Reconsideration of the Prebisch-Singer Hypothesis

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Abstract
In this paper, the long-term price developments as well as the primary commodity terms of trade of the most important primary commodities are presented, together with the underlying reasons for these trends. It is discussed if the observed trends can provide a confirmation of the Prebisch-Singer Hypothesis. Thereafter, the terms of trade of selected EU member countries are shown and the presumption is made, that the idea of the Prebisch-Singer Hypothesis can be used for the explanation of the diverging terms of trade development of industrialized countries with different export structures. A possible cause lies in the differing specialization in specific export sectors of these countries and the corresponding price developments of the exported goods.

Keywords: international trade, terms of trade, commodity prices

JEL code: F1

The Prebisch-Singer hypothesis assumes a long run decline in the terms of trade of countries that depend on exports of primary commodities (see Prebisch, 1950; Singer, 1950).

The terms of trade of a given nation are defined as the ratio of their average index of export prices relative to their average index of import prices:

Terms of trade $= \dfrac{Average\ index\ of\ export\ prices}{Average\ index\ of\ import\ prices}$

 (United Nations, 2012, p. 47). In the calculations, representative baskets are used, based on the most popular exports and imports of a given country.

Usually every country is interested in an improvement of their terms of trade since an increase means that, for a given quantity of exports, the country is now able to obtain a bigger quantity of imports. Terms of trade tell us about the domestic exports that are needed to secure the same level of imports.

A main reason for a long run decline in the terms of trade of countries that depend on exports of primary commodities is that the hypothesis presumes a widening gap in the long term price development of primary products and manufactured goods. The research findings of Baffes/Dennis (2013), Ocampo/Parra (2004) and Grilli/Yang (1988), among others, provide support for the Prebisch-Singer Hypothesis. Many economists tried to explain the unfavorable world price development of primary commodities with the insufficient world demand for these types of goods (see Nurkse, 1961, p. 294-295). Other economists point to the fact that, for primary commodities, the price elasticity of demand is usually greater than the price elasticity of supply (see Mankiw, 2014, p. 91; see Porter, 1980, p. 19). The price of primary commodities is to a large extent determined by demand. For manufactured products however, there is usually a higher price elasticity of supply than of demand. Therefore, supply is highly relevant for the determination of prices of manufactured goods.

Figure 1 illustrates the long term trend in the prices of primary and industrial commodities in the years 1950-1979

Figure 1: Price Indices of primary commodities and industrial commodities (1950=100)
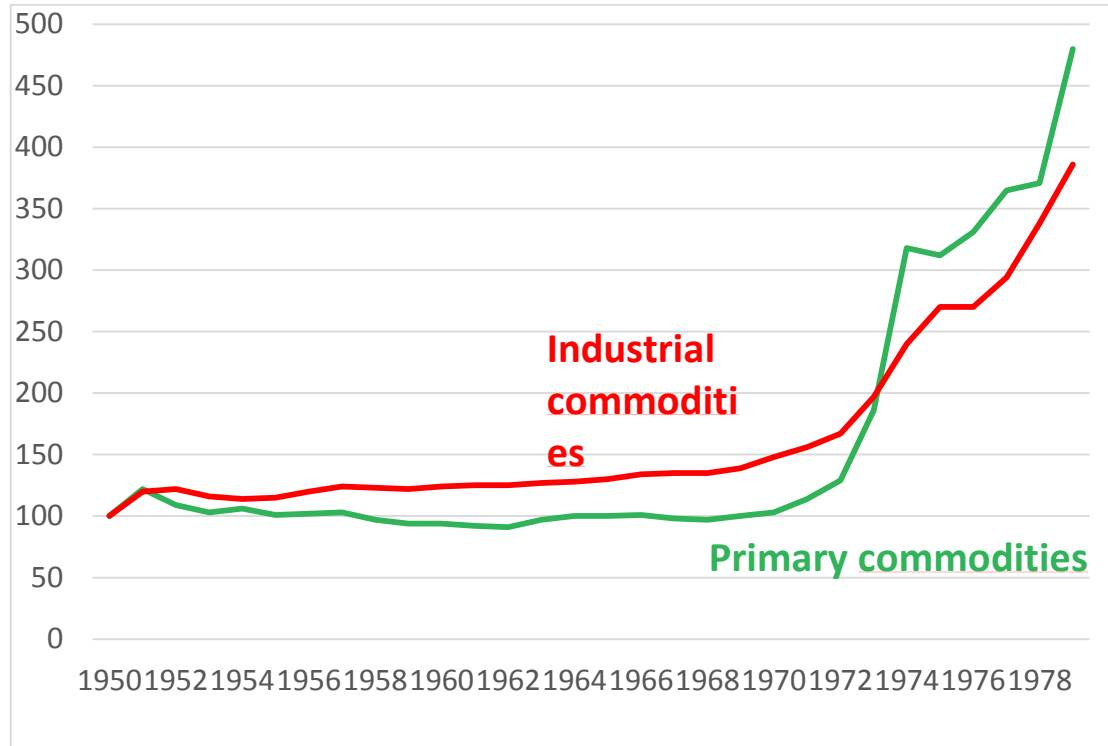
Source: Own calculations based on: United Nations 1958: Monthly Bulletin of Statistics, No. 12, special table, p. XIII; 1966, No. 12, p. XV; 1972, No. 12, p. XVII; 1975, No. 12, p. XIX; 1976, No. 12, XXIV; 1980, No. 12, p. XIII.

