared	0.66722	Mean dependent va	5.918755	
Adjusted R-squared	0.630917	S.D. dependent var	3.038994	
S.E. of regression	1.846256	Akaike info criterion	4.170202	
Sum squared resid	187.4764	Schwarz criterion	4.410362	
Log likelihood	-122.276	F-statistic	18.37907	
Durbin-Watson stat	2.286915	Prob(F-statistic)	0	

**Source:** Eviews is used for regression analysis

All variables explaining imports of Ecuador of CSG to and from its trading partners come with the usual sign except partner countries prices. Maybe CSG goods which have relatively low tariffs are traded at free trade prices and lower prices increases import demand. All are statistically significant (from t values and associated p values) except tariffs. R2 is 0.66 showing a good fit. White consistent standard errors takes care of heteroscedasticity. F test indicates overall importance of all variables taken together.

Standardized beta coefficients (not shown) results show that size of trading partner is the most important explanatory variable explaining trade of Ecuador of CSG with its trading partner. Then comes inter country dispersion of income, followed by distance, followed by reporter(importer) country's prices followed by exporter country's prices and then at the

last are the tariffs (any way relatively lower for CSG products than what are with respect to total trade of Ecuador or trade of specialized products). Then, why do we need tariff liberalization for CSG goods. Tariff liberalization may lead countries to achieve positive effective protection level if that is in country's interest. Trade in CSG consists mostly of component trade (inputs) to cleaner technologies and thus is also associated with transfer and investment into new technologies. Also, those Latin American countries who have a sufficiently large domestic market to develop cost effective manufacturing capacities at different stages of the supply chain may be more interested in liberalizing imports of certain intermediate products (such as solar cells, silicon ingots, gear boxes, and electronic control equipment). On the other hand, some of the Latin countries including Ecuador may need a certain level of tariff protection to build up local capacities and probably attract some FDI as well. Also, one cannot undermine the role of tariffs as trade of CSG is component trade (components to clean low carbon technologies) and such products cross custom boundaries many times..

Higher incomes a mean larger demand for climate smart components for cleaner technologies (based on knowledge from research on environmental Kuznetz curve). Higher incomes also lead to generation of resources to adopt cleaner technologies often with higher FDI and better infrastructure. However, in many developing countries a number of non technological and economic factors stand in a way for deployment of cleaner technologies. These include insufficient technical knowledge and absorption capacity to produce these innovative technologies locally, insufficient market size to justify local production units and insufficient purchasing power and financial resources to acquire the innovative products (Jha, 2009).

The extended gravity model used in the study (Mathur, 2011) analyzed ESCAP countries trade of CSG with host of countries. The study found a weak positive impact of regional trade agreements, mitigation policy and infrastructure on import of CSGs. Perhaps an inclusion of variables such as carbon taxation and domestic regulations would improve the model's explanatory power. Other possible variables including environmental subsidies, funding of environmental research projects, degree of industrialization, privatization and deregulation of markets, domestic standards and certification requirements, and domestic policies related to IPR, all of which could potentially improve the model. However data on such possibly useful variables are not available for a sufficient number of countries in the region. In addition, from the analysis done by Mathur (2011) it appears that language, domestic regulations, and the level of certifications and standards could play a particularly important role in stimulating trade in CSGs. The analysis also showed that tariffs do not appear to play a huge role in determining trade in CSGs.

### III.2 Gravity Analysis: Potential of Trade (Export) for Ecuador in CSG Products in 2010

We use the estimated equation of the gravity model to predict the values of imports (log). If the actual imported values of CSG exceed the fitted values, we call it import potential for the importing country or export potential for the Exporting Country. We get the following results. The first column depicts the import potential of the reporter or the importing country (second column) or the export potential of the exporting country (third column and is Ecuador). Positive values mean positive export potential (for exporters-Ecuador) or import potential (for importers). Ecuador seems to have positive export potential for CSG products with respect to Bolivia, Chile, Colombia, Peru and Singapore. The export potential with respect to its four Latin American Partners works out to be 34.84 million US \$. There is, however, negative potential for exports of CSG to all its Latin American partners taken together (Argentina, Bolivia, Brazil, Chile, Columbia, Paraguay, Peru and Venezuela) of the tune of negative 4.9 million. This is because of high negative potential with respect to Venezuela, Argentina and Brazil. These countries may be more inclined towards exporting the CSG products to Ecuador rather

than importing it. SMART analysis had shown that it is more beneficial for Ecuador to liberalize its trade with the China, Japan and the US. Both Ecuador and the trading partners China, Japan and the US gain by such a move. The next table (next section) confirms the same. There is lot of potential gains (for both Exporters and for Ecuador importing the CSG product) if Ecuador liberalizes its trade with the China, Japan, the US and the EU.

