The impacts of China on economic growth: evidence for Brazil, Chile and Peru

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1. Introduction

- Empirical evidence suggests that there have been positive impacts of exports on economic growth in the period of the commodity boom between 2001 and 2008 in LACs.
- Detailed analysis concentrating on the **South American Countries**, such as Brasil, Chile y Peru is required.
- The importance of the impacts can be different, in line with the export pattern and the productive structure of each country.

2, Methodology

- Previous studies performed counter-factual analysis such as Jenkins (2011) concentrated his analysis on the indirect impacts derived from the commodity prices.
- This study will focus on:

✓ **Direct impacts** derived from **the bilateral exports; to China** based on **the counter-factual analysis** .

✓ **Demand-side approach** (not neoclassical growth model);

=>Application of the **balance-of-payments-constrained (BPC) growth model** (original model: Thirlwall, 1979)

Cont.

- **BPC growth model:**

✓ **Export** is the only component of aggregate demand which can deliver the required foreign exchange to pay for imports in an open economy.

✓ **The long-term rate of expansion of aggregate demand** (and hence domestic output) is **constrained by** the availability of **foreign exchange.**

✓ In the basic model, the long-term economic growth can be predicted by the ratio of its **export growth** to its **income elasticity of demand for imports** (Thirlwall, 1979).

- The **counter-factual** scenarios: if the export volumes from those countries to all trading partners including China **had grown at the same volume with the previous period** (1992-2000), **how much smaller the economic growth** of those countries would have been ?

The data and assumptions

- X, M: Comtrade.
- Y, Pd and REER: CEPALSTAT.
- The period of analysis: Brazil, Peru: 2001-2008; Chile: 2001-2007; we assume that the income elasticity of demand for imports of those period can be approximated by the those of **1996-2008 and 1995-2007,** respectively.
- We assume that C can be approximated by the difference between M and X.
- We assume that counterfactual scenarios about export-side do not affect π.

3, The trade dynamics in Brazil, Chile and Peru

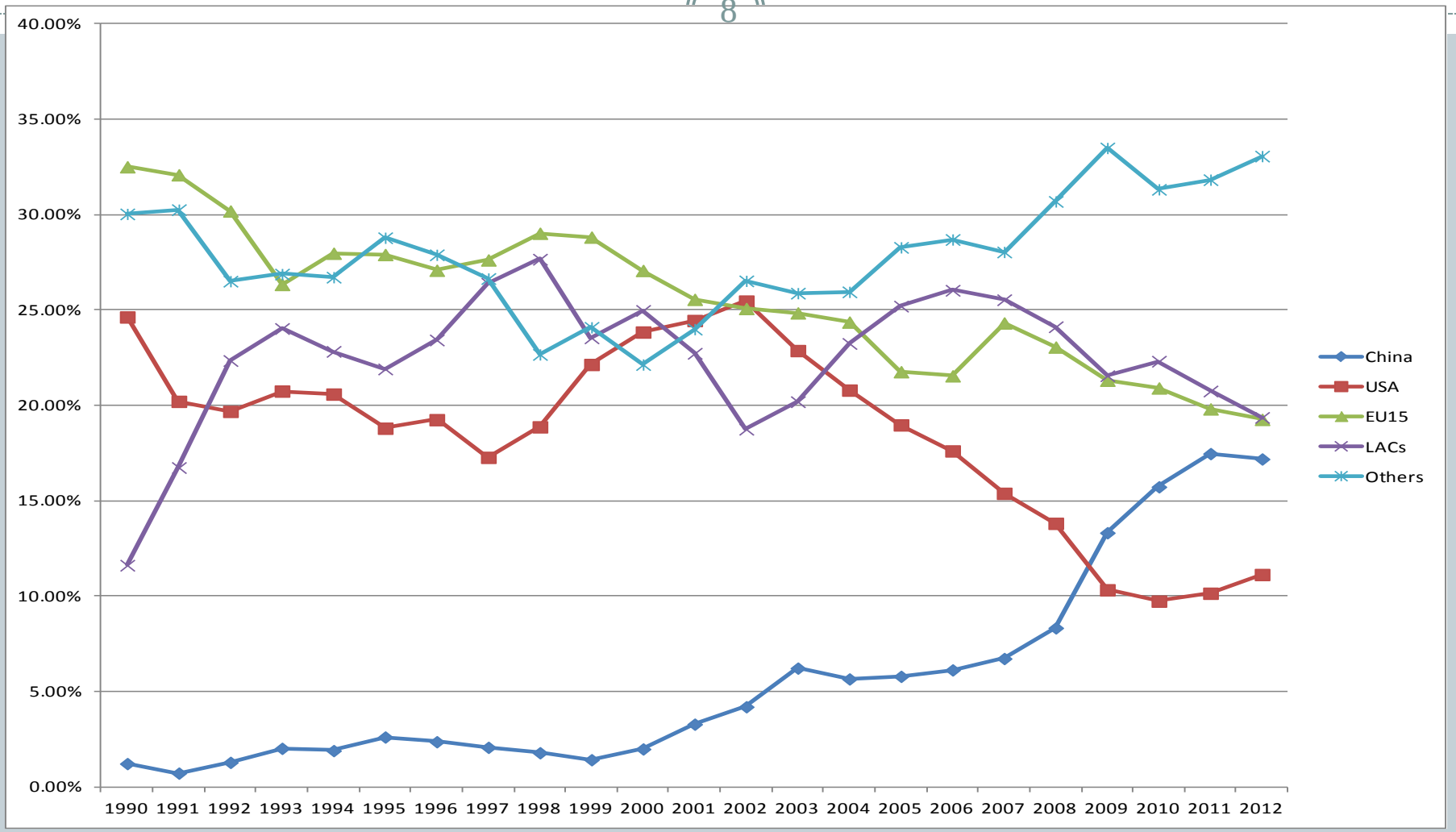
- All trading partners are classified into **China**, **USA**, 15 members of European Union (**EU-15**), **LACs** and all other countries (**Others**).
- The trading partners whose export volumes between 2001 and 2008 increased more than those between 1992 and 2000 (**real** growth rates **>counterfactual** growth rates) are:

✓ Brazil: China, EU-15, LACs and Others.

