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GCG
GEORGETOWN UNIVERSITY universia

Commodity and Non-Commodity Trade Dynamics in Colombia*

AREA: 1
TYPE: Application

Las dinámicas del intercambio comercial de commodities y no-commodities en Colombia

As dinâmicas do intercâmbio comercial de commodities e não-commodities na Colômbia

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This paper studies the dynamics between the Colombian external trade sector and real exchange rate variations of the Colombian currency within the theoretical framework of the Marshall-Lerner condition. To comprehensively study these dynamics, the analysis is disaggregated for commodity trade, i.e. goods with prices set in the international market, and for trade of non-commodities, which prices are determined at an exporter-importer level. In addition, Colombian bilateral trades with the U.S. and Venezuela, its two main trading partners, are provided distinct attention alas to consider two dissimilar trade scenarios, one where a country transacts internationally in its local currency versus another where the country does not. The M-L condition holds for the cases of Colombian non-commodity trade between with the U.S., and with Venezuela. Colombian commodity trade showed being unresponsive to changes in the Colombian terms of trade.

En este trabajo se estudia la dinámica entre el sector exterior colombiano y las variaciones del tipo de cambio real de la moneda colombiana en el marco teórico de la condición de Marshall-Lerner. Para lograr un estudio integral de esta dinámica, el análisis se desagrega para el comercio de productos commodities, es decir, bienes con precios fijados en el mercado internacional, y el comercio de productos no-commodities, cuyos precios se forman en un nivel exportador-importador. En adición, se le otorga atención particular al comercio bilateral colombiano con los EE.UU. y Venezuela, sus socios comerciales principales, para así considerar dos escenarios comerciales únicos; e.g. uno en que un país realiza transacciones a nivel internacional en su moneda local y otro escenario en que el país no lo hace. Se demuestra que, históricamente, la condición ML se ha cumplido para los casos del comercio exterior colombiano de no-commodities con los EE.UU. y con Venezuela. Sin embargo, el comercio de commodities colombiano se ha mostrado inafectado a cambios en los términos de intercambio internacional.

Este trabalho estuda a dinâmica entre o sector comercial externo colombiano e as variações na taxa de câmbio real da moeda colombiana no âmbito da condição de Marshall-Lerner. Para alcançar um amplo estudo dessa dinâmica, a análise é dividida no comércio de produtos commodities, *ou seja, de bens, com preços fixados no mercado internacional, e no comércio de não-*commodities, *cujos preços se estabelecem a um nível exportador-importador. Para além disso, é dada especial atenção ao comércio bilateral da Colômbia com os EUA e Venezuela, os seus principais parceiros comerciais, a fim de considerar dois cenários comerciais únicos; ex. um em que um país realiza operações internacionais em moeda local e um outro cenário em que não o faz. Demonstra-se que, historicamente, a condição M-L cumpriu-se para os casos de comércio externo colombiano de não-*commodities *com os EUA e com a Venezuela. No entanto, o comércio de* commodities *colombiano não se mostrou afectado por mudanças no intercâmbio comercial*

* We thank the excellent research assistance of María Fernanda García and Lorena A. Palacios Chacón

DOI 10.3232/GCG.2011.V5.N2.05
Received 01.03.2011
Accepted 07.07.2011

1. Introduction

Colossal and consecutive deficits in U.S. trade have translated on increasing trade surpluses at emerging economies. Parallel to this trade behavior and seeking to reestablish a trade balance, the U.S. dollar has devaluated in relation to most currencies of emerging countries and, consequently, many of these currencies have considerably appreciated causing a loss of competitiveness and the threat of a turnaround on their trade balances. The latter may realistically endanger the economic stability in emerging countries. This is certainly the case of Colombia where its local currency, the Colombian peso, has experienced considerable appreciation during the 1999-2009 decade.

Figure 1 illustrates the monthly time series, extending from 1996:1 to 2010:11, of Colombian net exports and its real exchange rate index[1]. At the first quarter of 2003 the exchange rate index shows the commencement of an appreciation of the Colombian peso, decreasing from a 131.6 index value in January 2003 to 82.4 in November of 2010. The behavior of net exports as a result of the appreciation of Colombian Peso is not of an immediate unbalance: by the end of the twelve month period following the initial appreciation, net exports peak at a surplus of 291 million USD in 2005, and not until 2006 a persistent trade deficit appears. Regardless that since 1999 till 2003 the Colombian peso experienced successive devaluations, net exports showed surpluses only in 1999 and 2000. For the remaining three years of the devaluation period, from 2001 to 2003, the trade balance was in a relative equilibrium. It should be noted that the Colombian economy suffered between 1999 and 2000 a severe economic crisis resulting in a contraction of its internal demand; on this matter see, for instance, Banco de la República (2000).

Visual inspection of Figure 1 draws suspicion on the existence of a degree of correlation between exchange rate and current account dynamics, with the presence of a trade response lag. To understand this relation it is necessary to review the literature on the subject and perform empirical analysis on the time series allowing a better understanding of the cross behaviors of these variables. This paper analyses the bilateral trade data taking into account the nature of goods traded and the partner country. For this purpose goods are classified in two groups: [i] commodities and traditional goods, including those goods traded in the commodity markets or priced to market according to seasonal demand, and [ii] non-commodities and non-traditional goods, these are goods priced by the result of transactions between sellers and buyers. Another aspect taken into account in the analysis is that of the partner country: studying Colombian bilateral trade with the U.S. and with Venezuela. Historically, these countries have been Colombia's main trading partners.[2] During the last decade, on average, thirty percent of Colombian total exports were commodity goods destined to the U.S. and Venezuela, and close to twenty percent of the total exports were non-commodity goods to these countries. An important distinction that should be born in mind when analyzing trade flows with these two trade partners is that while bilateral transactions with the U.S. are engaged on in U.S dollars, the