In figure 1, it can be observed that in the years 1950 to 1970, there had been a long-term downward trend in the price index of primary commodities compared to the price index of industrial products. In the development of the price indices an opening of the scissors is visible. This can be interpreted as a confirmation of the Prebisch-Singer Hypothesis. After a long-run decline of the primary commodity price index, beginning in the 1950s, there had been significant changes in the years 73-74 (see fig. 1, tab. 1). During this period, the growth pace of prices of raw materials and food had been higher than the growth rate of finished products. Reasons for these price changes were, among others, the collapse of agricultural production (drought periods) in many areas of the world, the devaluation of the dollar in 1971 and the war in the Middle East in the fall of 1973 and the subsequent oil embargo by OPEC. The prices of all primary commodities increased drastically, especially oil prices, and peaked in the beginning of 1974. Subsequently, the situation calmed down (see fig. 1). During the second oil crisis in 1979/80, oil prices had increased again for a short time period. The fear of a physical shortage in supply on the world market pushed the oil price to record levels above 40 USD per barrel. At the end of the 1980s the oil price dropped again (see Mineralölwirtschaftsverband e.V., 2001 p. 15).

Prebisch and Singer imply that commodity prices and manufacturers` prices have diverging evolutions in the long run. The relation of these two product sectors is reflected in the so-called primary commodity terms of trade (see Ocampo/Parra, 2004, p. 1, 18):

Primary commodity terms of trade (i.e. "real" price of a commodity) =

$$\frac{\textit{Primary commodity price index}}{\textit{Manufacturers` price index}}$$

(Ocampo/Parra, 2004, p. 1, 18; World Bank Group, 2015, p. 12).

The primary commodity terms of trade index depicts the price trend of primary commodities related to the price trend of manufactured goods. The World Bank uses the term "real" price of a commodity, which is calculated as the nominal price of a commodity divided by the Manufacturers' Unit Value (MUV) (see World Bank Group, 2015, p. 12). Different categories of commodities can be made in order to analyze the price development of selected product groups or even individual products. Usually, primary commodities are divided into the following groups: Food, agricultural resources, mineral resources and energy.

Table 1 and figure 2 show the trends of primary commodity terms of trade in the years 1950 to 1979 for the above-mentioned groups. They are calculated on the basis of world price indices, which are also listed in table 1. The price indices of primary commodities are divided by the relevant price indices of industry goods.

The unfavorable development in the world price indices of primary commodities relative to the price index of industrial products in the years 1950-70, previously shown in figure 1 and table 1, is expressed by the downward trend of primary commodity terms of trade for those years, which can be seen in figure 2.

Table 1: Price indices and primary commodity terms of trade

	Price indices						Primary commodity terms of trade				
Year	All primary commodities	Food	Agricultural raw materials	All mineral commodities	Energy	Industrial goods	All primary	Food	Agricult. raw materials	All mineral comm.	Energy
A	B	C	D	E	F	G	H=B/G	I=C/G	J=D/G	K=E/G	L=F/G
1950	100	100	100	100	100	100	100	100	100	100	100
1951	122	113	138	115	104	120	102	94	115	96	87
1952	109	112	102	119	107	122	89	92	84	98	88
1953	103	111	92	111	108	116	89	96	79	96	93
1954	106	118	92	110	111	114	83	104	81	96	97
1955	101	105	94	112	111	115	88	91	82	97	97
1956	102	104	93	116	115	120	85	87	78	97	96
1957	103	106	92	121	121	124	83	85	74	98	98
1958	97	103	81	117	118	123	79	84	66	95	96
1959	94	96	85	110	109	122	77	79	70	90	89
1960	94	94	78	109	108	124	76	76	63	88	87
1961	92	110	83	108	107	125	74	88	66	86	86
1962	91	110	80	108	107	125	73	88	64	86	86
1963	97	106	83	108	108	127	76	83	65	85	85
1964	100	112	85	110	108	128	78	88	66	86	84
1965	100	110	86	112	109	130	77	85	66	86	84
1966	101	112	87	112	109	134	75	84	65	84	81
1967	98	111	80	111	109	135	73	82	59	82	81
1968	97	107	79	110	108	135	72	79	59	81	80
1969	100	111	84	112	108	139	72	80	60	81	78
1970	103	117	83	117	112	148	70	79	56	79	76
1971	114	124	87	139	140	156	73	79	56	89	90
1972	129	142	102	153	157	167	77	85	61	92	94
1973	186	204	163	202	212	197	94	104	83	103	108
1974	318	270	187	551	647	240	133	113	78	230	270
1975	312	255	163	576	659	270	116	94	60	213	244
1976	331	268	183	605	699	270	122	99	68	224	259
1977	365	306	202	657	751	294	124	104	69	223	255
1978	371	309	215	662	778	338	110	91	64	196	230
1979	480	347	259	927	1074	386	124	90	67	240	278