✓ Chile: China, EU-15 and Others.

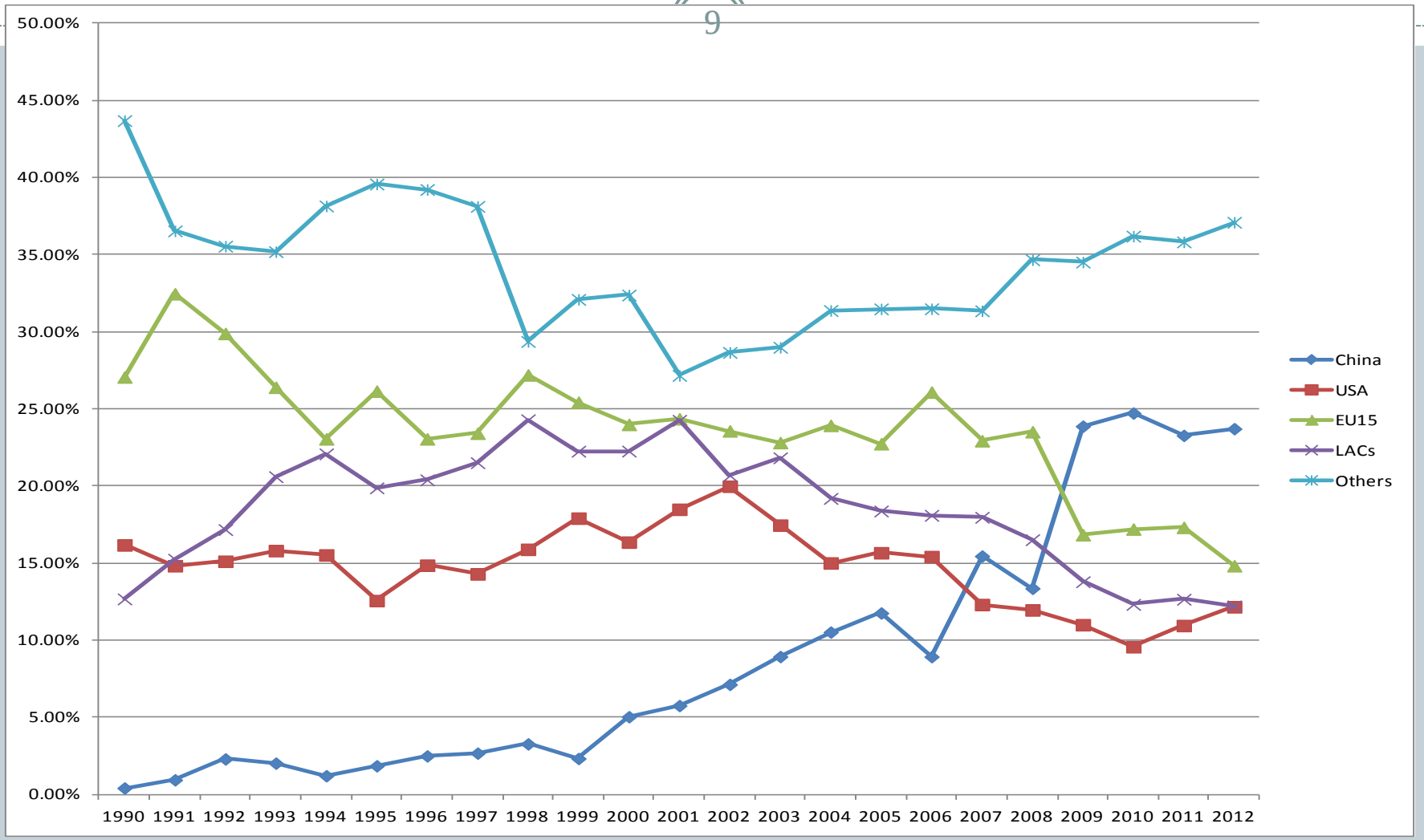
✓ Peru: China, EU-15, LACs and Others.