-1835.84	Argentina	ecu
487.7235	Bolivia	ecu
-4150.26	Brazil	ecu
-862.018	Canada	ecu
2383.047	Chile	ecu
-438.082	China	ecu
10977.05	Colombia	ecu
-15.03	Hong Kong	ecu
-95.0325	Korea, Rep	ecu
-1573.93	Mexico	ecu
-9.45748	Paraguay	ecu
20942.54	Peru	ecu
94.40047	Singapore	ecu
-2395.8	United States	ecu
-78399.1	Venezuela	ecu

Eviews is used for regression analysis

### III.3 Gravity Analysis: Export Potential in CSG for Other Countries targeting Ecuador

The export potential for China, Japan and the US works out to be 95 million US \$ in CSG. The export potential of the Latin American partners( Columbia, Argentina, Brazil, Paraguay, Uruguay, Chile, Peru, Bolivia and Venezuela) works out to be little more than 13 million US \$. This confirms the SMART results earlier that for Ecuador, it is more beneficial for Ecuador to liberalize its CSG trade with the China, Japan, the US and EU27 rather than with MERCOSUR countries. There are more gains for both Ecuador and its trading partners if its liberalizes its trade of CSG with the most efficient suppliers of CSG products, the Japan, the China, EU27 and the US.

3129.998	ecu	Argentina
57.94174	ecu	Austria
305.8984	ecu	Belgium
25.1797	ecu	Bolivia
14801.86	ecu	Brazil
-12.6218	ecu	Bulgaria
-3734.29	ecu	Canada
2276.634	ecu	Chile
49086.83	ecu	China
-7397.7	ecu	Colombia
-1.05194	ecu	Cyprus
-181.126	ecu	Czech Repu
85.81275	ecu	Denmark
4131.618	ecu	Finland
-1660.14	ecu	France
5637.105	ecu	Germany
-341.035	ecu	Greece
691.6041	ecu	Hong Kong,
-26.2943	ecu	Hungary
295.5748	ecu	India
404.8591	ecu	Indonesia
-402.86	ecu	Ireland
8499.415	ecu	Italy
2646.389	ecu	Japan
852.4722	ecu	Korea, Rep.
2.236048	ecu	Latvia
-2.75789	ecu	Lithuania
-26.3791	ecu	Luxembour
920.0683	ecu	Malaysia
1908.015	ecu	Mexico
250.0459	ecu	Netherland
3.225574	ecu	Paraguay
1.957566	ecu	Peru
-395.719	ecu	Poland
-467.575	ecu	Portugal
211.124	ecu	Romania
1376.677	ecu	Singapore
-38.9377	ecu	Slovak Repu
1.568218	ecu	Slovenia
2596.047	ecu	Spain
1058.544	ecu	Sweden
291.8869	ecu	Thailand
-521.268	ecu	United King
44045.36	ecu	United Stat
182.4031	ecu	Uruguay
2.237917	ecu	Venezuela
-14.105	ecu	Vietnam

### III.4 International and National Policies to Promote Trade of CSG

Keep focusing on increasing growth rates of GDP of all Lower inter country dispersion of income Lower trade costs between countries by having open regionalism policies, reduce transportation costs within and between countries, lower border disputes to have open trade between neighboring countries.

Increase prices for exporters and lower prices of CSG goods in importers country by focusing on having sound competition policies, effective legislations for sound environmental policy( say increasing paper less trade and single window clearance as a starting point, carbon tax and regional emission trading system), appropriate regulatory framework, financial infrastructure and investment climate for production of CSGs, having appropriate standards and labels, mechanism of technology transfer, mechanisms to promote CSG trade among countries by coordination and cooperation and promoting R&D activities for CSG products among countries

### III.5 Environmental Sustainability in Ecuador

As regards the international scene in the fields of the environment and sustainable development, Ecuador has ratified the main conventions (Biodiversity, Desertification, and Climate Change) and, in particular, the Kyoto Protocol in 1999. Ecuador has a good background in terms of environmental legislation, strategies and plans, dating back to the beginning of the 1980s. Possibly, this can be the reason of having some positive trade balance for Climate Smart Goods with the Latin American trading partners in 2010( see Table I above). The Environmental issues and policies need to be very high on the agendas of governments. The country faces many other serious threats including intensive deforestation (mainly caused by encroaching agriculture, logging, and exploitation of hydrocarbons); a significant loss of biodiversity, soil and water pollution (mainly due to mining and hydrocarbon extraction); erosion caused by poor agricultural practices in vulnerable areas (leading to erosion and desertification); institutional weakness in ensuring compliance with the legal framework; and a lack of local and national capacity to develop and sustain effective environmental management, both generally and in sensitive areas such as the Amazon and the Galápagos Islands. The challenge is to tackle all these problems on the basis of a land-use planning model that promotes environmental awareness and sustainable development, ensures that disaster risk reduction is incorporated within all activities, secures the rational use of natural resources and, where relevant, protects the rights of indigenous and Afro-Ecuadorean peoples living in the affected areas (European Commission, Ecuador Strategy Paper, 2007). Promoting the CSG goods will be the good strategy for sustainable growth, having safe and secure energy source, directing social spending towards low carbon emanating technologies and promotion of small and medium enterprises for production of CSG goods.