Source: Own calculations based on data from United Nations 1958, No. 12, special table, p. XV; 1972, No. 12, special table, p. XVII; 1975, No. 12, special table, p. XIII; 1966, No. 12, special table, p. XIII; 1980, No. 12, special table, p. XXIV; 1980, No. 12, special table, p. XIII, XXVI.

**Figure 2:** Primary commodity terms of trade (1950=100)
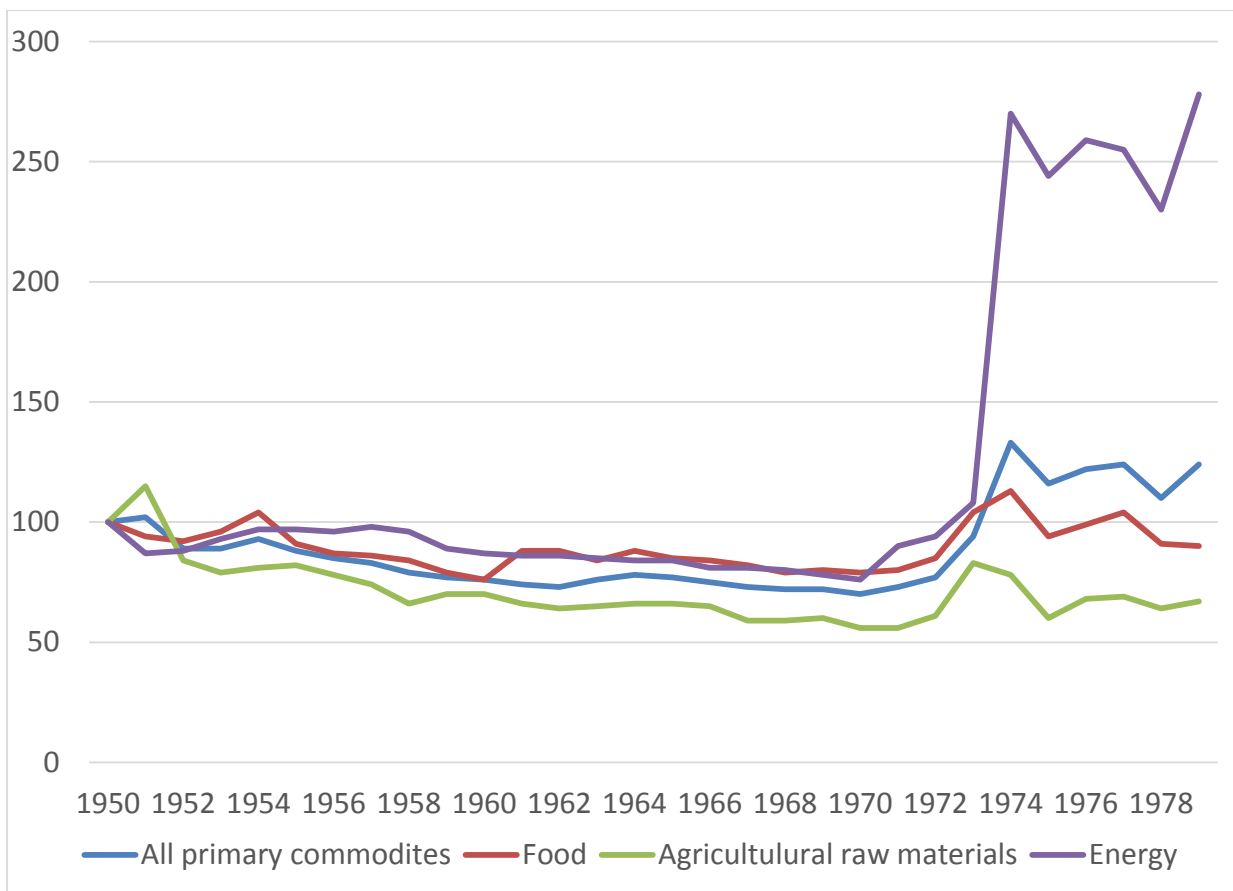
Source: Own calculations based on: United Nation: Monthly Bulletin of Statistics, 1958, No. 12, special table, p. XIII; 1966, No. 12, special table p. XV; 1972, No. 12, special table, p. XVII; 1975, No. 12, special table, p. XIX; 1976, No. 12, special table, p. XXIV; 1980, No. 12, special table, p. XIII, XXVI.