Key words
Marshall-Lerner condition, Real Exchange Rate, Colombia

Palabras clave
Condición Marshall-Lerner, Tasa de Cambio Real, Colombia

Palavras-chave
Condições M-L, Taxa de Câmbio Real, Colômbia

JEL Codes
F14; F31; N16

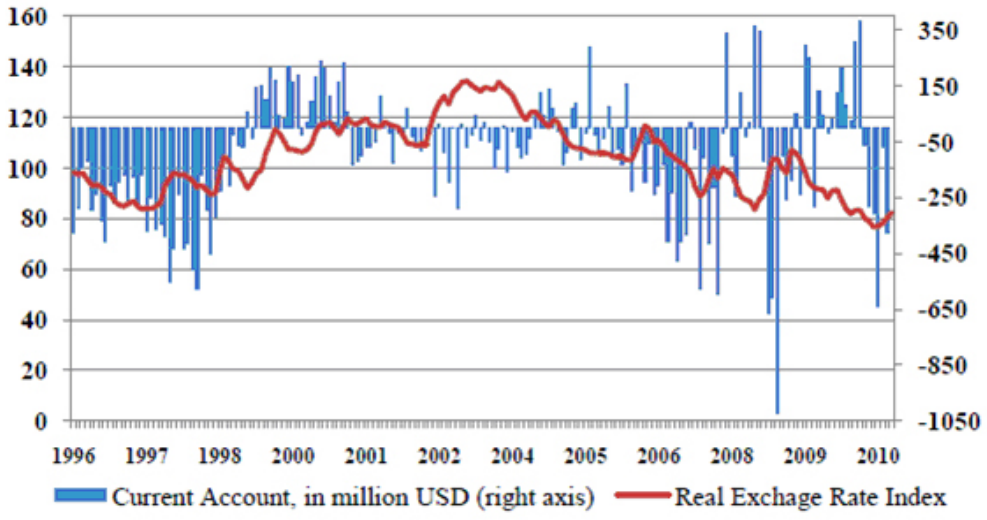
1 The Real Exchange Rate Index (CPI) published by the Banco de la República of Colombia is used. Base: Geometric Average 1994=100. An increase in the level value of the Index indicates a real appreciation of the Colombian peso. Detailed explanation of methodology to construct the index can be found in: "Revisión metodológica del ITCR y cálculo de un índice de competitividad con terceros países", Revista del Banco de la República, marzo de 2000.

2 Due to political circumstances and the withdrawal of Venezuela from the Andean Community, in the later period of 2009 and in 2010 the trade between Colombia and Venezuela shrank to a tenth of its historical records.

country´s local currency, this is not the case of trade with Venezuela. Later on the analysis, we will show that this distinction significantly and asymmetrically affects bilateral trade due to price changes responding to exchange rate variations.

The next section of the paper reviews the theoretical elements contained in the existing literature. Section 3 provides a description on commodity and non-commodity Colombian bilateral trade with the U.S. and Venezuela and the country's terms of trade. Section 4 presents the model used for analysis and its results, and Section 5 concludes.

Figure 1: Colombian Net Exports and Real Exchange Rate Index



Source: Banco de la República

2. Literature Review

Current account imbalances may threat economic growth in so far as they reflect distortions both at domestic and international level (Blanchard & Milesi-Ferreti, 2009) and, given the potential relation between exchange rates and those imbalances, it is important to review the academic literature on the relations between these variables. The question in more specific terms is whether the exchange rate is a suitable instrument to overcome current account imbalances. Not surprisingly, the literature is fairly divided on the matter. Some authors have found little evidence of a long run relationship between trade balance and real exchange rates (Wilson, 2000). Different authors believe that although the Marshall-Lerner condition does not always hold, real devaluations do improve the balance of trade, though after a lag,

mimicking a J-Curve –Magee (1973), (Boyd D, *et. al.,* 2001). The Marshall-Lerner condition, or M-L condition, occurs when relative price changes, resulting from variations in the exchange rate, give way to changes in country´s trade flows affecting the current account balance Goldstein and Khan (1985), Argy (1994). The magnitude of these changes will depend on the price elasticity of imports and exports, and the M-L condition is said to hold when the sum of the absolute values of these elasticities is greater than unity (IMF, 2007). Changes in the exchange rate between two trading nations affect their terms of trade, with a negative impact from devaluation. The question that arises is whether the worsening of the terms of trade will be offset by the benefits of a favorably balanced current account resulting from the dynamics on the price elasticity of exports and imports.

It is well documented that a positive effect of devaluation on trade flows does not happen instantaneously, since at a time of devaluation foreign purchases in local currency increase and exports do not respond to lower prices given that transaction prices have already been set; resulting in a greater current account deficit in the short term Krueger (1983). Only after a lag imports decrease due to price increase and exports respond to lower prices. This effect is known as the J-Curve because the behavior of the current account follows a trend which resembles a "J", showing at first a deficit followed by current account surpluses (Rose & Yellen, 1989).

Empirical studies have tested the validity of the M-L condition and the existence of a J-Curve, both using aggregate trade data (Bahmani-Oskooee 1985), and trade data and exchange rates at bilateral level (Rose & Yellen 1989). More recent studies have disaggregated bilateral trade date and exchange rates at industry level (Bahmani-Oskooee & Ratha, 2007). The analysis contained in this paper uses disaggregated data on the bilateral trade of Colombia with its two main trading partners, e.g. the U.S. and Venezuela, making the distinction among goods that are priced to market, i.e. commodities, and those with prices set between a buyer and a seller. In that sense the analysis avoids statistical and inferential problems derived from aggregate data (Rose & Yellen, 1989).