Various national and international policies can be followed by Ecuador and its trading partners to promote trade of CSG goods. Gravity analysis (third objective) reinforces the below points

- Keep focusing on increasing growth rates of GDP of all. Larger sizes promote trade of Climate Smart Goods.
- Lower inter country dispersion of income for promoting trade of CSG among countries
- Lower trade costs between countries by having open regionalism policies, reduce transportation costs within and between countries, lower border disputes to have open trade between neighboring countries.
- Increase prices for exporters and lower prices of CSG goods in importers country by focusing on having sound competition policies, effective legislations for sound environmental policy( say increasing paper less trade and single window clearance as a starting point, carbon tax and regional emission trading system),



appropriate regulatory framework, financial infrastructure and investment climate for production of CSGs, having appropriate standards and labels, mechanism of technology transfer, mechanisms to promote CSG trade among countries by coordination and cooperation and promoting R&D activities for CSG products among countries

- Lower tariffs by small countries in the American Peninsula for imports of CSG from Ecuador. In particular there is potential to reduce tariffs(Applied duties) by Djibouti(26%), Belize(15%), Costa Rica(10%), Guatemala(11.97%), Honduras(9.87%), Nicaragua(12.49%), Cuba(8.99%) and El Salvador(12%).


Following are the potential barriers to production, trade and investment of CSG. Ecuadorian governments need to attend to the following points

- Low level of competition
- Limited foreign ownership
- Inefficient transmission and grid interconnection
- Limited access to local financing
- Inadequate training and skills to produce CSGs
- Weak Intellectual property rights enforcement

Climate change specific policies may include the following for Ecuador. This is adapted from the studies undertaken by UNESCAP (2011, a, b). It will help Ecuador to adapt and acclimatize itself to the CSG environment

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1) Nationally Appropriate Mitigation Actions (NAMA)

Nationally Appropriate Mitigation Actions (NAMAs) are voluntary emission reduction measures undertaken by countries that are reported by national governments to UNFCCC, and can cover any policy that works towards reducing Green House Gas (GHG) emissions. In principle, this means that NAMAs also cover carbon-friendly trade and investment policies. Apart from the policies discussed in this study, NAMAs cover a wide range of policy areas, including sectoral policies. NAMAs involve improvements of land, soil and water management. The idea is that some policies that are effective in some countries may not be effective in others, so the countries themselves should be able to design their own mitigation strategies. Whatever strategy a country chooses, it must conform to international trade rules if they affect trade. NAMAs ensure that mitigation actions undertaken at the national level are recognized internationally and that they will bolster the demand for CSGTs, particularly in renewables. However, it is important to have a proper monitoring, evaluation and verification process in place with clear objective indicators and measurements to ensure that NAMAs are actually implemented.

2) National Adaptation Programmes of Action (NAPA)

NAPAs can take many forms, including awareness creating campaigns, the construction of flood shelters and flood protection systems (dams, dykes etc.), research and development of drought and saline tolerant crops, evacuation of coastal areas and retraining facilities. Many such actions require substantive amounts of investment and thus offer investment opportunities.

3) Environmental policy (environmental standards, carbon taxes should be designed carefully so that national and international companies get affected in the same manner, cap-and-trade schemes for greenhouse gas reductions, also known as Emission Trading Schemes)

Emission Trading Schemes or Systems (ETS) at the national, regional or multilateral level, i.e. CDM under the Kyoto Protocol, set an aggregate limit on the amount of GHGs that may be emitted annually by certain capped sources. Subject to the overall limit, capped sources may buy and sell permits for the right to emit GHGs.

4) Industrial policy (including energy efficiency standards)

Energy efficiency labels are informative labels attached to manufactured products to describe the product's energy performance (usually in the form of energy use, efficiency or energy cost). These labels give consumers the data necessary to make informed purchases, and to promote the trade and purchase of CSGs and other green products. Carbon standards are an important tool for informing consumers of the carbon footprint of a particular product as well as for indirectly encouraging domestic demand for, and production of products on the basis of RE.

5) Public procurement of energy efficient products

Sustainable public procurement is a tool that allows governments to leverage public spending in order to promote the country's social, environmental and economic policies. It provides governments with a powerful tool to influence the way in which businesses operate through purchasing decisions. Government procurement often involves large sums, with regard to investment projects and in the procurement of goods and services for consumption. More importantly, it includes the procurement of key infrastructure, such as power- and

transport-related infrastructure as well as public buildings, i.e. the type of investments that will have an impact on GHG emission levels for many years to come.

By applying clear sustainability criteria in purchasing and investment decisions, governments can provide a major driving force for lowering emissions. First, this will help to ensure that public investments are low-emitting and use low GHG-emitting input materials. Second, in so doing, this will stimulate the market for environmental goods and services, thus stimulating innovation and increasing the competitiveness of such goods and services, both locally and globally. By actually encouraging green procurement practices in government activities, new markets for indigenous green products and services can be developed

- 6) Energy policy (e.g. requirements of renewable/low-carbon energy shares in energy mix of utilities, feed-in tariffs, subsidies and incentives for low-carbon investments). Policies to be in consonance with the WTO provisions
- 7) Technology policy (related to generation, dissemination and diffusion of technology policy (related generation, low-carbon know-how)
- 8) Trade policy adjustments for low-carbon activities (e.g. tariff reductions for capital goods/inputs for low-carbon activities, tariff policy of the home country with respect to potential host countries – for export activities of Multinational Companies)
- 9) Incentives for manufacturers of low carbon goods and/or providers of energy efficiency or process improvement services (e.g. tax benefits, subsidies concessionary loans, export guarantee insurance). Policies to be in consonance with the WTO provisions