There are also differences between the falling tendencies of the various primary commodity terms of trade that are shown in figure 2. Among the privileged groups of primary commodities had been food and energy. The agricultural terms of trade had shown the strongest downward trend. In fact, a gap between agricultural raw materials terms of trade and the other groups in the primary commodity terms of trade can be seen. This means that countries exporting mainly agricultural raw materials tend to have less benefit from international trade than countries that export goods with a more advantageous price development.

A very clear downward trend of the agricultural terms of trade during the second half of the 20th century, defined as the nominal agricultural price index divided by the manufacturers' unit value (MUV), is visible in figure 3.

Figure 3: Agricultural terms of trade
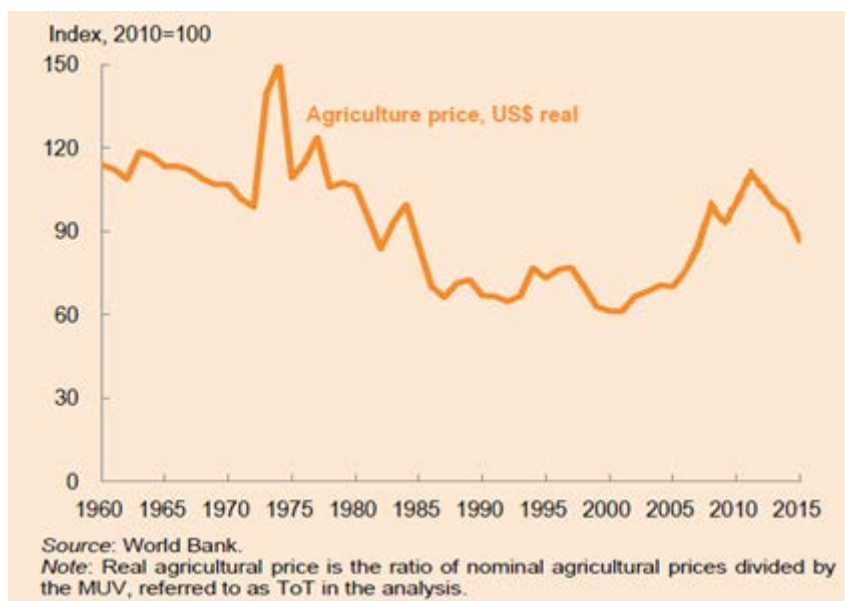
Source: World Bank Group 2015, p. 12.

The falling terms of trade trend of agricultural commodities until the end of the 20th century, apart from short-term fluctuations and apart from a drastic increase in the middle of the 1970s (described earlier), shows that prices of manufactured goods had a tendency to be more advantageous than prices of agricultural commodities for this period of time. For this long time period, the Prebisch-Singer hypothesis was valid. Therefore, the long-term development of a commodity terms of trade index can reveal the export profitability of the specified commodity. This indicates that the export of agricultural commodities had a tendency to be less profitable than manufactured products**.** In the first decade of the 21st century, a change in the price trends occurred. Figure 4 shows the development of the most important groups of primary commodity terms of trade since 1980.

Figure 4: Commodity terms of trade since 1980
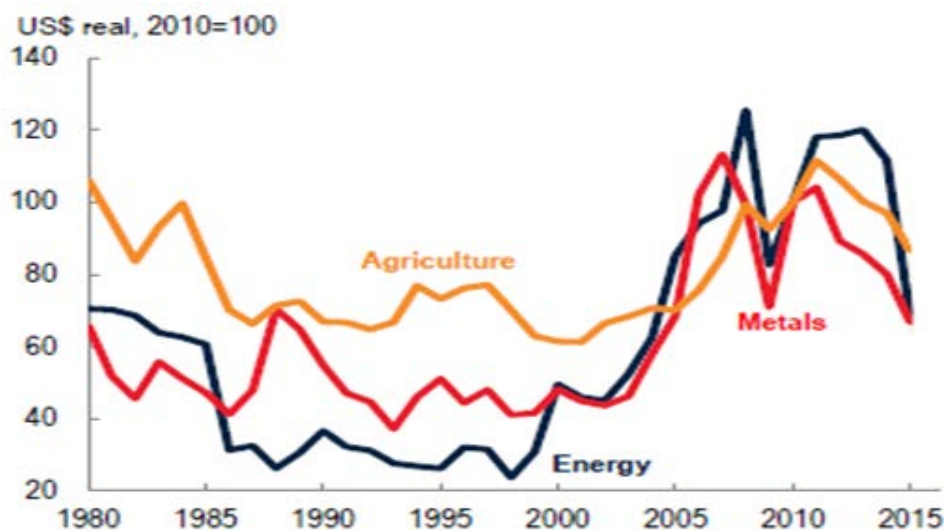
Source: World Bank Group 2015, p. 12.