The evolution of export destinations from Brazil, 1990-2012



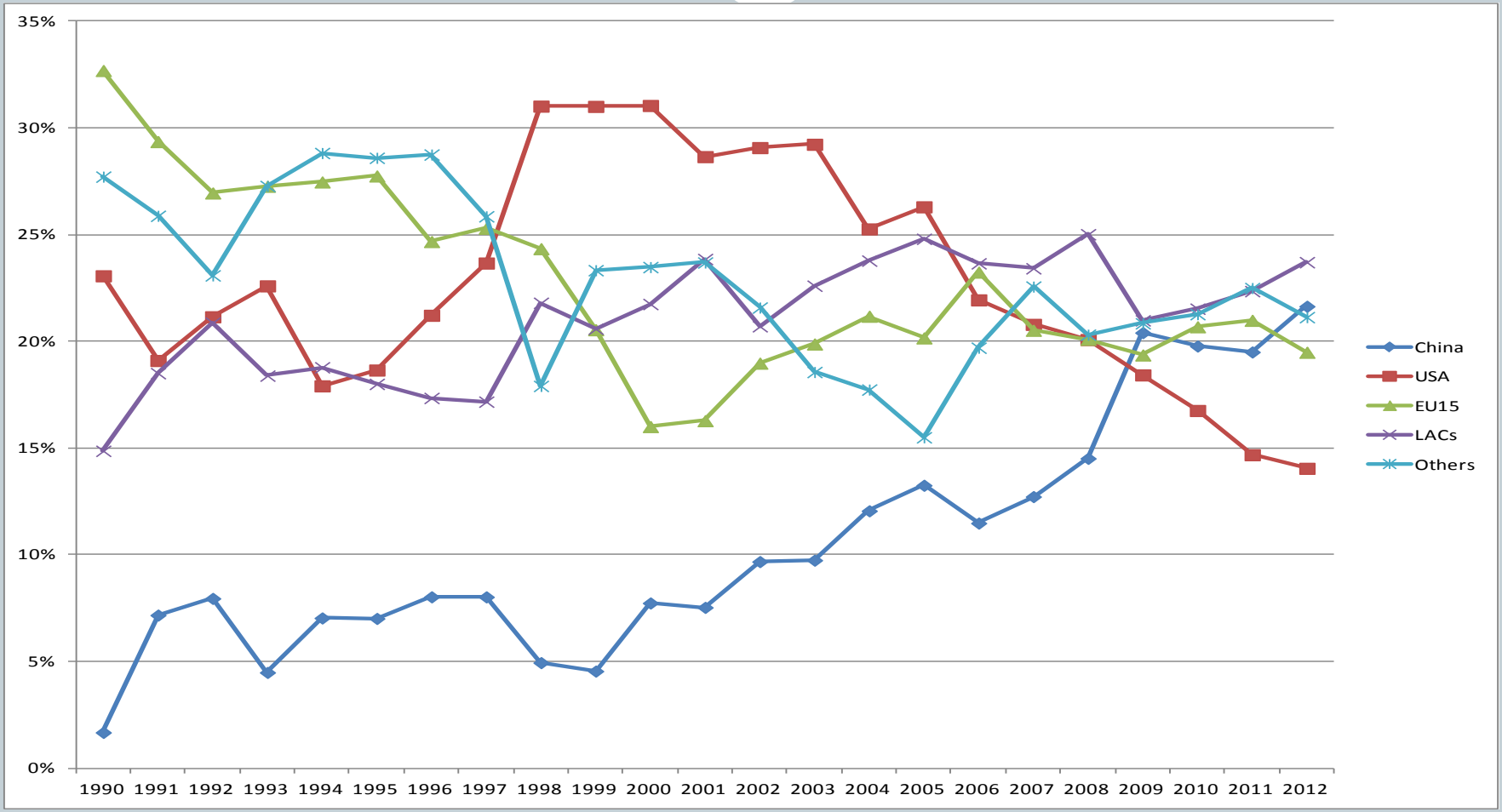
Source: COMTRADE

The evolution of export destinations from Chile, 1990-2012



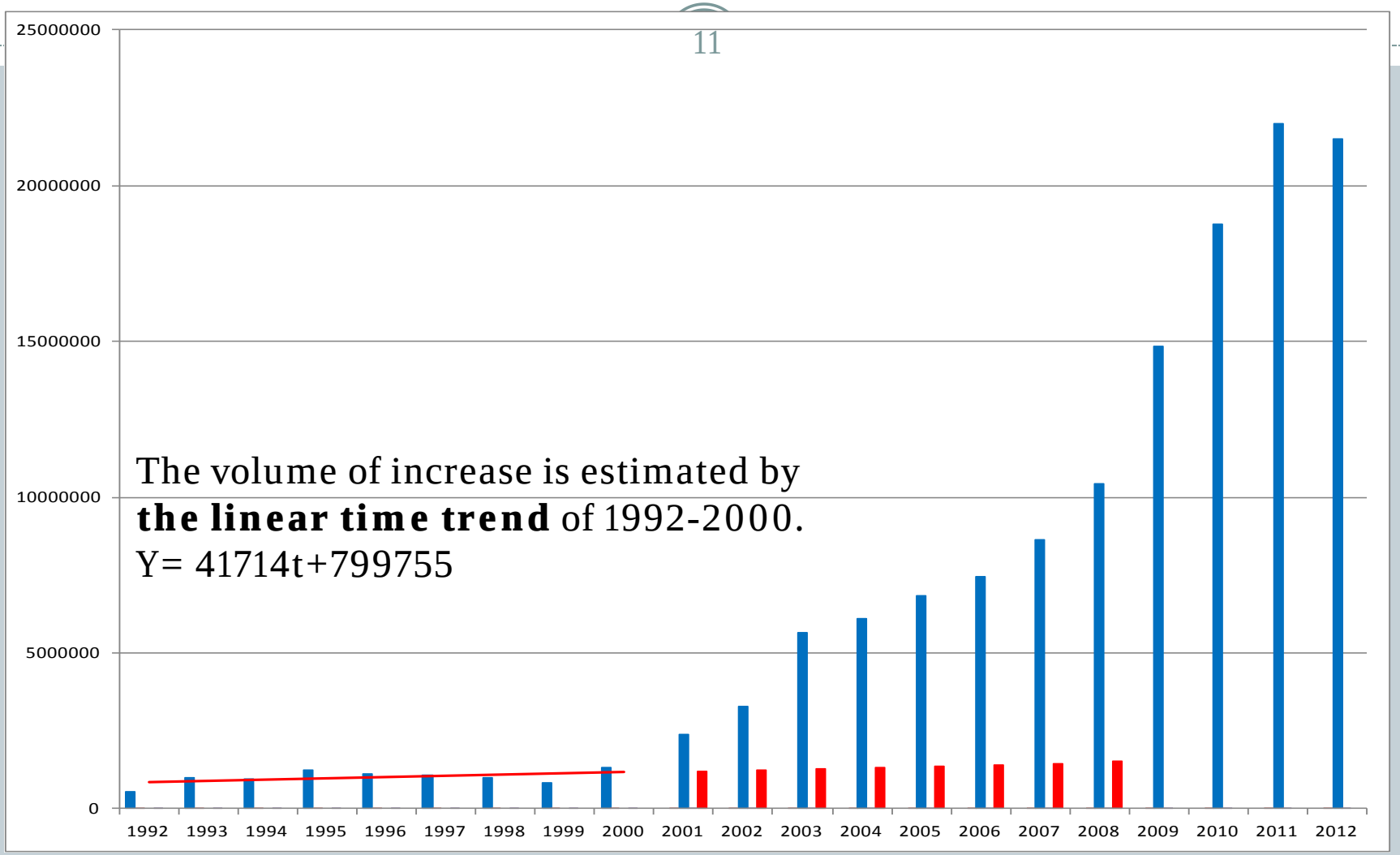