#### 10) Reducing Emissions from Deforestation and Forest Degradation

Closely related to cap-and-trade systems is the reducing emissions from deforestation and forest degradation (REDD) mechanism, which uses market/financial incentives to reduce GHG emissions from deforestation and forest degradation. Such actions offset carbon emissions and contribute to carbon credits. Actions involve reforestation and afforestation. REDD<sup>+</sup> adds to these actions in order to include the possibility of offsetting emissions through sustainable forest management, conservation and increasing forest carbon stocks. REDD and REDD+ are important for business as such actions contribute to sustainable business practices, ensuring sustained long-term supplies of forest-based raw materials for a variety of industries (e.g. furniture, and pulp and paper), and the preservation of forests with added benefits such as conservation of bio-diversity. Actions involving REDD are important NAMAs and are potentially an important carbon offset credit under cap-and-trading schemes. Forest-rich countries stand to potentially benefit from REDD projects. Apart from REDD, specific sectoral policies can be designed to mitigate GHG emissions. In various energy-intensive sectors, binding emission reduction targets need to be imposed in combination with emission crediting schemes. In the agricultural sector, land, livestock and waste management needs to be improved while increased attention should be paid to the development of drought or flood-resistant crops. In summary, this policy will include

- Creating a financial value for the carbon stored in standing forests;
- Industrialized countries to make financial transfers to developing countries like Ecuador to compensate them for avoiding deforestation.

11) Legal framework and compliance mechanisms for climate change mitigation and adaptation

This is required for the effective implementation of all NAMAs and NAPAs and any other policy outlined above. A comprehensive “green growth” legislative framework would also ensure the coordination, consistency and coherence among all policies and ensure environmentally sustainable and climate-smart economic growth.

12) Strengthening supply-side capacities of small and medium-sized enterprises to produce and use CSGs.

13) Strengthen public-private partnerships and promote adoption and implementation of the principles of corporate social responsibility

14) When negotiating trade agreements, ensure broad coverage of CSGs and climate-smart services as well as deep commitments (ideally zero tariffs with generous rules of origin and verifiable NTBs such as standards)

15) Avoid Non tariff Barriers (NTBs) such as local content requirements, which also discourage investment and may violate the WTO Trade-Related Investment Measures (TRIMS) Agreement, and ensure that others (such as standards, taxes and subsidies) are applied in a non-discriminatory manner (national treatment).

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- 16) Keep Regional Trade Agreements (RTAs) open to new members in order to avoid trade diversion. Liberalization of CSGs has more impact with wider membership. Regional cooperation can be in the form of establishment of regional emission trading schemes, regional investment collaboration, regional harmonization of climate smart standards and labels, regional financing schemes, regional cooperation in development of climate smart technologies and technical assistance.
- 17) Promote exports of CSGs through environmental regulations and incentives while avoiding restrictive trade practices, including Border Carbon Adjustments (BCAs), which may violate WTO rules or otherwise constitute distortions of international trade
- 18) Apart from subsidies there are other financial instruments for supporting the production and development of CSGs. Many of those instruments have close links to subsidies or are themselves subsidies in disguise. In particular, development banks can provide soft loans for such purposes, refinanced by governments. Such loans offer flexible or lenient terms for repayment, usually at lower than market interest rates. In particular, such loans could be channelled to SMEs to raise their capacity to adopt green practices (e.g. acquire or develop CSTs). For example, the India Renewable Energy Development Agency provides loans for clean energy projects while government low interest loans have assisted in the development of the PV industry in the Republic of Korea. Green bonds are tax-exempt bonds that are issued by qualified central or local government agencies for the development of environmentally-friendly projects. A related concept is climate bonds, which are bonds issued by a government or corporate entity in order to raise finance for climate change mitigation or adaptation-related programmes or projects. All funds raised from such bonds will only go to climate-related programmes or assets, such as Renewable Energy plants or climate mitigation focused funding programmes. Various provisions in the tax code could be made to allow suitable tax breaks for enterprises or adopt relaxed tax calculation methods based on the equipment and technologies (and their depreciation) used by enterprises. Tax breaks could be given to enterprises that undertake R&D in CSGs or development of CSGs, and/or enterprises that are actually already producing such goods and climate-smart services. Such measures are normally associated with the promotion of investment. In the absence of an internationally agreed-defined list of CSGs and climate-smart services, countries could adopt their own lists for tax purposes. Another end-user type of innovative financing mechanism is dealer-credit financing where the Renewable Energy provider obtains a loan from a financial institution, either national or international, which is then converted into a loan to consumers so that they can purchase the appropriate Renewable Energy Technology. Additional financial instruments include risk-sharing instruments such as catastrophe bonds, weather derivatives, mutual funds and micro-insurance index-based schemes through partnerships involving the private sector.
- 19) The Government can help improve the CSG production, trade and investment by adopting the following policies
- a) Start Incubation programmes for small and medium enterprises interested in developing CSGs.
  - b) Link Multinationals with domestic enterprises to transfer technology for producing CSGs
  - c) Apprise and inform all on standards for motor vehicles; buildings, etc, labels and rules and regulations for producing and importing CSGs
  - d) Improve access to finance, strengthen IPR climate, strengthen domestic R&D and national innovation system, hone human resource and skills and promote public and private partnerships for the production of CSGs

- e) Low cost loans for developing new CSG products
- f) Leverage the power of institutional investors such as pension funds, insurance companies and sovereign wealth funds towards CSG production and R&D
- g) Provide infrastructure support such as special economic zones for facilitating production of CSGs
- h) Provide corruption free bureaucracy and enabling regulatory framework where in disputes can be settled
- i) Liberalize and deregulate energy markets