Several works review the literature on the relation between exchange rates and trade balance and it is evident that there is no conclusive evidence proving the effect exchange rates have on trade balances (Bahmani-Oskooee & Ratha, 2004). A significant number of studies recognize a relation between exchange rates and trade balance in many distinct international markets. Boyd, Caporale & Smith (2001) argue that the M-L condition holds on the long run when testing aggregate data for a group of OECD countries. Hacker & Hatemi (2003) supports the existence of a J-Curve and an M-L condition in northern European countries using aggregate data. Menzies (2005), also using aggregate data, finds evidence of an M-L condition for Australia originating in its local market. The author argues in his work, as we do in ours for the case of Colombia, that when considering commodities apart from non-commodities, and due to the high volume of natural resource exports, most Australian exporters are "price takers" abroad. Kalyoncu *et. al.* (2009) examines aggregate data for four Latin American countries, and only finds evidence of a J-Curve in two of them. These two are Argentina and Perú.

As previously mentioned, many other studies support a lack of relation between these variables. Rose & Yellen (1989) finds no reliable long–run relationship between the US trade balance and the real exchange rate or the existence of a J-Curve. Wilson (2000) uses bilateral

data of trade and exchange rates between Korea and the U.S. and Japan finding that real exchange rates does not have a significant impact on real bilateral trade balance, and came to a similar conclusions when analyzing bilateral data of Singapore and Malaysia (Wilson, 2001). Mahud, Ullah & Yucel (2004), using a non-parametric kernel estimation technique on aggregate data, found that of five northern European countries the M-L condition only holds for one of them. Coupet & Coupet (2006) did not find evidence of the existence of J-Curve in a study covering 26 OECD countries.

On the matter of policy implications, Fang, Lai & Miller (2006) consider that any benefits gained in the trade balance from terms of trade manipulations are annulled by the risk factors associated with exchange rate variations. Other elements, such as the currency used for billing trade transactions and how this can limit the capacity to transfer prices resulting from exchange rate variations and the nature of the goods traded, are also considered in Wilson (2001) when examining the relation between exchange rate variations and current account balances.

The M-L condition and J-Curve are concepts conceived in terms of a local currency and imply that price variations resulting from exchange rate fluctuations is transferred to export and import markets. Only the U.S., Japan and Europe, bill export and import transactions in their local currencies and, on these cases, price transfers through trade flows are more likely; allowing for a “pass-through effect”. The “pass-through effect” measures the capacity that relative price variations, resulting from exchange rate fluctuations, result in variations of import and export prices. Empirical evidence questions the capacity to transfer these price variations both in the more advance nations and the developing countries; see Gust & Sheets (2006) and Gust, Leduc & Vigfusson (2006) on the former, and Frankel, Parsley & Wei (2005) on the latter.

The degree to which prices are transferred depends on price elasticity of import and export goods, and macroeconomic and microeconomic conditions. If price demand elasticity of import goods is high, then price transfer will happen more easily. Whereas in a homogeneous market with high competition, the possibility of price transfer decreases; see Dwayer, Kent & Pease (1994). This latter is commonly the case of commodity trade, regularly with low or no price elasticity, being the price of these goods determined primarily by supply and demand dynamics in an open market. Opposite is the scenario of goods that trade in segmented markets and with high price elasticity, as is the case with the import of consumer and luxury goods.

Evidence also shows that full transfer is more likely to occur at trade with countries that bill in their local currencies, and more limited in countries that bill in a foreign currency, creating an asymmetric impact on current account balances unfavorable to these countries (Goldberg & Tille, 2006). Countries billing their exports in a currency distinct from their home currency are vulnerable to market price fluctuations, since their export goods will compete in an open market with local and international competition priced in the currency of the importing country, and changes in the exchange rate will only affect their profit margins, increasing or decreasing it depending on whether the local currency revaluates or devaluates (Irandoust, 1999). Price of imports by these countries gets to be transferred as soon as they are purchased since the international price will be converted into local currency. These considerations are taken into account in the analysis of this paper on Colombian international trade. When

studying the relation between exchange rates and trade balance in the bilateral trade of Colombia and the U.S., the trade variables are denominated in U.S. dollars, since price transfer is more likely to occur; particularly in the case of non-commodity trade. The analysis on Colombia and Venezuela bilateral trade uses variables denominated in Colombian pesos; that is to numerically capture the pass-through effect, since the U.S. dollar, which is the currency used for the bilateral transactions, is neither the currency of Venezuela or Colombia.

3. Data on Colombian National Income and Bilateral Trade

The data in the analysis is of quarterly frequency and extends from the first quarter of 1998 to the last of 2009. Colombian national income is measured using the real gross domestic product. For terms of trade between Colombia and the World, the inverse of the Colombian real exchange rate index, deflated using the consumer price index (or CPI), is used as a proxy. The respective bilateral real exchange rates are used to proxy the terms of trade between Colombia and the U.S. and Venezuela. The bilateral real exchange rate between Colombia and country i ($RER_{i,t}$) is calculated according to $RER_i=(P_{col}\cdot NER_i)/P_i$; where P_{col} and P_i are the consumer price indexes of Colombia and country *i*, and NER_i is the nominal exchange rate between Colombia and country i. Figure 2 depicts the trends of the three considered Colombian real exchange rate time series for the period under consideration. The trend of each series is computed using a Hodrick-Prescott filter. The source on Colombian exchange rates, price indexes and national income is the Banco de la República.

The source of aggregated and disaggregated, by partner and types of goods, Colombian trade data is the Statistical System of International Commerce at the Bureau of National Taxes and Tariffs of Colombia (SIEX at the DIAN, for their respective Spanish abbreviations), and is expressed in "Free on Board" (or FOB) and in nominal U.S. dollars.[3] The commodity goods exchanged between Colombia and the U.S. and Venezuela included in the analysis are those consistently traded goods among the three countries for which their prices are determined in international commodity exchange markets or are fixed seasonally upon supply and demand dynamics[4]. These goods are flowers and flower bulbs, toasted and untoasted caffeinated and decaffeinated coffee, corn, unrefined cane sugar, coal, crude oil and bituminous minerals, raw gold and ferronickel. Appendix A provides a detailed description of the commodity goods considered in the study with their respective Harmonized System (HS) Code Classifications.