Source: COMTRADE

The evolution of export destinations from Peru, 1990-2012



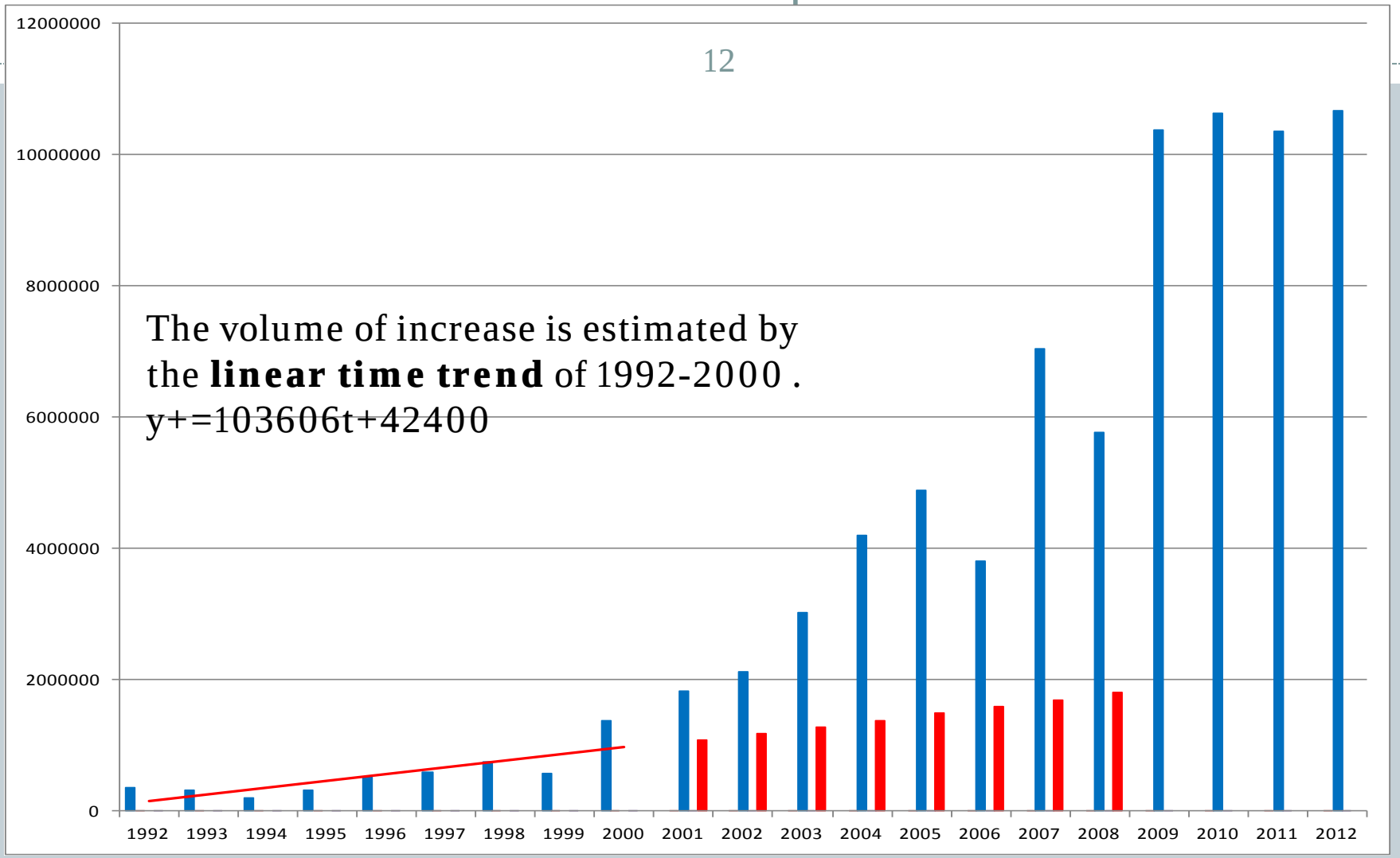
Source: COMTRADE

The evolution of the real and counterfactual export volumes to China at constant prices in Brazil