### III.6 Gravity Analysis For Trade Of 20 Specialized Products Of Ecuador

We use the gravity analysis to explain the basis of trade of 20 specialized products between Ecuador and countries in MERCOSUR (nine excluding Ecuador), EU27, NAFTA (03 countries), East Asia (11) and India. We do this regression exercise on cross sectional data for 2010. Gravity Analysis helps us to explain basis of trade of merchandize and services. Gravity model examines the role of tariff barriers, inter country dispersion of income, prices, trade costs, preferential trading arrangements, trade resistance terms, inflations, economic size and endowments, general policy environment and overall infrastructure, distance between trading partner, membership of multilateral agreement, foreign direct investments, common language and borders, common colony, among others on trade of merchandize and services.

As before we use variant of the Baier and Bergstrand (2001) Gravity formulation. This study uses gravity analysis which explains log of imports as a function of log of sum of GDPs of the trading partner, log of distance( capturing trade cost in the form of transportation cost, maybe language barriers ,common border and common preferential trading arrangement), log of inter-country dispersion(log of  $s_i*s_j$ ), log of tariffs-weighted applied tariffs(log (1+tariffs)) and log of prices in reporting(importer country) and log of prices in partner(exporter country)

We consider 65 trading partners in 2010.

Import data to and from Ecuador of 20 specialized goods-one category is taken from WITS data base for 2010

#### Data And Data Requirements For Gravity Analysis

GDP data of trading partners is expressed in billions of US dollars and the basic source of data is the IMF, World Economic Outlook (April 2011 edition)

Distance data is taken from the dist\_cepil.xls file of CEPII data base ([www.cepii.fr](http://www.cepii.fr))

Tariff data is applied weighted tariff (%) for each country is available from the TRAINS data (within WITS data base)

Intercountry dispersion is product of two terms  $s_i*s_j$  where  $s_i=GDP_i/(GDP_i+GDP_j)$  and  $s_j=GDP_j/(GDP_i+GDP_j)$ .  $S_i$  and  $S_j$ is constructed from GDP data of trading partners. The product has an inverse relationship with variance of country's share of income in total group income. Variance of country's share of income in total group income is inversely related to volume of trade between countries. Please see appendix Table VII for understanding the relationship between volume of trade and inter country dispersion of income.

Prices data of reporter (importer) and partner (exporter) from the GDP deflators available from the World Bank World Development Indicators available at the World Bank website for 2010(Index Numbers)

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- **Hypotheses** Sum of GDPs (sizes) matter for imports of country. Positive sign is hypothesized
- Distance is negatively related to imports. Greater distance means larger transportation cost, maybe higher language barriers, no common borders and limited access to each other's goods because of limited open regionalism.
- Lower is the inter country dispersion of income ( $si^*sj$ ) higher is the trade between countries (Helpman and Krugman, 1985)
- Larger are the tariffs, lower will be the imports as tariffs are trade costs
- Higher prices in reporter country increases imports while lower prices in partner country lowers imports. Higher the price in the exporter's country more is the incentive to supply CSG goods abroad.
- All variables are in logs (natural) so the estimates of parameters will capture elasticity of explanatory variables with respect to imports

### Regression Results

Dependent Variable: SER01					
Method: Least Squares					
Date: 01/31/12 Time: 08:23					
Sample: 1 65					
Included observations: 65					
White Heteroskedasticity-Consistent Standard Errors & C					
	Variable	Coefficient	Std. Error	t-Statistic	Prob.
	C	9.352303	7.175336	1.303396	0.1976
tariffs	SER02	-1.00856	0.275368	-3.66258	0.0005
distance	SER03	-2.04551	0.190326	-10.7474	0
intercountrydispersion	SER04	1.071621	0.857488	1.249722	0.2164
sumgdps	SER05	2.154259	0.729975	2.95114	0.0046
priceimporter	SER06	0.222428	0.482644	0.460853	0.6466
priceexporter	SER07	1.391106	0.818167	1.700272	0.0944
	R-squared	0.745147	Mean dependent va	8.360802	
	Adjusted R	0.718783	S.D. dependent var	3.284182	
	S.E. of regr	1.741599	Akaike info criterion	4.048925	
	Sum squar	175.9238	Schwarz criterion	4.28309	
	Log likelihc	-124.59	F-statistic	28.26366	
	Durbin-Wa	2.41406	Prob(F-statistic)	0	

All variables come with the right signs.  $R^2$  is 0.74. 74% of the variability in the dependent variable (log of imports) can be explained by variability in the explanatory variables. White consistent standard errors take care of Heteroscedasticity. Size of trading partners, distance and tariffs (both have negative impact) matter (statistically) for imports of specialized products to and from Ecuador from MERCOSUR, EU27, EAST ASIA, NAFTA countries and India in 2010. Inter country dispersion of income and prices are not important for trade of 20 specialized products. Unlike trade in CSG, reduction in tariffs are important for movement of Ecuadorian goods across countries

Distance matters for imports of specialized products because Latin American countries trade more among themselves because of one common language, common market MERCOSUR and custom union the Andean region and because of lower transportation cost

### III.7 Export Potential of Ecuador to Some Selected Countries: Gravity Analysis

We use the estimated equation of the gravity model to predict the values of imports (log). If the actual imported values of specialized products exceed the fitted values, we call it import potential for the importing country or export potential for the Exporting Country. We get the following results. The first column depicts the import potential of the reporter or the importing country (second column) or the export potential of the exporting country (third column and is Ecuador). Positive values mean positive export potential (for exporters-Ecuador) or import potential (for importers).