During the analyzed period, on average, 28.4% and 10.8% of the total Colombian exports were commodity and non-commodity exports destined to the U.S., respectively. Colombian commodity and non-commodity exports to Venezuela represent 0.1% and 7.3%, respectively, on average, of its total volume of exports for the same period. Table 1 contains

3 Monthly trade data spanning from 2002:3 to 2004:1 is currently under revision at the SIEX. For that reason and the purpose of this study, the quarters including these months under review are not considered in the analysis.
4 The latter refers specifically to the market of flowers and sugar cane.

selected average statistics of the Colombian commodity trade to the U.S. and Venezuela. The table indicates the average value per quarter, in nominal thousand USD, of Colombian exports and imports of the considered commodity types to and from the U.S. and Venezuela, and the average value of each type of good among all Colombian commodity exports or imports to and from these countries. Colombian commodity exports to the U.S. are dominated mainly by the trade of flowers, coffee, gold and, most importantly, oil. Colombian commodity exports to Venezuela are more symmetrically distributed. Oil being the principal export, closely followed by coal, flowers and sugar. Oil is the only non-trivial Colombian commodity import from the U.S. and Venezuela. It represents over 99% of commodity imports from both countries.

Figure 2: HP-Trend of Colombian Real Exchange Indexes (1999:1=100)

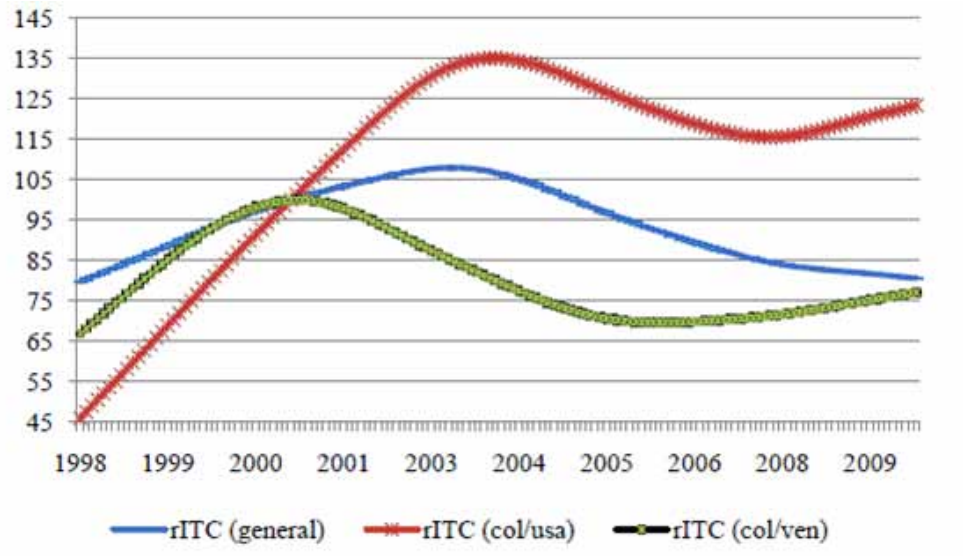


Table 1: Colombian trade of commodity goods with the U.S. and Venezuela, 1998:1-2009:4

Commodities	*-Comm* $x_{USA,t}$ **(x$1,000)**	*Comm* $x_{USA,t}$ **(%)**	*-Comm* $m_{USA,t}$ **(x$1,000)**	*Comm* $m_{USA,t}$ **(%)**	*-Comm* $X_{VEN,t}$ **(x$1,000)**	*Comm* $X_{VEN,t}$ **(%)**	*-Comm* $m_{VEN,t}$ **(x$1,000)**	*Comm* $m_{VEN,t}$ **(%)**
Flowers	160,637.6	10.91%	8.1	0.01%	942.0	21.03%	0.0	0.00%
Coffee	123,957.6	8.49%	2.9	0.0%	136.5	2.57%	0.0	0.00%
Corn	0.2	0.00%	198.8	0.27%	223.5	4.36%	35.7	0.15%
Sugar	5,925.7	0.42%	51.0	0.09%	700.3	16.01%	0.0	0.00%
Coal	4,036.4	0.25%	3.8	0.0%	1,223.5	24.58%	0.3	0.00%
Oil	1,128,323.7	75.59%	73,480.7	99.62%	1,507.0	31.46%	25,915.1	99.85%
Gold	57,038.1	3.62%	0.0	0.00%	0.0	0.00%	0.0	0.00%
Ferronickel	10,901.2	0.71%	0.0	0.00%	0.0	0.00%	0.0	0.00%

Intending to eliminate any spurious dynamics generated by uninformative outliers in the data, non-commodity goods considered in our study are limited to those with a yearly trade volume consistently exceeding $20,000 USD. Considering this threshold value and the asymmetric composition of the Colombian trade for this type of goods with the U.S. and Venezuela, the classification of goods included in the non-commodity time series will not be symmetrical for both countries. Both countries engage in considerably large non-commodity trade with Colombia of refined sugar products, pharmaceutical products, perfumery, miscellaneous chemical and plastic products, paper, clothing accessories, articles of iron and steel, electrical and mechanical machinery, and vehicles.

In addition to the aforementioned types of products, contained in the "Other" category of Table 2, the non-commodity goods traded between Colombia and the U.S. contain also, mainly, edible fruits, distilled mineral fuels, dyeing extracts, pearls, (8.8%, 34.2%, 5.5% and 7.0% of Colombian non-commodity exports to the U.S., respectively), processed cereals, organic chemicals, aircrafts, and optical and surgical instruments (7.8%, 11.8%, 9.8% and 5.0% of Colombian non-commodity imports from the U.S.). In addition to the previously mentioned shared product categories with the U.S., the Colombian and Venezuelan non-commodity trade series contains similar proportions of dairy products, edible vegetables, printed editorial products and furniture. Appendix B lists in detail the non-commodity goods considered in the study for the Colombian trade with the U.S. and Venezuela.