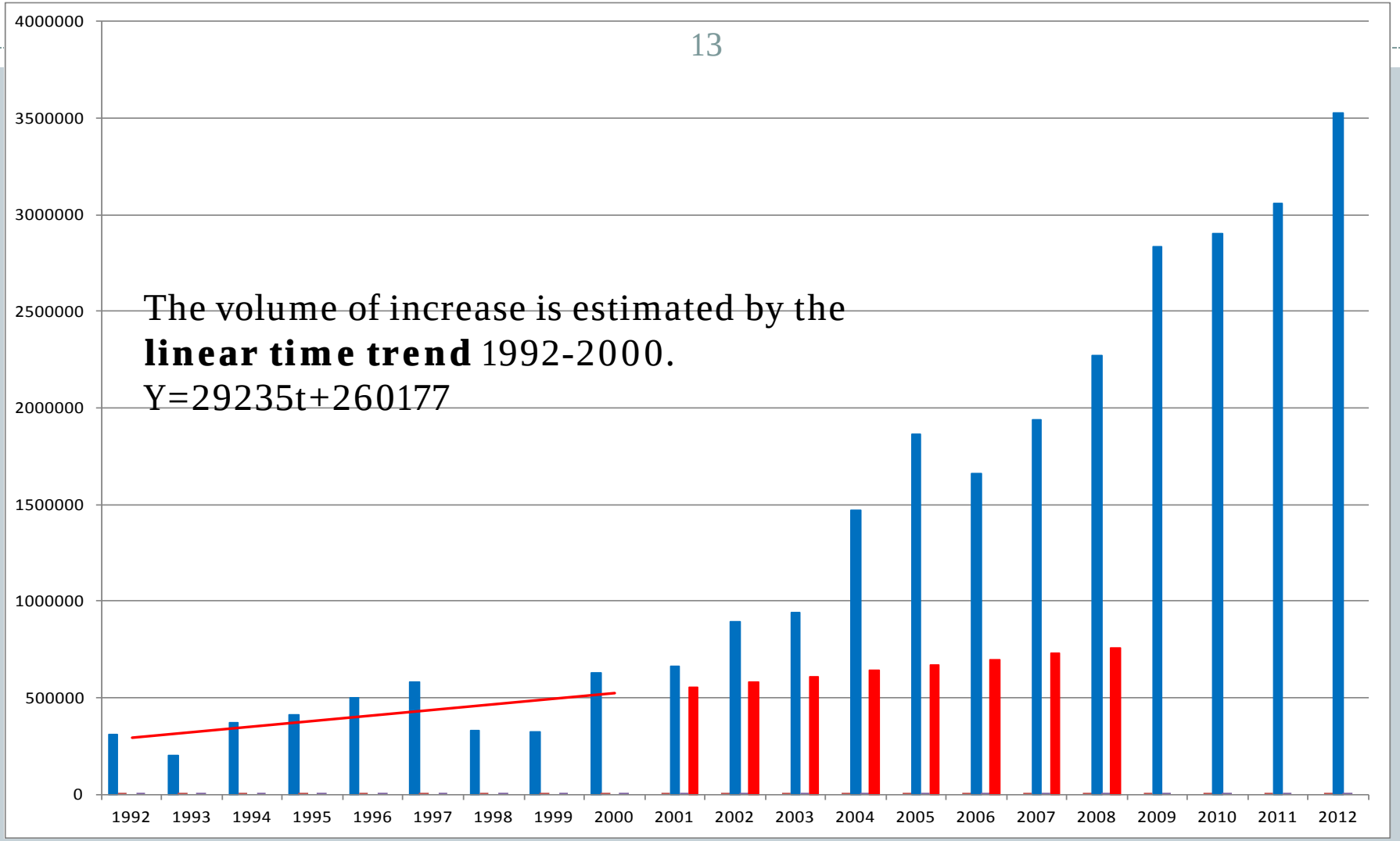
Source: COMTRADE and CEPALSTAT. Note: The values (thousand USD) at constant prices are calculated by the **external trade deflator** of each country (the price index of 2005=1).

The evolution of the real and counterfactual export volumes to China at constant prices in Chile



Source: COMTRADE and CEPALSTAT. Note: The values (thousand USD) at constant prices are calculated by the **external trade deflator** of each country (the price index of 2005=1).

The evolution of the real and counterfactual export volumes to China at constant prices in Peru



Source: COMTRADE and CEPALSTAT. Note: The values (thousand USD) at constant prices are calculated by the **external trade deflator** of each country (the price index of 2005=1).

The growth rate of the real and counterfactual export volumes during the period of commodity boom

Brazil	Trading Partner	real 2001-2008	counterfactual 2001-2008
	China	**32.3%**	3.2%
	USA	1.6%	**4.2%**
	EU15	**6.6%**	3.3%
	LACs	**12.3%**	1.6%
	Others	**13.0%**	2.1%
	Weighted average of Export growth (%)	10.2%	2.9%

Chile	Trading Partner	real 2001-2007	counterfactual 2001-2007
	China	**30.0%**	8.3%
	USA	4.1%	**5.3%**
	EU15	**4.6%**	4.4%
	LACs	-0.4%	**5.8%**
	Others	**8.5%**	3.9%
	Weighted average of Export growth (%)	7.2%	4.9%

Peru	Trading Partner	real 2001-2008	counterfactual 2001-2008
	China	**18.9%**	4.7%
	USA	3.1%	**7.1%**
	EU15	**10.7%**	3.1%
	LACs	**11.1%**	5.7%
	Others	**7.5%**	3.9%
	Weighted average of Export growth (%)	9.1%	5.2%

Source: COMTRADE and CEPALSTAT. Note : The export volumes are calculated from the **external trade deflators.**

Cont.

- The characteristics of the export baskets:

✓ Brazil to **China: primary commodities** (oil seeds), to **USA** and **LACs**: **manufacturing goods** (transport equipment), except (petroleum and petroleum products) after the booming period.

✓ Chile and Peru: regardless of the trading partners and the period, **primary commodities** (non ferrous metals and metalliferous ores). The level of concentration on the main products is the highest in China.