Figure 4 illustrates that after a decline in the terms of trade of the primary commodities in the 1980s, a stabilization at a relatively low level in the 90s had taken place. There had been no large changes, only minor fluctuations, in the terms of trade of agriculture, energy and metals, until the end of the 20th century.

At the beginning of the 21st century, a different price development took place. The prices of primary commodities began to rise faster than the prices of manufactured goods (see fig. 4). An important feature of this primary commodity boom has been a strong differentiation of price dynamics. The highest price increase has been denoted for metals and fuels, and the lowest for agricultural commodities (see IMF, 2008, p. 199).

The main reason for the price increases of primary commodities in these years has been a strong increase in demand for these products. There has certainly been a connection with the worldwide economic boom and the general growth of income per capita, but especially with the rapid pace of industrial development and economic expansion in the so-called emerging markets, especially China and India (see United Nations, 2005, p. 73).

In the described price increase, the low elasticity of supply has been an issue as well. The structural basis of the weak supply response has undoubtedly resulted from a general underinvestment in these sectors in the 90s of the 20th century, when primary commodity prices were still very low.

One important reason for the price increases of primary commodities since the beginning of the 21st century has been the rising global demand for oil. The rapid economic growth of countries like China and India has resulted in a rising demand for raw materials and rising commodity prices. After a significant increase in mid-2008, commodity prices began to fall. This was due to the global economic crisis. This strong decline was visible until the first quarter of 2009. After that, prices began to rise again. However, since 2012 a decline in most primary commodity prices has taken place, which is illustrated in table 2.

Table 2: Nominal price indices (2010=100)

Primary commodities	Price indices (2010 = 100)						Change in %	
	2011	2012	2013	2014	2015	2016 F[1]	2014-15	2015-16 F[1]
Energy	129	128	127	118	65	49	− 44,92	− 24,62
Metals	113	96	91	85	67	60	− 21,18	− 10,45
Agricultural	122	114	106	103	89	88	− 13,59	− 1,12

[1] F denotes forecasts.   Source: Own representation, based on data from World Bank Group 2015a, p. 4; World Bank Group 2016, p. 8.

The price decline has resulted from an insufficient demand from important emerging economies, especially China. But also leading primary commodity producers have played a part in contributing to the fall in commodity prices. In the hope of a lasting boom, manager invested heavily in new capacity, only to face a market with insufficient demand (see Focus Webpage, 2015). Overcapacity had been created. In June 2014, a very strong oil price decrease had started. One reason for the price decline has been an excess supply in the international oil market, which has been mainly caused by the mass extraction of oil and gas from unconventional sources in the United States using fracking technology. Using fracking, the US was able to increase its oil production to 4 million barrels per day (World Bank Group, 2015a, p. 16; Unternehmenspositionen Webpage, 2015). As a consequence, the US

improved its position in the oil market, while OPEC lost influence. Major oil producers such as Saudi Arabia did not react with a restriction of their oil production. On the contrary, they produced more in order to defend their market shares (see Unternehmenspositionen Webpage, 2015). Due to the nuclear agreement between Iran and the US, and the resulting lifting of Iran's oil export restrictions, it is very probable that another huge oil producer will enter the world market (see Tirone /Gaouette, 2015).

In the middle of 2015, a stock market crash in China occurred, and the Chinese economy deteriorated dramatically. This has had worldwide implications, especially for the German economy, which is very closely connected with China. China is Germany's third largest trading partner. In 2014, Germany's export value to China had been 74 billion EUR. Especially the automakers are affected. For the year 2014, 44 % of global Volkswagen sales had been achieved in China, one fifth of BMWs business activities had been carried out in China, and Audi had sold every third car in China. Now car sales in China are expected to decrease (Dometeit et al., 2015, p. 58). Moreover, the economic crisis in China has had a global impact on primary commodity prices (see World Bank Group, 2015, p. 11). All the major commodity price indices have fallen (see fig. 4).

Changes in the world prices of primary commodities have an impact on the formation of the terms of trade of individual countries. The persistent price increases for raw materials since the beginning of the 21st century were the main cause for the falling terms of trade of most EU countries. In the following, certain countries were selected to illustrate the terms of trade trend graphically (see fig. 5).