Table 2: Colombian trade of non-commodity goods with the U.S. and Venezuela, 1998:1-2009:4

Non-Commodities	*-NonCom* $x_{USA,t}$ (x$1,000)	*NonCom* $x_{USA,t}$ (%)	*-NonCom* $m_{USA,t}$ (x$1,000)	*NonCom* $m_{USA,t}$ (%)	*-NonCom* $X_{VEN,t}$ (x$1,000)	*NonCom* $X_{VEN,t}$ (%)	*-NonCom* $m_{VEN,t}$ (x$1,000)	*NonCom* $m_{VEN,t}$ (%)
Sugar confection	5,238.1	0.97%	6.8	0.10%	22,330.7	5.93%	116.8	0.17%
Chem. Prods.	3,101.1	0.59%	64,488.6	4.89%	28,205.2	7.32%	15,751.5	20.49%
Essential oils	398.5	0.07%	53.8	0.80%	18,846.8	4.64%	1,608.4	2.17%
Plastic products	20,924.7	3.75%	387.8	5.76%	35,517.2	9.01%	11,316.2	24.76%
Paper products	3,485.3	0.66%	151.1	2.24%	28,749.8	7.18%	18,470.9	2.98%
Clothing apparel	75,819.3	14.35%	5,073.2	0.42%	64,182.5	15.91%	2,099.0	0.10%
Articles iron/ steel	19,304.5	3.47%	141.8	2.10%	10,121.4	2.61%	38.3	7.26%
Mech. machinery	10,697.4	1.94%	1,544.8	22.93%	33,635.0	8.36%	37.8	3.57%
Elect. machinery	10,832.9	1.95%	650.2	9.65%	25,508.1	6.38%	5,680.9	5.38%
Vehicles	1,451.4	0.26%	285.1	4.23%	85,756.2	21.73%	2,703.7	31.66%
Other	388,777.9	71.99%	614,771.9	46.88%	43,413.6	10.93%	1,061.5	1.45%

4. Analysis

Assessing the impact of Colombian national income and terms trade on its external sector, Equations (1)-(3) formulate the Colombian trade balance, real export and real import functions as dependants on the nation's real exchange rate and real gross domestic product. *j* refers to the trade of all aggregate goods, commodity goods or non-commodity goods, e.g. *j={All, Comm, NonCom}*, and *i* indicates the considered Colombian trade partner, i.e. *i={World, USA, VEN}*. $tb^{j}_{i,t}$, $x^{j}_{i,t}$ and $m^{j}_{i,t}$ are the natural logarithms of Colombian trade balance, real exports and real imports of *j* type of goods to and from country *i* at time *t*. The trade balance is defined as the ratio of exports over imports. The trade variables between Colombia and the U.S. are expressed in constant USD, while those between Colombia and Venezuela are expressed in constant Colombian pesos. Real Colombia-U.S. exports and imports are obtained deflating their nominal exports and imports time series, originally expressed in USD, using the US-CPI. The source for the US-CPI is the U.S. Bureau of Labor Statistics. Real Colombia-Venezuela exports and imports are obtained by converting into Colombian pesos the series of Colombian nominal exports and imports with Venezuela, originally expressed in USD, using the bilateral nominal exchange rate between Colombia and the U.S. and deflating the series using the Colombian consumer price index. $rer_{i,t}$ is the natural log of the real exchange rate between the Colombian peso and the currency of country *i* at time *t*; that is, an increase in $rer_{i,t}$ represents a real devaluation in the Colombian currency. $gdp_{COL,t}$ is the natural log of Colombian real gdp at *t*.

$$tb^{j}_{i,t} = \alpha_{i,j} + \beta^{rer}_{i,j} \cdot rer_{i,t} + \beta^{gdp}_{COL,j} \cdot gdp_{COL,t} + \mu^{j}_{i,t} \quad (1)$$

$$x^{j}_{i,t} = \alpha_{i,j} + \beta^{rer}_{i,j} \cdot rer_{i,t} + \beta^{gdp}_{COL,j} \cdot gdp_{COL,t} + \varepsilon^{j}_{i,t} \quad (2)$$

$$m^{j}_{i,t} = \alpha_{i,j} + \beta^{rer}_{i,j} \cdot rer_{i,t} + \beta^{gdp}_{COL,j} \cdot gdp_{COL,t} + \upsilon^{j}_{i,t} \quad (3)$$

No expectation on $\alpha_{i,j}$ is formulated provided that the values assumed by these parameters are purely empirical. $\beta^{rer}_{COL,j}$ is the real exchange rate elasticity of the dependent variable. If a real devaluation is believed to increase exports and decrease imports, then $\beta^{rer}_{i,j}$ is expected on being positive in Equation (1) and (2) and negative in Equation (3). $\beta^{gdp}_{COL,j}$ denotes the average percentage change in the dependent trade variable as a response to a percentage increase in Colombian real income. Either, a positive or negative sign for $\beta^{gdp}_{COL,j}$ is sustained by the literature. $\beta^{gdp}_{COL,j}$ could be positive if an increase in Colombian real income leads also to an increase in imports. Yet, if the increase in real income is due to increases in national production of import substitutes then $\beta^{gdp}_{COL,j}$ is expected to have a negative sign; see Halicioglu (2008).