Exports of the 5 main products (before and after the period of commodity boom) en Brazil

	China		USA		EU15		LAC		Others	
Brasil 2000	Oil seeds, oil nuts and oil kernels	31.1%	Transport equipment	21.5%	Transport equipment	10.6%	Transport equipment	20.8%	Metalliferous ores and metal scrap	11.8%
	Metalliferous ores and metal scrap	25.4%	Iron and steel	10.0%	Oil seeds, oil nuts and oil kernels	9.5%	Machinery, other than electric	12.2%	Sugar and honey	9.8%
	Pulp and paper	5.0%	Machinery, other than electric	10.0%	Feed. Stuff for animals excl.unmilled cereals	9.1%	Electrical machinery, apparatus and appliances	11.0%	Iron and steel	8.6%
	Tobacco and tobacco manufactures	4.6%	Footwear	8.5%	Metalliferous ores and metal scrap	8.7%	Iron and steel	4.9%	Transport equipment	7.5%
	Transport equipment	4.4%	Electrical machinery, apparatus and appliances	8.1%	Coffee	6.2%	Paper, paperboard and manufactures thereof	4.7%	Meat, fresh, chilled or frozen	7.2%
Brasil 2008	Oil seeds, oil nuts and oil kernels	34.9%	Petroleum and petroleum products	24.1%	Metalliferous ores and metal scrap	14.1%	Transport equipment	25.7%	Meat, fresh, chilled or frozen	19.4%
	Metalliferous ores and metal scrap	33.9%	Transport equipment	20.0%	Oil seeds, oil nuts and oil kernels	10.5%	Petroleum and petroleum products	18.1%	Metalliferous ores and metal scrap	13.9%
	Petroleum and petroleum products	11.2%	Machinery, other than electric	11.7%	Feed. Stuff for animals excl.unmilled cereals	8.5%	Machinery, other than electric	15.7%	Sugar and honey	9.9%
	Fixed vegetable oils and fats	5.4%	Chemical elements and compounds	9.4%	Transport equipment	7.5%	Electrical machinery, apparatus and appliances	11.0%	Special transact. Not class. According to kind	9.3%
	Pulp and paper	4.5%	Electrical machinery, apparatus and appliances	6.4%	Petroleum and petroleum products	6.8%	Chemical elements and compounds	4.6%	Transport equipment	9.1%

Source: COMTRADE

Note: classified by SITC Rev. 1. The yellow marker shows that the product is primary commodity or natural resource based manufacture.

Exports of the 5 main products (before and after the period of commodity boom) en Chile

	China		USA		EU15		LAC		Others	
Chile 2000	Non ferrous metals	42.4%	Non ferrous metals	22.2%	Non ferrous metals	46.4%	Non ferrous metals	19.6%	Metalliferous ores and metal scrap	31.9%
	Metalliferous ores and metal scrap	30.6%	Fruit, fresh, and nuts excl. Oil nuts	16.9%	Metalliferous ores and metal scrap	11.4%	Paper, paperboard and manufactures thereof	7.0%	Non ferrous metals	23.6%
	Pulp and paper	15.6%	Fish,fresh & simply preserved	15.0%	Pulp and paper	10.8%	Metalliferous ores and metal scrap	6.3%	Fish,fresh & simply preserved	10.9%
	Chemical elements and compounds	2.6%	Wood, lumber and cork	8.3%	Chemical elements and compounds	6.7%	Transport equipment	5.9%	Pulp and paper	6.1%
	Feed. Stuff for animals excl.unmilled cereals	2.6%	Chemical elements and compounds	5.7%	Beverages	6.0%	Fruit, fresh, and nuts excl. Oil nuts	5.9%	Special transact. Not class. According to kind	5.4%
Chile 2008	Non ferrous metals	51.7%	Non ferrous metals	37.2%	Non ferrous metals	49.8%	Non ferrous metals	20.8%	Metalliferous ores and metal scrap	39.9%
	Metalliferous ores and metal scrap	31.3%	Fruit, fresh, and nuts excl. Oil nuts	18.0%	Metalliferous ores and metal scrap	14.5%	Metalliferous ores and metal scrap	8.8%	Non ferrous metals	25.6%
	Pulp and paper	8.6%	Fish,fresh & simply preserved	11.1%	Fruit, fresh, and nuts excl. Oil nuts	6.3%	Transport equipment	7.1%	Fish,fresh & simply preserved	6.8%
	Feed. Stuff for animals excl.unmilled cereals	2.9%	Wood, lumber and cork	4.6%	Pulp and paper	5.2%	Petroleum and petroleum products	6.3%	Pulp and paper	4.1%
	Chemical elements and compounds	2.0%	Chemical elements and compounds	4.3%	Chemical elements and compounds	4.5%	Paper, paperboard and manufactures thereof	4.6%	Fruit, fresh, and nuts excl. Oil nuts	3.3%

Source: COMTRADE

Note: classified by SITC Rev. 1. The yellow marker shows that the product is primary commodity or natural resource based manufacture.