290040.1	Venezuela	ecu
-4759.89	Argentina	ecu
-709.13	Bolivia	ecu
-819955	Brazil	ecu
36633.4	Canada	ecu
799241.2	Chile	ecu
345205.7	China	ecu
-222946	Colombia	ecu
4455.463	Hong Kong	ecu
261.5587	Indonesia	ecu
130585.4	Japan	ecu
1504.165	Korea, Rep	ecu
-23582.9	Mexico	ecu
-1124.93	Paraguay	ecu
487399.3	Peru	ecu
-1493.3	Singapore	ecu
1370.239	Vietnam	ecu
923086.6	United States	ecu
-564.786	Uruguay	ecu

Ecuador has positive export potential in providing these specialized products to Venezuela, Peru and Chile. These together add up to 1576.668 million US\$ in 2010. The export potential to the US is worth 923 million US \$ in 2010

We work out the Export Potential for 20 Specialized Products of Other Countries into Ecuador in 2010 using Gravity Analysis



180570.3	ecu	Argentina
99.78049	ecu	Austria
3068.556	ecu	Belgium
66681.59	ecu	Bolivia
-50628.4	ecu	Brazil
-17.9234	ecu	Bulgaria
2826.779	ecu	Canada
92744.8	ecu	Chile
35029.64	ecu	China
31974.83	ecu	Colombia
1817.811	ecu	Cyprus
-157.46	ecu	Czech Repu
122.4923	ecu	Denmark
-227.039	ecu	Estonia
-207.343	ecu	Finland
-6676.82	ecu	France
-1827.26	ecu	Germany
-39.4012	ecu	Greece
239.037	ecu	Hong Kong,
643.3756	ecu	India
-462.804	ecu	Indonesia
55.46467	ecu	Ireland
628.5142	ecu	Italy
-4298.49	ecu	Japan
100.7447	ecu	Korea, Rep.
-530.895	ecu	Lithuania
27.55283	ecu	Luxembour
174.1041	ecu	Malaysia
-22028	ecu	Mexico
13692.75	ecu	Netherland
20531.03	ecu	Paraguay
163806.5	ecu	Peru
285.4557	ecu	Poland
2648.288	ecu	Portugal
-136.186	ecu	Romania
345.896	ecu	Singapore
-109.84	ecu	Slovak Repu
5187.999	ecu	Vietnam
-227.525	ecu	Slovenia
4967.741	ecu	Spain
-1049.65	ecu	Sweden
500.1947	ecu	Thailand
-3280.85	ecu	United King
-12044.4	ecu	United Stat
92.29361	ecu	Uruguay
-4134093	ecu	Venezuela

Argentina, Peru and Columbia, among other Latin American countries have lot of potential in trading of such products with Ecuador. SMART analysis confirms that liberalizing imports with respect to MERCOSUR countries will bring more overall gain to Ecuador.

### III.8 Other Benefits of being Part of an Economic Agreement

The above analysis covers more technical aspects of an economic agreement. SMART analysis, in particular, gives numbers for evaluating the benefits of an economic agreement. The other benefits of having a preferential trading arrangement is to discuss the following

- Discuss energy and security issues
- Infrastructure Development including IT and Telecommunications and advent of some new air, road and rail links for increasing connectivity
- Services and Investment Liberalization measures
- Harmonizing regulatory standards relating to customs, accounting, educational services including professional activity
- Measures to tackle Climate Change, Disaster Management
- Tackle issues of Women Empowerment, Child Care
- Information Technology Enabled Services like Telemedicine and Tele-education
- Solar Rural Electrification, seed testing and rain water harvesting
- Dealing with financial crisis
- Water Scarcity
- Discuss ways and means to increase human capital and tackle inequality and poverty

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## Limitations of the Study

There are several challenges related to the Harmonized Commodity Coding and Description (HS) system makes it tricky to:

- Isolate ‘climate-friendly’ products from others for easier trade liberalization. ‘Dual-use’ categories include environmental and non-environmental products. E.g. *Efficient supercritical and ultra-supercritical boilers (and turbines) cannot be easily tracked because there is no suitable HS code differentiation for boilers (and turbines) by temperature and pressure.*
- Deal with intrinsically ‘dual-use’ products such as pipes and valves.
- it is difficult to distinguish between traditional coal and “clean” coal technologies at the HS 6-digit level, a fair amount of the trade analyzed here may in fact still be traditional “dirty” coal technologies. Further examination at a more disaggregated HS level and of regional industry trade trends is needed for a more accurate evaluation.

## Future Research

It will be interesting to find the intensity of carbon emissions of the specialized products of Ecuador at both 2 digits and at 6 digit level of disaggregation. They are probably lower than the EU27, US, China, India and Brazil. Also, emission intensity indices of exports and imports can also be worked out. The values of these indices range from 0 to infinite but the important benchmark is a value equal to 1. For example, if the emission intensity index of imports is larger than 1, emissions embodied in goods produced overseas and transported to a destination are larger than the emissions that would have been caused by local production in that destination of the same amount of goods. In other words, from a climate change perspective, it would have been less damaging to produce these goods locally than to import them. In the opposite case, when the index is less than 1, the environment is less damaged by trade than when no trade takes place. The index value of 1 indicates that emissions associated with imports of goods are the same as those associated with local production replacing trade.