Figure 5: Trends in the terms of trade for selected EU member states: Austria, Belgium, Finland, France, Germany, Greece, Netherlands, Portugal and Spain, (2000=100)
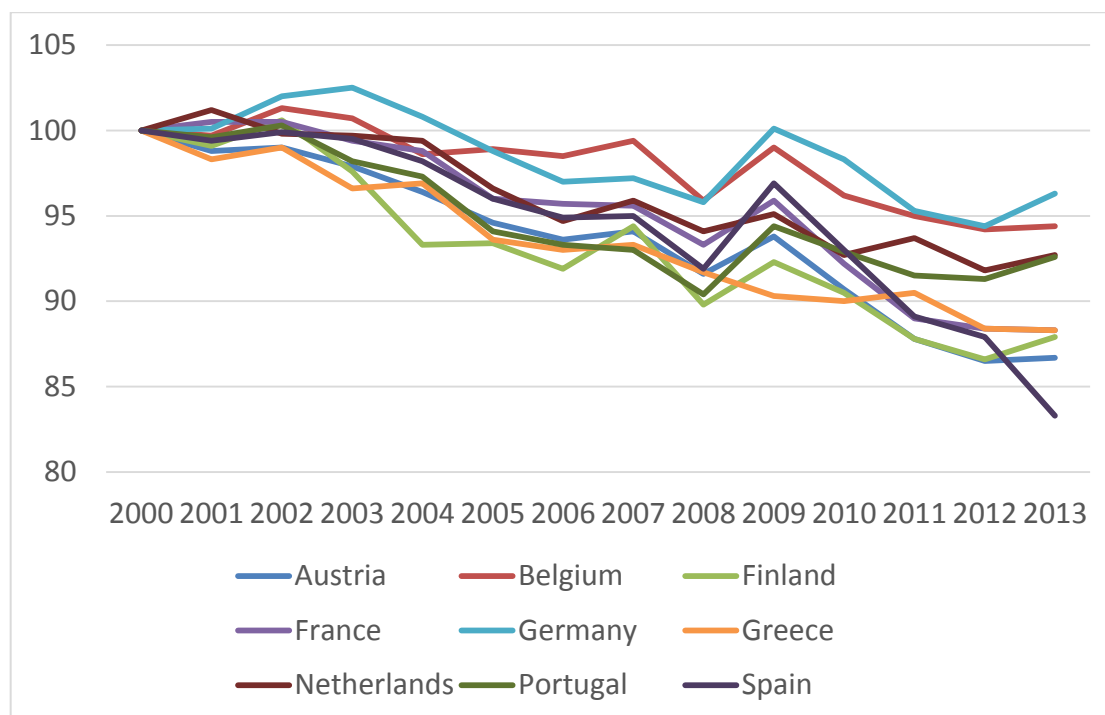
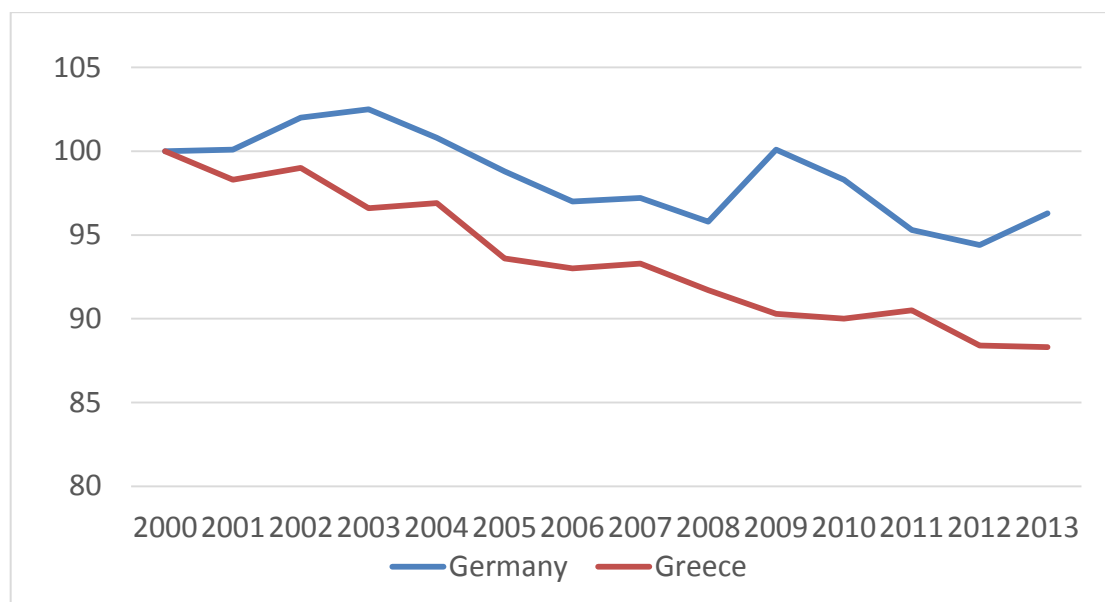Source: Own representation, based on data from World Bank Webpage (2015).