The regression coefficients in Equations (1)-(3) are estimated using least squares where t-statistics are corrected for serially correlated errors using the procedure in Newey & West (1987).[5] Table 3 presents the coefficient estimates on the equations representing the "aggregate models"; that is, the log of Colombian trade balance, real exports and real imports on all goods with the rest of the World. The absolute values of Newey-West t-statistics are

5 Computation algorithms are performed using a Matlab v7.10.0 code, on a PC with an Intel Core 2 Extreme Processor of 2.53 GHz.

on parenthesis. The Durbin-Watson statistic denotes the presence of serial-correlation at the trade balance equation. Again, as previously mentioned, this is not unexpected. The first column of values contains the parameter estimates on the regression equation of the Colombian trade balance, on all goods with the rest of the World. Based on the low *R* squared estimates and the lack of statistically significant coefficient values, it is trivial to conclude that Equation (1) is an unsatisfactory formulation for estimating the aggregate Colombian balance of trade with the rest of the world. Several explanations exist for this. In addition to dealing with the aggregation of heterogeneous products combined in a single international trade variable responding distinctly to the considered regressors, the regression equation is trying to match the individual responses of exports and imports to changes in the three regressors with only one coefficient per regressor. The second and third columns of values detail this last argument. These columns denote the parameter estimates for the regression equations on total Colombian real exports and real imports with the rest of the world, those are Equations (2) & (3) where *j=All & i=World*. Colombian total exports and imports with the rest of the World are responsive, with statistical significance, to changes in Colombian real national income. A percentage increase in national income is associated, in average, with a 0.61% and 0.60% percentage increase in real exports and real imports, respectively. The subtraction of these responses of seemingly equal magnitude is responsible for the statistically insignificant response of the aggregate trade balance to changes in real national income. Aggregate imports are sensitive to changes in the real exchange rate; aggregate real exports are not. On average, a percentage devaluation of the Colombian peso decreases total imports by 1.02%.

Table 3: Colombian total aggregate trade volume coefficient estimates, 1998:1-2009:4

Coefficient Parameters	tb^{All}_{world}	x^{All}_{world}	m^{All}_{world}
$\alpha_{All,world}$	-2.49 (0.85)	6.28 (3.21)***	8.77 (2.98)***
$\beta^{rer}_{All,world}$	0.50 (1.28)	-0.51 (1.48)	-1.02 (2.43)***
$\beta^{gdp}_{COL,world}$	0.01 (0.09)	0.61 (9.06)***	0.60 (5.66)***
R^2	0.13	0.60	0.67
R^2_{adj}	0.09	0.57	0.65
$DW(^{P}_{val})$	0.57 (0.0)	2.06 (0.8)	1.90 (0.4)

***: 1% significance, t-stat > |2.73|; **: 5% significance, t-stat > |2.03|

Table 4 presents the parameter estimates for the regression equations on the Colombian trade balance, real exports and real imports of commodity and non-commodity goods with the U.S.; those are Equations (1)-(3) where *j={Comm, NonCom} & i=USA*. The results presented in Table 4 provide some insight on Colombian trade on two categories of goods, one characterized by low price elasticity (commodities) and another characterized by the opposite (non-commodities), with a partner having the capacity of billing its exports and imports on its national currency.

The trade balances of Colombian commodity and non-commodity goods are negatively affected by the increases of real wealth in Colombia. Variations in Colombian real national income exhibit statistically significant impacts on most Colombia-U.S. trade variables, increasing the volume of Colombian imports on all types of goods originated from the U.S. On average, a percentage increase in Colombian real GDP is associated with a 0.88% increase in Colombian commodity exports to the U.S. and with an increase of 3.72% in commodity imports from the U.S. Colombian non-commodity imports from the U.S. are affected, yet inelastically, to changes in Colombian real wealth; a percentage increase in Colombian real wealth is associated with a 0.81% increase in non-commodity imports from the U.S. Colombian non-commodity exports to the U.S. appear unaffected by changes in its national real income. These coefficients seem to indicate that an increase in Colombian real wealth may be associated with the substitution of the home production of non-commodities, causing a drive up in non-commodity imports from the U.S.

Consistent with our initial conjectures, Colombian and U.S. commodity trade is not responsive to changes in the terms of trade among both nations. That is not the case for the non-commodity trade of goods; also consistent with the initial conjectures.Colombian trade balance of non-commodity goods with the U.S. improves when the Colombian national currency devaluates; in average, it increases by 1.10% with a percentage devaluation of the Colombian peso. Real exchange rate variations are statistically significant in the determination of Colombian non-commodity exports and imports with the U.S.; a percentage real devaluation of the Colombian peso is associated with an increase in real non-commodity exports by 0.81% and a decrease in non-commodity imports by 0.29%. The absolute values of the real exchange rate elasticities of real non-commodity exports and imports sum greater than on; complying with the M-L condition, also coherent with the initial conjectures. The pass-through effect in Colombian imports resulting from the U.S. billing in their local currency is reflected in the associated decrease of non-commodity imports following a devaluation; while the U.S. billing in their local currency allows Colombian exporters to transfer the lower prices associated with the devaluation.

Table 4: Colombia-U.S. trade coefficient estimates, 1998:1-2009:4

Coefficient Parameters	tb^{Comm}_{USA}	x^{Comm}_{USA}	m^{Comm}_{USA}	tb^{NonCom}_{USA}	x^{NonCom}_{USA}	m^{NonCom}_{USA}
$\alpha_{USA,j}$	36.92 (18.57)***	6.85 (3.30)***	-30.08 (10.67)***	-1.18 (1.06)	7.26 (6.51)***	8.44 (18.94)***
$\beta^{rer}_{USA,j}$	-0.15 (0.68)	-0.14 (0.41)	0.00 (0.01)	1.10 (9.05)***	0.81 (9.64)***	-0.29 (4.46)***
$\beta^{gdp}_{COL,j}$	-2.84 (17.15)***	0.88 (3.23)***	3.72 (11.72)***	-0.63 (5.50)***	0.19 (1.50)	0.81 (14.97)***
R^2	0.84	0.54	0.87	0.66	0.77	0.85
R^2_{adj}	0.83	0.52	0.86	0.64	0.75	0.84
$DW(P_{val})$	2.06 (0.8)	0.58 (0.0)	1.72 (0.2)	1.85 (0.3)	1.88 (0.4)	2.05 (0.7)

***: 1% significance, t-stat > |2.73|; **: 5% significance, t-stat > |2.03|

Provided the heterogeneous nature of its aggregate composition (see Table 2), the case of Colombian non-commodity imports from the U.S. requires further analysis. According to the regression coefficient estimates, a devaluation of the Colombian currency is associated with a decrease in aggregate non-commodity imports from the U.S. Table 5 presents the parameter estimates for eleven regressions, following Equation (3), on eleven time series of Colombian non-commodity imports from the U.S. obtained from disaggregating the aggregate non-commodity imports time series in the categories considered in Table 2. The disaggregation of non-commodities per categories aims at estimating the value of coefficient $\beta^{rer}_{USA,NonCom}$ per non-commodity category.