## Summary and Policy Conclusions

According to the International Panel on Climate Change (IPCC) there is compelling evidence that GHG emissions cause climate change and that most GHG emissions are due to anthropogenic factors. The changes in climate foreseen towards the end of this century involve a gradual warming of the planet, with a temperature increase ranging from 1.1°C to 6.4°C above pre-industrial levels during the twenty-first century. Therefore, there appears to be a certain urgency to initiate actions to curb global GHG emissions and drastically reduce the unsustainable use of so-called carbon sinks, such as the world’s forests and oceans, in order to prevent global temperatures from rising by more than 2°C, which is the rate at which climate change can still be managed. This study details various policies including trade and investment policies in Climate Smart Goods(CSGs) to limit climate change.

Climate Smart Goods are defined as broadly as products, components and technologies that tend to have less adverse impact on climate change (greenhouse gas emissions<sup>10</sup>) and environment in general. The study considers a 64 goods list of CSG floated by the UNESCAP- APTIR (2011), basically constituting low carbon emanating industries. Access to CSG is very

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10 **Greenhouse gas** - a gas that “traps” infrared radiation in the lower atmosphere causing surface warming; water vapor, carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, and ozone are the primary greenhouse gases in the Earth’s atmosphere.

important for implementation of various strategies of technological transformation deemed necessary to mitigate climate change. For example, CSGs consists of articles of iron and steel and aluminum, machinery and mechanical appliances, electrical machinery equipment, ships, boats and floating structures, glass and glass ware articles, among others. One of the subcategories of CSG clean coal technology aims to improve energy efficiency and reduce environmental impacts, including technologies of coal extraction, coal preparation and coal utilization. Wind technology another sub category of CGS focuses on wind energy generation and is composed of three integral components: the gear box, coupling and wind turbine. Wind power and turbine production has experienced stupendous growth over recent years and is now one of the most widespread forms of climate smart technologies. As the region will have to come to terms with the expected effects of climate change, there is a collective need to increase trade and investment in these goods, which would benefit companies in different parts of the supply chain, and, hence all countries, no matter what their stage of development.

The interest in the subject of Trade in Climate Smart Goods was fuelled by Ecuador's positive trade balance with the rest of the Andean Community and MERCOSUR region in 2010. This may be a reflection of Ecuador's maturity in dealing with environmental issues since the early 1980s. It may be also due to preferential trade policies followed upon by member nations of the ANDEAN region. Or, the above trend can be just a consequence of their fast export growth. One, however, would like to establish with more certainty the association of various policies that have been put in place to help mitigate climate change and trade pattern changes. The study looks closely at the trade indices, worked out for Ecuador's total trade, CSG trade and specialized products and uses gravity analysis which helps in finding the export potential for trade in CSG and other products. As Ecuador in the Latin American region probably continues to design policies more conducive to fostering climate smart development, their domestic capacity to meet the increased domestic demand for climate smart goods and services, and then foreign demand through exports, is likely to increase. Depending on the relative strengths of the incentives between those in the region and outside, trade flows and patterns of the region is being affected possibly by reorienting the Ecuadorian trade more towards the intra-regional focus and hence the positive trade balance with the ANDEAN and MERCOSUR region. Whatever may be the exact reason, one thing which surely comes out of the study (SMART analysis) is that for Ecuador it will be better to liberalize CSG trade with the leading suppliers of the CSG goods, the China, Japan and the US.

In particular, Ecuador had a comparative advantage in the production of two Industry codes out of 64 goods list (based on RCA analysis). These industries are

732111

Solar driven stoves, ranges, grates, cookers (including those with subsidiary boilers for central heating), barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel.

732190

Stoves, ranges, grates, cookers (including those with subsidiary boilers for central heating), barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel.

These industries have potential for greater trade and inward foreign direct investment. The study identifies the markets for the same using the Export Specialization Index. These are Chile, Columbia and Peru. Gravity analysis helps us to work out

the export potential of Ecuador for 64 goods list of CSG. The export potential of Ecuador to four Latin American –Bolivia, Chile, Columbia and Peru is 34.79 million US\$. However, the greater potential lies with the other countries marketing the CSG goods in Ecuador. These countries include the most efficient suppliers of CSG goods, the China, Japan and the US. SMART results confirm that Ecuador will gain more( in terms of total trade effect, welfare and consumer surplus effects) by liberalizing its imports of Climate Smart Goods with the China, Japan and the US instead of MERCOSUR or EU27 countries.