As can be observed in figure 5, the terms of trade of most countries have been falling since the year 2000. This is due to the price increase for raw materials, which accounted for a large proportion of imports for many European countries.

Moreover the terms of trade of most EU countries responded to cyclical fluctuations, with an especially strong response to the global financial crisis that began in the United States in 2008. Almost all EU countries faced significant drops in their terms of trade that year.

The terms of trade analysis of the selected EU member countries shows that the terms of trade are very diverse, which is an indication of the different trade patterns and economic powers of these countries. As can be seen in figure 5, the terms of trade of most EU member countries are decreasing, but at different speeds. To illustrate this point, a comparison between the terms of trade of two countries, Germany and Greece, is made (see fig. 6), since their sectors of exports and imports are very different.

Figure 6: Trends in the terms of trade for Germany and Greece (2000=100)

Source: Own representation, based on data from World Bank Webpage (2015).

From figure 6 can be inferred that the terms of trade of both countries had fallen over time, but in varying degrees. The terms of trade of Germany had decreased more slowly than the terms of trade of Greece, and from the figure it is obvious that the scissors of terms of trade between the two countries are opening. The evolution of the terms of trade of Germany is very interesting. The terms of trade of Germany show a downward trend, which means there is a deterioration of the terms of trade ratio. Does this imply that the German economy is getting worse off? Such an impression could arise, if only the terms of trade development was viewed, but not the global revenue, which for that matter can be a valid point criticism regarding the terms-of-trade concept. If, for instance, certain German companies increase their productivity because of technological progress, and as a result their costs decrease, they can charge lower end-prices for certain products. As a consequence, the terms of trade of Germany can deteriorate, but it is possible that there is an increase in the welfare of the country. Also, if German companies can sell a higher number of products in new markets because of good quality, reputation and marketing, which results in an increase of the total

value of exports, then this situation can be advantageous for German companies, even if the terms of trade of Germany have a falling tendency. This has been the case for the German economy in the recent years. The quantity of products sold has been very high. Germany has been very successful in foreign markets and the surplus in the German trade balance has been relatively high. Greece, on the other hand, has been in a worse situation because of their weak exports and lack of competitive products and diversified exports. The consequence has been debt growth and decrease wealth. The slow growth of exports has only deepened the recession.

The limitations in the informational value of the terms of trade as a welfare indicator has led to the development of a number of other concepts. One of them is the *factorial terms of trade.* This ratio takes into account productivity gains in the domestic export industry and can be obtained by multiplying terms of trade with an index of factor productivity of the export industry (Wagner et al., 1983, p. 93 f.). Another important concept is the *income terms of trade*, which takes into consideration the quantities of exports. Income terms of trade are calculated as a multiplication of terms of trade with the index of the volume of exports (Knall/Wagner, 1986, p. 96). As the example of Germany shows, a decrease in terms of trade is not necessarily detrimental for a country if it leads to a significant expansion in export volumes which results in an increase in the value of exports.

To clarify the reasons for the different development of the terms of trade of Germany and Greece, it can be useful to take a look at the trade profiles to examine which goods make up the exports of each country. This way, the specialization of each country can be detected. Figure 7 and 8 show top 5 export commodities of Germany and Greece.

Figure 7: Top 5 exports of Germany in 2014 (export shares)

Source: Own representation, based on data from United Nations (2015): International Trade Statistics Yearbook, New York, p. 176

Figure 8: Top 5 exports of Greece in 2014 (export shares)
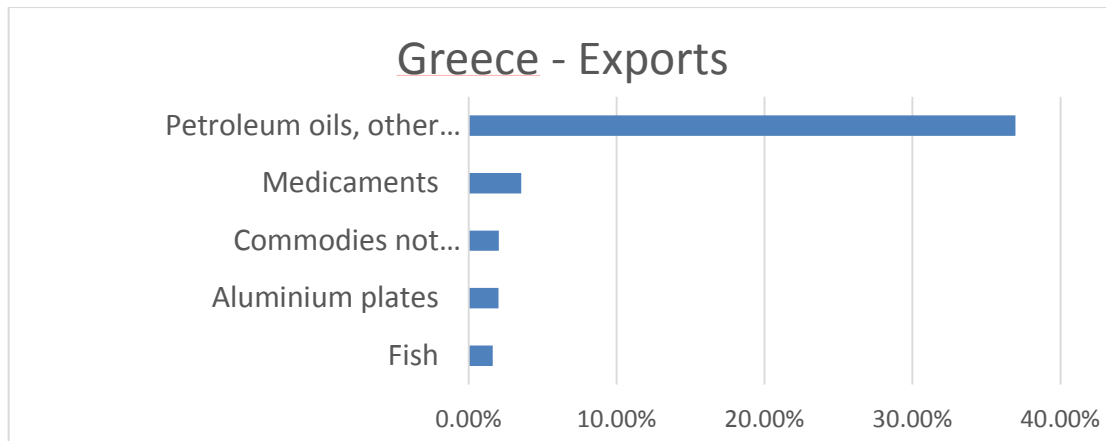
Source: Own representation, based on data from United Nations (2015): International Trade Statistics Yearbook, New York, p. 180.