Exports of the 5 main products (before and after the period of commodity boom) en Perú

	China		USA		EU15		LAC		Others	
Peru 2000	Feed. Stuff for animals excl.unmilled cereals	73.5%	Non ferrous metals	44.1%	Non ferrous metals	23.8%	Non ferrous metals	21.0%	Metalliferous ores and metal scrap	31.8%
	Metalliferous ores and metal scrap	17.0%	Clothing	22.0%	Feed. Stuff for animals excl.unmilled cereals	16.3%	Metalliferous ores and metal scrap	13.8%	Feed. Stuff for animals excl.unmilled cereals	28.4%
	Textile fibres, not manufactured, and waste	5.0%	Petroleum and petroleum products	8.9%	Metalliferous ores and metal scrap	11.6%	Petroleum and petroleum products	11.2%	Non ferrous metals	12.8%
	Non ferrous metals	2.7%	Coffee	4.5%	Coffee	11.3%	Textile yarn, fabrics, made up articles, etc.	5.0%	Petroleum and petroleum products	8.5%
	Animal oils and fats	1.0%	Vegetables, roots & tubers, fresh or dried	3.2%	Vegetables, roots & tubers pres or prepared nes	8.3%	Miscellaneous manufactured articles, nes	4.4%	Fish,fresh & simply preserved	3.7%
Peru 2008	Metalliferous ores and metal scrap	70.4%	Petroleum and petroleum products	28.9%	Metalliferous ores and metal scrap	34.4%	Metalliferous ores and metal scrap	20.4%	Metalliferous ores and metal scrap	52.3%
	Feed. Stuff for animals excl.unmilled cereals	19.8%	Non ferrous metals	28.0%	Non ferrous metals	23.2%	Non ferrous metals	18.3%	Non ferrous metals	17.3%
	Non ferrous metals	2.4%	Clothing	15.4%	Coffee	7.8%	Petroleum and petroleum products	11.6%	Petroleum and petroleum products	8.6%
	Fish,in airtight containers,nes & fish preptns.	1.8%	Vegetables, roots & tubers, fresh or dried	4.1%	Feed. Stuff for animals excl.unmilled cereals	4.8%	Clothing	10.2%	Feed. Stuff for animals excl.unmilled cereals	7.8%
	Wood, lumber and cork	1.7%	Metalliferous ores and metal scrap	4.0%	Vegetables, roots & tubers pres or prepared nes	4.3%	Chemical elements and compounds	3.6%	Animal oils and fats	2.6%

Source: COMTRADE

Note: classified by SITC Rev. 1. The yellow marker shows that the product is primary commodity or natural resource based manufacture.

4, Model

- In the model application: the restrictive assumptions of "**single trading partner**" and "**without capital flows**" of the original model (Thirlwall, 1979) **are relaxed.**
- The combination of the **generalized model** (allows multilateral trading partners with different income elasticity of demand for imports, Nell:2003) and **extended model** (allows capital flows, Thirlwall y Hussain: 1982).

Cont.

- **BOP equilibrium condition**:

(1) $$P_d X + C = P_f ME$$

where, X and M= the volumes of exports and imports; E =the nominal exchange rate; Pd = the domestic price of exports, Pf=the foreign price of imports; and C=the value of nominal capital flows.

- Taking the rates of change of the variables in equation (1)

(2)
$$\theta(p_d + x) + (1-\theta)(c) = p_f + m + e$$

where, θ =the share of the total import bill financed by exports earnings in the initial period (**θ>1 and C<0 :current account surplus and capital outflows** and **θ<1 and C>0: current account deficit and capital inflows**).

Cont.

- Taking the rates of change of the import and export demand functions with constant elasticities, which **allows multilateral trading partners**:

(3)
$$m = \psi(p_f + e - p_d) + \sum_p \pi_p w_m^p (y)$$

(4)
$$x = \eta(p_f - e - p_f) + \sum_p \varepsilon_p w_x^p (y_p)$$

where, $\psi(<0)$, $\eta(<0)$ = the price elasticity of demand for imports and exports; $\pi(>0)$, $\varepsilon(>0)$ =the income elasticity of demand for imports and exports; y, y^p = the growth rate of domestic income and of **trading partner *p***; w_m^p , w_x^p =the share of imports and exports **of trading partner *p*** in the total imports and exports.

Cont.

- Substituting the equation(3) y (4) into the equation (2), we obtain the **full formulation of BPC growth**:

$$(5)\quad y_B = \frac{(\theta\eta + \psi + 1)(p_d - e - p_f) + \theta\sum_p \varepsilon_p w_x^p(y_p) + (1-\theta)(c - p_d)}{\sum_p \pi_p w_m^p(y)}$$

- If the **real exchange rate is constant** in the long-run, the equation (5) reduced to:

$$(6)\quad y_B = \frac{\theta\sum_p \varepsilon_p w_x^p(y_p) + (1-\theta)(c - p_d)}{\sum_p \pi_p w_m^p(y)}$$

Cont.

- If the income elasticity of the demand for exports multiplied by the growth rate of income is equal to **the growth rate of the demand for exports**, the equation (5) reduces :

(7)
$$y_B = \frac{\theta \sum_p w_x^p x_p + (1-\theta)(c - p_d)}{\sum_p \pi_p w_m^p (y)}$$

- In the case of initial equilibrium **(θ=1)** and no capital flows **(C=o)** , the equation(7) reduces to the generalized form of **Thirlwall's Law (1979)** ;

(8)
$$y_B = \frac{\sum_p w_x^p x_p}{\sum_p \pi_p w_m^p (y)}$$

Cont.

- We call the **equation (7): extended model**; the **equation (8): generalized model** .
- **The income elasticity of demand for imports** (the only unknown parameter of (7) and(8)), can be estimated from **the equation (3).**
- Test introduced by **McCombie (1989):** the estimated BPC growth rate (yb) from (7) and (8) is the good predictor of the real growth rate (y).