Table 5: Colombia-U.S. non-commodity imports coefficient estimates, 1998:1-2009:4

Non-Commodities	$\alpha_{USA,NonCom}$	$\beta^{rer}_{USA,NonCom}$	$\beta^{gdp}_{COL,NonCom}$	R^2	R^2_{adj}	$DW(P_{val})$
Sugar confection	1.48 (0.93)	-0.49 (3.12)***	0.94 (4.75)***	0.46	0.43	1.62(0.1)
Chem. Prods.	-3.00 (2.13)**	0.00 (0.01)	1.31 (7.15)***	0.80	0.79	1.38(0.01)
Essential oils	9.51 (9.70)***	-0.36 (2.09)**	0.33 (2.55)**	0.19	0.15	1.55(0.05)
Plastic products	6.56 (14.05)***	-0.39 (5.17)***	0.73 (11.21)***	0.77	0.76	1.98(0.6)
Paper products	3.80 (4.38)***	-0.31 (4.99)***	0.99 (11.24)***	0.86	0.85	1.05(0.0)
Clothing apparel	12.14 (13.25)***	-0.60 (4.08)***	0.35 (3.09)***	0.40	0.36	1.22(0.0)
Articles iron/steel	-3.72 (3.13)***	-0.54 (3.66)***	1.69 (15.61)***	0.84	0.83	1.80(0.3)
Mech. machinery	6.33 (12.89)***	-0.47 (5.94)***	0.98 (15.87)***	0.82	0.81	2.14(0.9)
Elect. machinery	14.58 (13.40)***	-0.78 (4.39)***	0.35 (2.93)***	0.41	0.38	1.42(0.02)
Vehicles	-1.54 (1.56)	-0.95 (5.32)***	1.80 (13.92)***	0.73	0.71	2.21(0.9)
Other	6.87 (10.58)***	0.00 (0.01)	0.71 (9.37)***	0.81	0.80	1.88(0.4)

***: 1% significance, t-stat > |2.73|; **: 5% significance, t-stat > |2.03|

The coefficients in Table 5 indicate that all Colombian non-commodity imports have, on average, a positive response to increases in Colombian real wealth; confirming the findings presented previously in Table 4. Also, all Colombian non-commodity imports have, on average, a non-positive response to a devaluation of the Colombian peso. All of these import categories are mainly final products. The only non-responsive categories to changes in the Colombia-U.S. terms of trade are chemical and pharmaceutical products and the "other" category. The latter is a heterogeneous aggregate containing, mainly, processed cereals, organic chemicals, aircrafts, and optical and surgical instruments. It is reasonable to consider that a significant fraction of the Colombian chemical and pharmaceutical imports from the U.S. is intended for the use as intermediate products or inputs in the manufacture of a final Colombian product. A likely explanation of the results seen in Table 5 is that the positive trade effects of deteriorating the terms of trade on Colombian non-commodity imports from the U.S. are evident on finished goods, but not so on intermediate goods.

The coefficient estimates on Table 6 are those of the regression equations on Colombian trade balance, real exports and real imports of commodities and non-commodities with Venezuela; e.g. Equations (1)-(3) where *j={Comm, NonCom} & i=VEN*. These regression models shed light on the dynamics of Colombian trade on two categories of goods, with distinct price elasticities, with a partner not having the capacity of billing its commodity exports and imports on its national currency.

The response of Colombian trade with Venezuela to increases in real national income is significantly distinct to that response of trade with the U.S. In average, Colombian imports of commodities and non-commodities from Venezuela decrease by 1.90% and 1.44%, respectively, with a percentage increase in Colombian real gross domestic product. This is an indication that the increase in Colombian real production may be due to the substitution of non-commodity imports from Venezuela and, when considering to the results in Table 4, it may be hypothesized that the increase in Colombian real wealth may cause a substitution of Venezuelan non-commodity imports for instead non-commodity imports from the U.S. Commodity exports to Venezuela appear unaffected by changes in income, while non-com-

Table 6: Colombia-Venezuela trade coefficient estimates, 1998:1-2009:4

Coefficient Parameters	tb^{Comm}_{VEN}	x^{Comm}_{VEN}	m^{Com}_{VEN}	tb^{NonCom}_{VEN}	x^{NonCom}_{VEN}	m^{NonCom}_{VEN}
$\alpha_{VEN,j}$	-24.68 (2.26)**	26.57 (2.87)***	51.26 (9.11)***	-42.60 (11.77)***	3.70 (0.65)	46.30 (5.92)***
$\beta^{rer}_{VEN,j}$	2.33 (1.74)	0.42 (0.49)	-1.91 (2.27)**	2.79 (12.60)***	1.09 (2.50)**	-1.70 (3.10)***
$\beta^{gdp}_{VEN,j}$	0.99 (1.78)	-0.91 (1.82)	-1.90 (1.82)	2.66 (10.03)***	1.22 (3.53)***	-1.44 (2.92)***
R^2	0.10	0.24	0.24	0.82	0.56	0.42
R^2_{adj}	0.05	0.20	0.20	0.81	0.53	0.39
$DW(^{P}_{val})$	1.34 (0.01)	1.38 (0.01)	1.38 (0.01)	0.71 (0.0)	0.60 (0.0)	0.39 (0.0)