Trade in CSG will help Ecuador to promote alternative industries in the face of Global Economic Downturn. Also, it will help country to look for safe, alternative and reliable energy source rather than believing in trade of crude and Petroleum Oil only or investing a great deal in nuclear energy. Nuclear energy was in the brink of being affected in Japan due to recent Earthquake in Japan. Ecuador can direct its social spending in promoting small industries which can provide CSG goods at low cost. Countries can gain in terms of their comparative advantage and establish new industries. Positions keep changing in terms of the advantage of producing goods and services. Based on our analysis and review of studies done on CSG (APTIR, 2011, ICSTD, WTO and World Bank) one may conclude that various national and international policies can be followed by Ecuador and its trading partners to promote trade of CSG goods. Gravity analysis (third objective) reinforces the below points

- Keep focusing on increasing growth rates of GDP of all. Larger size promotes trade of Climate Smart Goods.
- Lower inter country dispersion of income for promoting trade of CSG among countries
- Lower trade costs between countries by having open regionalism policies, reduce transportation costs within and between countries, lower border disputes to have open trade between neighboring countries.

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- Increase prices for exporters and lower prices of CSG goods in importers country by focusing on having sound competition policies, effective legislations for sound environmental policy( say increasing paper less trade and single window clearance as a starting point, carbon tax and regional emission trading system), appropriate regulatory framework, financial infrastructure and investment climate for production of CSGs, employ feed in tariffs for promoting CSGs, have appropriate standards and labels, mechanism of technology transfer, mechanisms to promote CSG trade among countries by coordination and cooperation and promoting R&D activities for CSG products among countries
- Lower tariffs by small countries in the American Peninsula for imports of CSG from Ecuador. In particular there is potential to reduce tariifs(Applied duties) by Djibouti(26%), Belize(15%), Costa Rica(10%), Guaetmala(11.97%), Honduras(9.87%), Nicaragua(12.49%), Cuba(8.99%) and El Salvador(12%)

Countries including Ecuador need to design sustainable and climate smart growth that entails sharply reduced GHG emissions to a level of 450 ppm( or may be lower) and that limits the global temperature rise to not more than 2 degrees Celsius by the end of the century. The stud lists such policies and is not confined to trade policies alone. Trade policies related to CSG though are the main focus of this study. The entire set of policies which can reduce GHG emissions and limit climate change can be structured into regulatory measures( including regulations, standards and labeling), economic incentives( including taxes, tradable permits and subsidies conforming to WTO laws and provisions), trade and investment policies and financial, energy and enterprise development policies, among others.

Regional climate-smart value chains could provide new opportunities for many less developed economies in the region to become parts and components suppliers to the leading CSG exporters in Latin American Region and other regions. At the same time, the capacity of domestic SMEs in the area of CSGs should be enhanced so that they can evolve into suppliers of low-carbon products and become effectively integrated with low-carbon value chains.

The study is also able to identify some specialized industries and identify markets for the two digit and 6 digit industries for Ecuador using RCA and Export Specialization index. There are 20 such products at the two digit level and 238 products/ industrial codes at 6 digit level disaggregation in 2010 were in Ecuador has a comparative advantage in production. These industrial sectors are potential for inviting FDI into Ecuador.

Export specialization and HH indices indicate the more concentrated nature of Ecuadorian production and trade structure. Ecuador needs to rethink its trade policy by diversifying its trade into manufactured products and more diversified production structure. Information Technology services, Tourism, Manufacturing of Automobiles, Education and Training Services, Bio combustibles, Housing materials, Pharmaceutical industries, Health Products and Hospital services, Hardware production, Industrial and Textile Goods and Chemicals are some areas where Ecuador can think of developing niche and cater to European markets. Production and Trade in Climate Smart Goods is another area of focus. In particular, study identifies the following industries for further diversifying industrial structure of Ecuador for its gain in future. These are Industrial Codes- 61(Articles of apparel and clothing accessories, knitted or crocheted), 62(Articles of apparel and clothing accessories, not knitted or crocheted),42( Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal), 90(Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; parts and accessories thereof), 84(Electronic appliances), 85(Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles),87 (Vehicles other than railway or tramway rolling-

stock, and parts and accessories thereof), 83 (Miscellaneous articles of base metal), 73 (Articles of iron or Steel), 69 (Ceramic products), 30 (Pharmaceutical products), 29 (Organic chemicals), Climate Smart Goods- 840510 (Clean Coal Technologies), 850720, 853710 and 854140 (Solar Photovoltaic systems), 848340 and 848360 (Wind Power Technologies), 853931 (Energy Efficient Lighting), among others. In services sector, Tourism, IT and ITES, Hospital services, Education and Training Services (training of English), Cultural Services, Knowledge Processing Outsourcing and Financial Analytics, Infrastructure services have lot of potential of bring the necessary foreign exchange and stability into the system. Ecuador need to diversify into the following industries and services for higher and more stable export earnings, job creation and learning effects, and the development of new skills and infrastructure that would facilitate the development of even newer export products.

Gravity Analysis has been used in this study the basis of trade of CSG goods of Ecuador and Trade of 20 specialized products in 2010. Further, the variant of the Baier and Bergstrand (2001) gravity model has been used to work out the export potential of CSG and specialized products to and from Ecuador. The theoretical justification of extending the most simple Gravity model, as used in this study, is done using extensions of work done by Helpman and Krugman (1985). Appendix Table X gives the note linking less dispersion of income with volume of trade.

SMART analysis on trade liberalization shows that it is beneficial to trade in 20 (2 digit level) and 238 products (at 6 digit level) with the MERCOSUR trading partners while for trade in CSG it is better to liberalize trade with the Japan, the US and the China, the main suppliers (exporters) of CSG products rather than EU 27 and MERCOSUR Countries in 2010.

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