The largest commodity groups for exports for Germany in 2014 were "machinery and transport equipment", "chemicals", "goods classified chiefly by material" representing respectively 47.2, 14.9 and 12.2 percent of exported goods (see United Nations, 2015, p. 176). From 2012 to 2014, the largest export commodity was "Motor cars and other motor vehicles principally designed for transport", 10.6 % of all their exports in 2014 (see United Nations, 2015, p. 176). Germany is the world's largest exporter of this commodity (see United Nations, 2015, p. 176). For Greece, the largest commodity groups for export in 2014 were "mineral fuels, lubricants", "food, animals + beverages, tobacco", and "goods classified chiefly by material" representing respectively 38.4, 15.9 and 13.8 percent of exported goods (see United Nations, 2015, p. 180). From 2012 to 2014, the largest export commodity was "petroleum oils, other than crude", 36.95 % of their exports in 2014 (see United Nations, 2015, p. 180).

In conclusion, there is a huge difference in the export sectors of both countries. Germany exports mostly highly developed goods from the industrial sector and there is a high diversification of exports. The export of Greece, on the other hand, is less diversified. Greece exports mainly various processed primary commodities, mostly petroleum oils (other than crude), aluminum plates, many intermediate goods and agricultural products, as well as some manufactured goods.

Consequently, the unfavorable development of the terms of trade of Greece compared to the terms of trade of Germany could be a result of a less favorable export structure of Greece compared to Germany. A possible explanation can be provided by the Prebisch-Singer hypothesis. As a consequence of this premise it can be conjectured that the terms of trade of a country tend to be less profitable when primary commodities predominate in its export structure, compared to a situation in which industrialized goods make up the majority of a country's exports. It can be assumed that a similar effect as in the case of primary goods also exists for industrial goods with a low percentage of value added.

Conclusion

Pointing to the Prebisch-Singer hypothesis, a long-term falling trend of primary commodity terms of trade in the second half of the XX century indicates that the export of primary commodities tends to be less profitable than the export of manufactured goods. Moreover, there are differences in the falling tendencies of the various primary commodity terms of trade, reflecting the diverse profitability of exports of these groups, such as energy, food, mineral commodities and agricultural raw materials. A long-term falling trend of the agriculture commodity terms of trade indicates that the export of agriculture commodities tends to be less profitable than the export of other types of goods.

Furthermore, it could be shown that the structure of exports and imports of a country and the corresponding price developments affect the gains from trade of a country. The long-term development of a commodity terms of trade index can reveal the export profitability of the specified commodity. In the analysis of the terms of trade it could be discovered that, when individualized products have a dominant position in the export structure of a country, this country tends to have more benefits from trade in the long run compared to a country whose exports are largely composed of more standardized products.

The idea of the Prebisch-Singer hypothesis can be used as an inspiration for the explanation of the diverse terms of trade of industrialized countries and to formulate the presumption, that not only the export of primary commodities, but also the export of relatively uncomplicated industry products tends to bring less gains than the export of highly-developed products. It can be assumed that a similar terms of trade development as predicted by the Prebisch-Singer hypothesis for countries exporting mainly primary commodities also exists for countries that are mostly exporting simple industrial goods with a relatively low percentage of value added.

As a result, the long run development of the terms of trade ratio of less industrialized countries is deteriorating when compared to the terms of trade of those highly developed countries that export very specific, high quality goods with high value added. Countries with an export structure, in which individualized, knowledge-specific products have a dominant position, and that have a high diversification of their exports, tend to have more benefits from trade than countries with an export structure with less individualized goods with a small percentage of value added. However, these benefits can only be maintained with continuous product and technology improvements that require high and consistent research and development activities.

The necessary profitability of trade has a dynamic effect on the domestic economy, since the national suppliers face competitive pressures and competitive world prices. This leads to an adjustment of production structures (improving productivity and specialization in favor of export goods), and a creation of incentives for investments in research and development. It can be concluded that the terms of trade concept is a meaningful ratio, which is particularly relevant in discussions about development and industrialization. Therefore, it is of great importance to calculate and analyze the terms of trade numbers in today's globalized world, since they are an important indicator of the gains from trade as well as the international competitive advantage of a given country.

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