***: 1% significance, t-stat > |2.73|; **: 5% significance, t-stat > |2.03|

modity exports are elastic to income changes; e.g. in average, a percentage increase in real income is associated with an increase of 1.22% in Colombian non-commodity exports to Venezuela. A similar scenario occurs when measuring the response of Colombia-Venezuela trade statistics to changes in real exchange rate. Commodity and non-commodity Colombian imports from Venezuela decrease by 1.91% and 1.70%, respectively, with a percentage devaluation of the Colombian peso to the Venezuelan bolívar. Colombian non-commodity exports to Venezuela elastically respond to changes in the bilateral real exchange rate. A percentage real devaluation of the Colombian peso on average increases non-commodity exports to Venezuela by 1.09%. Colombian commodity exports to Venezuela are unaffected by changes in the real exchange rate between the countries.

Colombian trade balances with Venezuela of commodity and non-commodity goods, on average, improve when the Colombian national currency devaluates. These dynamics are the consequences of the negative responses to a devaluation of Colombian commodity and non-commodity imports from Venezuela, combined with the positive response of non-commodity exports and the non-responsiveness of commodity exports to devaluations. Coincidentally, on all types of Colombian bilateral trade with Venezuela, the absolute values of the real exchange rate elasticities of real exports and imports sum greater than one and comply with the M-L condition. Different behavior between commodities and non-commodities reflect the fact that commodities are priced internationally in US dollars and do not respond to variations in exchange rates.

5. Concluding Remarks

An empirical analysis on Colombian external trade evidences that the country's non-commodity bilateral trade with Venezuela and the U.S. complies with the Marshall-Lerner condition, and confirms the existence of distinct behaviors in the relations between trade flows and exchange rates for the two trade partners. These findings reflect different pass-through effects to price variation that result from exchange rate variations for a country that transacts internationally in a local currency versus one that does not.

The analyzed research agenda has relevant public policy implications provided that Venezuela has been historically an important market for Colombian non-commodity goods, enjoying high protection due to a discriminatory Andean external tariff, and although the U.S. is the main Colombian non-commodity goods trading partner and enjoys also preferential tariffs due to APTDEA[6], the level of tariff preference is significantly lower than that of Venezuela. The analysis' results indicate that the trade flows involved in the preferential tariff agreements, as those between Colombia and Venezuela, are highly sensitive to exchange rate variations, and thus an appreciation of the Colombian peso, as is currently occurring, is likely to decrease Colombian exports and contribute to a deterioration of the trade balance.

6 APTDEA is a unilateral tariff reduction given by the US to 98% of Colombian products, as part of a joint effort to curve illicit drug trade.

Even though the U.S. market is the principal destination of Colombian non-commodity exports, the total volume of exports is increasingly being represented by commodities which are unaffected by exchange rate variations. In addition to their superior presence in total Colombian exports, the current high and increasing levels of commodity prices counteract the negative effects of the M-L condition in the face of a revaluation. In the context of public policy implications and as a prospective future research agenda, we hypothesize that the effects of a Colombian peso revaluation are observable in the non-commodity goods labor sector, provided that an appreciation of the Colombian peso curtails non-commodity exports.

Appendix A: Commodity Goods

Head & Subhead	Description of commodity good
0603	Cut flowers and flower buds of a kind suitable for bouquets or for ornamental purposes, resh, dried, dyed, bleached, impregnated or otherwise prepared
090111	Coffee, not roasted, Not decaffeinated
090112	Coffee, not roasted, decaffeinated
090121	Coffee roasted, Not decaffeinated
090122	Coffee roasted, decaffeinated
100510	Cornseed
170111	Raw sugar not containing added flavouring or colouring matter. Cane sugar
170199	Raw sugar not containing added flavouring or colouring matter. Other
2704	Coal
2709	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes
2710	Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70 % or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations; waste oils.
710812	Gold (including gold plated with platinum) unwrought or in semi-manufactured forms, or in powder form. Other unwrought forms
720260	Ferro-nickel

Appendix B: Non-Commodity Goods, Colombia-U.S. Bilateral Trade

Chapter	Description of non-commodity good
3	Fish and crustaceans, molluscs and other aquatic invertebrates
6	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage
8	Edible fruit and nuts; peel of citrus fruit or melons
9	Coffee, tea, maté and spices
10	Cereals
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder
17	Sugars and sugar confection
21	Miscellaneous edible preparations
25	Salt; sulphur; earths and stone; plastering materials, lime and cement
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes

Chapter	Description of non-commodity good
29	Organic chemicals
30	Chemical products
31	Fertilisers
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations
34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artificial waxes, prepared waxes, polishing or scouring preparations, candles and similar articles, modelling pastes, “dental waxes” and dental preparations with a basis of plaster
37	Photographic or cinematographic goods
38	Miscellaneous chemical products
39	Plastics and articles thereof
40	Rubber and articles thereof
42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)
47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard
52	Cotton
54	Man-made filaments
61	Articles of apparel and clothing accessories, knitted or crocheted
62	Articles of apparel and clothing accessories, not knitted or crocheted
70	Glass and glassware
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewellery; coin
72	Iron and steel
73	Articles of iron or steel
76	Aluminium and articles thereof
82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal
84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof
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
88	Aircraft, spacecraft, and parts thereof
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; parts and accessories thereof

Appendix C: Non-Commodity Goods, Colombia-Venezuela Bilateral Trade

Chapter	Description of non-commodity good
4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
7	Edible vegetables and certain roots and tubers
17	Sugars and sugar confection
30	Chemical products
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations
38	Miscellaneous chemical products
39	Plastics and articles thereof
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard
49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans
61	Articles of apparel and clothing accessories, knitted or crocheted
62	Articles of apparel and clothing accessories, not knitted or crocheted
73	Articles of iron or steel
84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof
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
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings

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