Counterfactuals

- **The counterfactual BPC growth rate**:

(9)
$$y^*_B = \frac{\sum_p w^{*p}_x \, x^*_p}{\sum_p \pi_p w^p_m(y)}$$

- **The impacts of trading partner *p*** (the contribution of the difference between the actual and counterfactual BPC growth rate):

(10)
$$y_B - y^*_B = \sum_{p=1} \frac{w^p_x x_p - w^{*p}_x \, x^*_p}{w^p_m \pi_p}$$

5, Estimation results
5-1 The income elasticity of demand for imports

- The weighted averages of the income elasticity of demand for imports are statistically significant in Chile and Peru.
- Our estimation results, 1996-2009: **Chile(3.44)>Brazil(3.19)> Peru(2.21)**
- López, P. & Thirlwall (2006), 1989-2002: Brazil (2.53)= Chile(2.53)> Peru (1.73)
- The income elasticities of demand for imports **increased compared with the previous period**.
- **The income elasticities of demand for imports from China are relatively large** in Brazil and Peru.

The estimation results of income elasticity of demand for imports in Brazil, Chile and Peru

	Brasil 1996-2008	Chile 1995-2007	Peru 1996-2008
China	4.23	3.10 ***	2.85 ***
	(2.66)	(1.18)	(0.86)
USA	2.33 **	4.65 ***	0.87
	(1.04)	(1.03)	(1.00)
EU15	0.57	4.95 ***	2.68 ***
	(2.37)	(1.18)	(0.72)
LACs	3.32 **	3.13 ***	2.48 ***
	(1.48)	(0.33)	(0.85)
Others	5.28 ***	2.15	2.38 *
	(1.24)	(2.05)	(1.29)
Weighted average of Income elasticity of imports	3.19	3.44 ***	2.21 ***
	(1.61)	(1.04)	(0.95)

Note: ***, **, y * indicate statistically significant at the 1, 5 and 10 % levels, respectively. The numbers in parenthesis are Newey–West HAC standard errors.

5-2 The BPC growth rate

- Brazil: **y(3.65%) >extended model (3.01%)> generalized model (2.95%)** [current account surplus in 2001, x>c-pd]
- Chile**: y (4.32%)> generalized model (2.09%)> extended model (0.33%)** [current account surplus in 2001, x<c-pd]
- Peru: **extended model (7.49%) > y (5.83%) > generalized model (4.13%)** [current account deficit in 2001, x<c-pd]
- Even during the period of commodity boom, **the BPC growth rate (yb)< the real growth rate (y); the growth rate of the export volumes< the growth rate of the real capital flows(c-pd)** in Chile and Peru.
- **Except for the extended model in Chile**; the estimated BPC growth rate (yb) **are the good predictors** of the real growth rate (y).
- It is statistically justifiable to use the estimated BPC growth rates for the counterfactual analysis.

The estimation results of the BPC growth rates and the application of the test of McCombie (1989)

	Real growth rate of income (y)	Real growth of export (x)	Estimated weighetd average of income elasticity of import(π)	Growth rate of real capital flows (C-Pd)	Initial conditions of BOP	BPC growth rate for the extended model (equation 7)	BPC gwowth rate for the generalized model (equation 8)	Test results of extended model	Test results of simplemodel
Brazil 2001-2008	3.65%	9.42%	3.19	4.44%	surplus	**3.01%**	**2.95%**	0.346	0.382
Chile 2001-2007	4.32%	7.19%	3.44	48.30%	surplus	**0.33%**	**2.09%**	3.048 ***	1.706
Peru 2001-2008	5.83%	9.13%	2.21	40.77%	deficit	**7.39%**	**4.13%**	-0.622	0.681

Note: *** indicates statistically significant at the 1% level.

5-3 The counter-factual BPC growth rate and the impacts of China

- The impact of China: Brazil (0.57%), Chile (0.75%) y Peru (0.84%)
- **The impact of China is the largest** in **Chile y Peru** and **the second largest** in **Brazil.**
- The impact of others including other emerging economies (0.99%) is larger than the impact of China in Brazil.
- **The impacts of LACs** (0.33% and 0.62%) are relatively important in **Brazil y Peru**, while the impacts of LACs are negative in Chile (export growth to LACs decreased in comparison with the previous period)

The estimation results of the impacts of each trading partner in Brazil, Chile and Peru

	BPC growth rate (yb)	Counter-factual BPC growth rate (yb*)	Differences (yb-yb*)	Decomposition into the effect of each trading partner	
Brazil 2001-2008	2.95%	1.05%	**1.90%**	**China**	**0.57%**
				USA	-0.19%
				EU15	0.21%
				LACs	0.33%
				Others	0.99%
Chile 2001-2007	2.09%	1.43%	**0.66%**	**China**	**0.75%**
				USA	-0.08%
				EU15	0.02%
				LACs	-0.42%
				Others	0.39%
Peru 2001-2008	4.13%	2.36%	**1.77%**	**China**	**0.84%**
				USA	-0.69%
				EU15	0.70%
				LACs	0.62%
				Others	0.30%

Note: The sum of the impact of each trading partner is equal to the difference between (y) and (yb).

6, Conclusions

- The magnitude of the **direct impact** of China was **less than 1% of GDP**, although the impact is the largest or the second largest among all trading partners in the three countries.
- **Brazil and Peru** also received the benefits from the increasing **intra-regional trade** among LACs, while **Chile did not**.
- Even during the period of commodity boom, **(yb) < (y),** due to **the low growth level of the export volumes** in comparison with **the income elasticity of demand for imports** in the three countries.
- It is likely that **the income elasticity of demand for imports can even further increase**, because **the income elasticities of demand for imports from China-** whose shares in the total imports are increasing- **are especially high.** Moreover, recently the export growth is stagnant in those three countries.
- Therefore, **the BOP position will remain the main constraint of growth** in the three countries.
- The findings are well predicted by the "Center-Periphery Theory" of Prebisch.